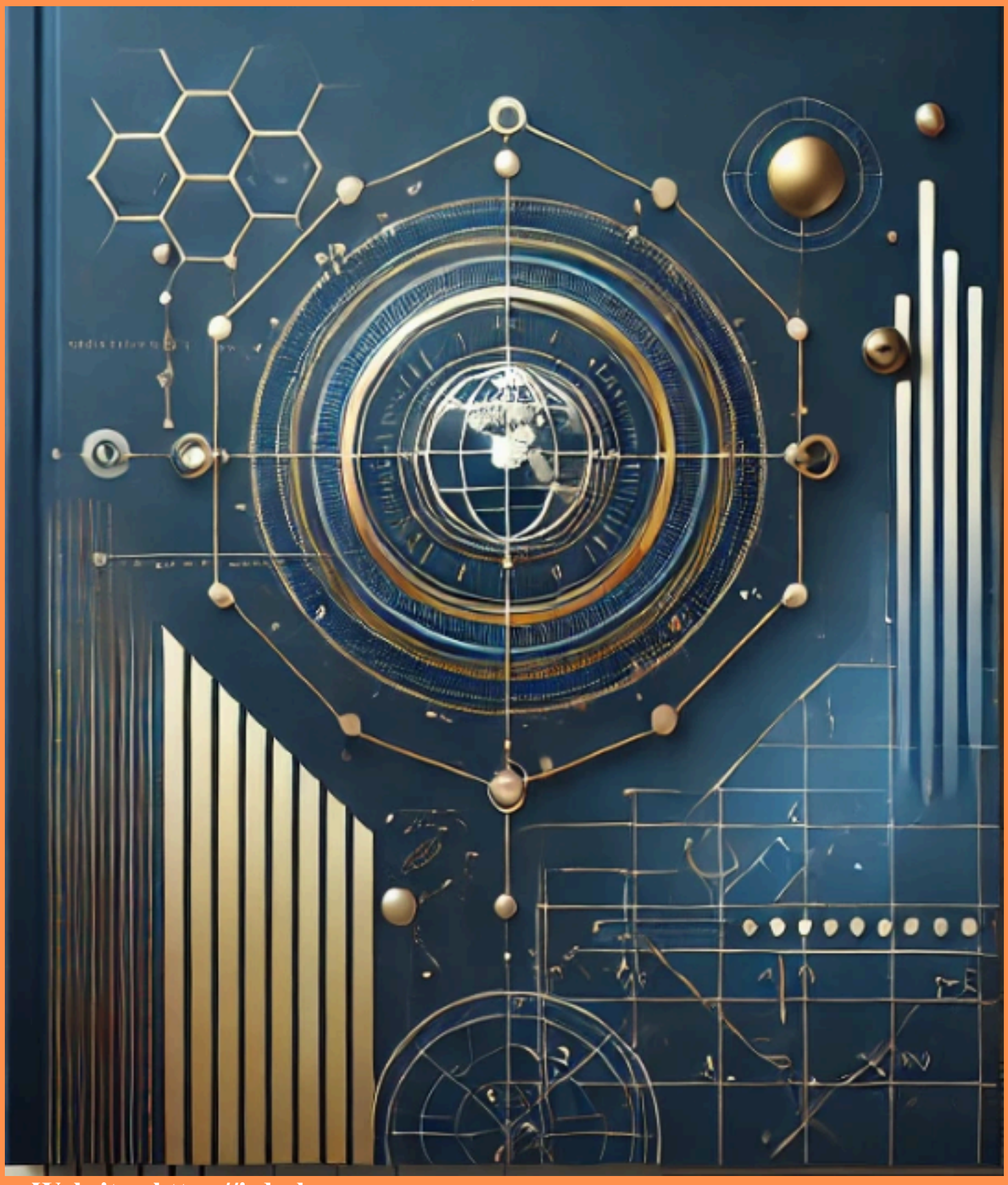
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Sr. No.	CONTENTS	Page No.
1	E-marketing and its Impact on Consumer's Satisfaction in Amravati District of Western Vidarbha **Narendra D. Najardhane, Dr. Vandana K. Mishra**	1-6
2	Public Health and Well Being: Mental Health Awareness, Global Strategies, Emerging Technologies and health Innovation in the Post pandemic Era **Upama Sadanand Raypure Dr. Shirish Nakhate**	7-11
3	The Role of Ethics in Environmental Policy: From Moral Responsibility to Legal Mandates **Dr. Rajendra Sitaram Pawar**	12-16
4	Dielectric Characterization of Sodic Soils in the C-Band: Implications for Soil Classification and Reclamation **Farhat Shaheen M. Khan, Kranti Zakde**	17-21
5	The relevance of AI, telemedicine, and genomics in nutrition and public healthcare, focusing on India and the global future **Dr Roopali Bhargava**	22-27
6	Gender Equality and Social Inclusion in a Changing World: Perspectives from South Asia **Bhawana Purohit**	28-31
7	Constructivist Approach to Learning– An Effective Approach of Teaching **K. Anupama, Nuti Naga Sree Vaibhavi, Bhavani Tripura**	32-37
8	Improving Student Engagement with Technology Tools **K. Anupama, Nuti Naga Sree Vaibhavi, Bhavani Tripura**	38-42
9	A comparison of Physical Properties between Plain and Madder Dyed Khadi Cotton Fabric using Harda as a Mordant **Ashwini D. Lambat**	43-47
10	Historical Elements in the Novels of Ashwin Sanghi **Avinash B. Chinchulkar, Dr. R. W. Soor**	48-50
11	Vivekananda's Vision for a Sustainable Future **Dr. Archana Thakre**	51-55
12	Analysis of Physico-Chemical Parameters of Water Quality in Malkhed Lake, Amravati District **R. L. Rahatgaonkar**	56-59
13	The Legal Landscape Of Ai In India: Existing Frameworks And Future Regulatory Needs **K. Pavithra, M.Aravind Kumar.**	60-64
14	The Impact of Literature in Social Change with Reference to Select Indian Authors **Mr. B. S. Savase, Dr. S. S. Mane**	65-67
15	Intelligent Disruption: How AI and Automation Are Transforming Work, Education, Communication, and Social Identity **Akella Subhadra**	68-73
16	Interlingual and Intralingual Errors in Second Language Acquisition: A Study in Applied Linguistics **Dr. Vimal Kumar Vishwakarma , Dr. Deepa Rastogi**	74-76
17	Village water survey and study of various parameters of different soil samples **Dr. Sujata Modhave, Dr. Deepak Nighot**	77-79
18	Communicative Language Teaching in the Age of AI: A Hybrid Model for Indian Classrooms **Tamilselvan M**	80-82
19	To Study the Impact of Management Education on Entrepreneurial Development on the Students of Urban Rajasthan **Aayushi Sharma**	83-87
20	Evaluation Of Medicinal Plant Extracts As Potential B-Lactamase Inhibitors By Studying Their Synergistic Effect With B-Lactam Antibiotics To Combat Antibiotic Resistance **Asst. Prof. Lisa Sam , Smit R Kamble**	88-93
21	Cultural Heritage and Socio-Economic Significance of the Karvat Kathi Saree: A Comprehensive Awareness Study **Snehal B. Fulare**	94-97
22	Human Resource Management and its Outsourcing: A Positive or Negative aspect **Dr Rajat Rabindranath Mandal**	98-101
23	Impact of Quality of Work Life of Employees on Organizational Performance With Respect To Micro, Small and Medium Enterprises (MSMES): A Pilot Study **Kavita Divekar, Dr. Manisha Kumbhar**	102-106
24	Risk Management in Banking and Financial Services **Dr. Manjula A Soudatti**	107-110
25	Extraction Of Protease From Cicer Arietinum **Ishwari Nitesh Mehta, Dhairya Jain**	111-114

Journal of Research and Development
Peer Reviewed International, Open Access Journal.
ISSN : 2230-9578 | Website: https://jrdrvb.org Volume-17, Issue-5(I)|May - 2025

26	Ecological Conflicts in Amitav Ghosh's The Hungry Tide and Jean Rhys's Wide Sargasso Sea **Dr Sunitha Ramesh Menon**	**115-118**
27	Gamification and Self-Determination Theory: Enhancing Employee Motivation and Performance in Digital Banking Workplaces **Ms. Milagrin Mary Arokiyaswamy C, Dr. Pralhad Rathod, Ms. N S Aishwaryalaxmi**	**119-122**
28	Funding Challenges for Small and Medium Enterprises (SMEs): A Perspective on Access to Capital and Financial Inclusion **Dr. Babasaheb sawant, Mr. Ram Govind Dalve**	**123-125**
29	Environmental Impact of Modern Synthetic Pesticides Cleaning Products versus Traditional Natural Alternatives: An Ecological Perspective **Umesh Virappa Belore**	**126-129**
30	AI Gamification in Business Growth **Mr. Shivam Ashok Chaurasia,**	**130-133**
31	Death, Disease, and the Dharma Dilemma: Reinterpreting Samskara in a Pandemic Framework **Sanket Sanjay Nagrale, Dr Harish G. Tapadia**	**134-137**
32	Personality Analysis of Major Characters in the Novel in the Woods by Tana French through Myers-Briggs Type Indicator **Janani P R , Dr. Preetha C**	**138-140**
33	Bridging inequalities- A journey from exclusion to empowerment through Social Justice and inclusion of marginalized groups especially third genders **Dr. Mrs. Vaishali A. Sukhdeve**	**141-146**
34	AI-Generated Voice Acting for Real-Time Character Dialogue in Game **Mr. Rijul Rajendra Patil,**	**147-150**
35	Bridging Disciplines through Mathematics How Researchers across Fields Use Mathematical Tools to Decode Complexity and Drive Innovation **Ankosh A Ramteke**	**151-155**
36	Literature as a Medium of Social Change and Innovation **Dr Rajesh N. Sonkusare**	**156-158**
37	The Role of Ethics in Environmental Policy: From Moral Responsibility to Legal Mandates **Dr. Rajendra Sitaram Pawar**	**159-164**
38	Ayurvedic Botany and Medicinal Practices in Medieval India: A Sanskrit-Based Study of Plant Usage in Charaka and Sushruta Samhitas with Reference to Nashik Flora **Harane Smita S., Harpale Dattatraya V., Prof. Sanjay Mahajan , Dr. Mahaesh S. Harane**	**165-169**
39	The Digital Divide: Challenges and Opportunities for Right to Education **Adv. Pallavi S. Kandikattiwar , Dr. Aejaz U Shaikh**	**170-172**
40	Transforming Education: Leveraging Technology for Online Learning and Future Innovations **Dr. D.K. Kamble**	**173-175**
41	Socio-Political Contribution of Dr. B. R. Ambedkar For Equality and Social Justice. **Dr. Prashant Dashrathrao Palkar**	**176-179**
42	Recent Trend in Poultry Farms **Shri Shinde Amol Sitaram, Dr. B. S. Sawant.**	**180-183**
43	The Impact Of Artificial Intelligence And Automation On Modern Businesses **Ramandeep Kaur , Dr. Pawanjot Kaur**	**184-188**
44	Role of Social Media in Transforming Business Marketing **Abhishek Rajendra Sangale**	**189-194**
45	Dual-Fingerprint Biometric Authentication System **Valroy Christopher Kadam**	**195-197**
46	Omnichannel Marketing and Its Effectiveness in Building Strong Brand Equity in the FMCG Sector **Rani Kuhasa**	**198-200**
47	A Study of Startup Ecosystems: Trends, Challenges, and Opportunities **Vijaykumar Gulabrao Shinde**	**201-204**
48	Ethical Responsibility and Climate Policy: A Comparative Analysis of Global Climate Agreements **Dr. Jagdish Chand**	**205-208**
49	Mapping Displacement and Belonging: A Study of Diaspora Consciousness in Amitav Ghosh's Novels, The Glass Palace and The Hungry Tide **Geeta Kuchekar , Dr. Shivaji D. Sargar**	**209-212**
50	The Digital Personal Data Protection Act, 2023: A Paradigm Shift in India's Data Privacy Landscape and its Cybersecurity Implications **Dr. Manisha Sureshchandra Araj**	**213-218**
51	Schema-Agnostic Indexing with Azure Document DB **Mr. Praveen Dinesh Pandey , Dr. Gauri Gaurav Vartak, Mentor**	**219-222**

Journal of Research and Development
Peer Reviewed International, Open Access Journal.
ISSN : 2230-9578 | Website: https://jrdrvb.org Volume-17, Issue-5(I)|May - 2025

52	The Role and Contribution of E-Resources in Advancing Academic Libraries **Jitendra Subhash Agrawal , Rupesh Jayram Sarkate**	223-227
53	Technological Innovations And Policy Frameworks For Climate Change Mitigation **Dr. M.Arul Simi Mr. A.Mohammed Ali**	228-231
54	Echoes of Identity: Cultural Heritage, Language, and Ethical Dilemmas in Postcolonial Literature **S. Saikripa, Dr. K.N. Umadevi**	232-235
55	Library Automation and Emerging Technologies **Prof.Anand Mukund Naik**	236-240
56	The Impact Of Ai On Organizational Culture: Shaping New Work Norms **Harsimran Kaur Batth, Dr. Manoj Kumar**	241-244
57	Sustainable Development in Nagpur City: Challenges and Opportunities **Mr. Gaurav R. Misar , Dr. Prof. Megha M. Sawarkar**	245-247
58	Quantum Frontiers: Exploring the Convergence of Quantum Computing and Nanotechnology **Vaibhav Rajesh Mishra**	248-250
59	System Using Artificial Intelligence Smart Library Management **Mr. Mangesh R Ubale**	251-253
60	Awareness of Learning Disabilities in Children among Secondary School Teachers **Mr. Dharm Pal Singh, Deepa Rana,**	254-256
61	Meditation beyond Mindfulness: The Role of Brahma Kumaris Raj yoga in Psychological Wellness **Vaduguri Madhavi , Satya Suresh**	257-260
62	Herbal Pastes for Vitiligo Management: Formulation and Evaluation of Herbal Pastes and Natural Therapies for Skin Pigmentation Restoration & Quot **Subhash Chandrakar**	261-267
63	Harmonizing Technology and Traditional Knowledge for Environmental Protection **Gajanan Keshav Malwe**	268-271
64	Schema-Agnostic Indexing With Azure Document Db **Mr.Praveen Dinesh Pandey, Gauri Gaurav Vartak**	272-275
65	Effect of Seaweed Extract on Onion under Drought Conditions **Shivam R. Patil, Nikita Y. Shirsath , Bhosale K.S**	276-277
66	From Rituals to Realization: Tracing Indian Society's Evolution through ' Vidyā' and 'Avidyā' in the Īśa Upaniṣad **Tapaswini Rath**	278-281
67	The role of DNA evidence in criminal trials **Mali Shashikant Anna**	282-285
68	The Banking Ombudsman Scheme - Relevance And Significance In The E-Banking System **Dr. (Mrs.) Kiran Kori**	286-290
69	Uses And Benefits Of Artificial Intelligence In Modern Library Management **Mr. Sandeep A. Meshram**	291-295
70	Identification and Removal of Emerging Pollutants in Water: A Comprehensive Review of Techniques and Technologies **Dr. Humeshwar D. Anande**	296-300
71	Impact Of Science And Technology On Senior Citizens **Dr. Laxmi S. Dakhole**	301-303
72	Language Diversity And Multilingualism **Mr. Kachgunde Shrihari Harichandra, Dr.Ingole.K.W.**	304-306
73	Regulating Ai: Should Governments Create Stricter Ai Laws? **Mr. Pankaj Verma**	307-309
74	Emerging Trends & Technologies in Library Services with the help of Mobile Apps **Dr. Seema Madhukar Kale**	310-314
75	Enhancing library services via mobile technologies: Advantages, Challenges and its impact on the Future Library Services **Dr. Swati S Shambharkar**	315-319
76	Expression, Repression, and Ambiguity in Aravind Adiga's Selection Day **Devina Rathore, Dr. Deepa S.Kumar**	320-323
77	The Impact of Artificial Intelligence on Society **Ms. Mariyam Farooq Patel, Mr. Mohammed Hamdan kachhawa, Dr. Sampada Deshmukh**	324-326

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Original Article

E-marketing and its Impact on Consumer's Satisfaction in Amravati District of Western Vidarbha

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Abstract

The present research paper is entitled by "E-Marketing and its Impact on Consumer's Satisfaction in Amravati District". The present research study is done in Amravati district in the state of Maharashtra. This study is an effort to enquire into the level of satisfaction of the consumers (buyers and sellers) and to understand the depth of E-marketing phenomena in Amravati district. This study includes some of the objectives which are mentioned further. The main purpose of the present research paper is to enquire into the scope, findings, conclusions and suggestions regarding E-marketing application, also to find out the gaps and missing links in the studies already done by many of the research scholars in the field of E-marketing. The research is being done by applying the exploratory methods and with interview techniques by preparing a designed questionnaire. This questionnaire is taken to 150 respondents for interview from all the tehsil places of the district. It is tried to find the responses from individuals at micro level in the district. After data collection the data analysis and data presentation are done by applying the Chi-Square Test a statistical tool for testing the hypothesizes. The key findings and the implications of the findings are mentioned in the further. In the present research paper, the objectives, significance, findings, conclusions, suggestions, and potential applications are given. Also, it is tried to provide the directions for the further studies in the concerned research work.

Keywords

E-mail-Electronic mail, SMS-Short Message Service, WTO-World Trade Organization, ATM- Automated Teller Machine, BPO-Business Process Outsourcing, KPO-Knowledge Process Outsourcing,

Introduction

The introduction describes a brief overview of this research paper. This title of research has deliberately been chosen for the purpose to understand the penetration of E-marketing concept and its impact on consumer satisfaction in the district of Amravati in the state of Maharashtra. It is an attempt to know the depth of public understanding and preference of E-marketing of this district, so as to find out the potential customers for various companies, also government will try to enhance its projects and supplies by formulating appropriate policies. Also, how the customers of this district response to E-marketing. The researcher endeavors to find out the satisfaction level of customers regarding E-marketing in Amravati district. The research study is being conducted for the purpose to provide guidelines to corporate sector as well as public sector to do trade

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And supplies the goods and services which will be bought and sold by the buyers and sellers of this district.

In this research paper, it is tried to explain the satisfaction level and the significance of the research study. The questions are kept into focused in relevance with the consumer satisfaction with E-marketing in Amravati district. What would be the importance or significance of E-marketing study in this area it tried to search out.

Objective of the Study

To find out the consumer satisfaction with E-marketing in Amravati district

Literature Review

Many managers face the problem of customer satisfaction in many situations; inadequate personnel to attend clients, crowded telephone lines and minimal banking hours (Abdullah, 1996). This is especially valid in Libya, a developing nation where there is a lack of structure in the banking community (Ramadan & Aita, 2018). Therefore, in order to gain customer satisfaction, Libyan financial institutions are expected to spend more resources and carry out study on direct banking facilities (Ahmadi Danyali, 2018). The biggest challenge confronted by Libyan banks is that most of them are now powered by obsolete systems (Ofori, Boateng, Okoe, & Gvozdanovic, 2017). Another challenge is the shortage of professional and qualified workers, which essentially describes their consumers' low-quality service output (Ahmida Ali, 2011). Improving customer care can require training procedures or upgrades to the bank's computer information systems (Bapat, 2017). Although enhancing consumer experience may contribute to increased visible accounting expenses, the frequency of intangible costs may also be steered away (Susanto, Chang, & Ha, 2016). Through studying consumer satisfaction, bankers will build quantitative data, with the hope of emphasising that the focus and quality of excellent customer satisfaction will contribute to enhanced sales that are greater than increased costs.

Research Methodology

The present research study is done by applying Exploratory Research method, it is also known as Formulative Research method. The main purpose of this method is to formulate the problem for more precise investigation or of developing the working hypothesis from an operational point of view. The major emphasis in such studies is on the discovery of ideas and insights. As such the research method appropriate for such studies must be flexible enough to provide opportunity for considering different aspects of a problem under study. The exploratory Research method has the following features in research study.

The steps of exploratory research method.

- Data collection
- Data classification
- Data tabulation
- Data analysis
- Data interpretation

The present research study is conducted on some samples (respondents) that are selected from the total population of each taluka of Amravati districts. The sampling is essential because that helps to collect the data because covering the whole population in the research study is not possible.

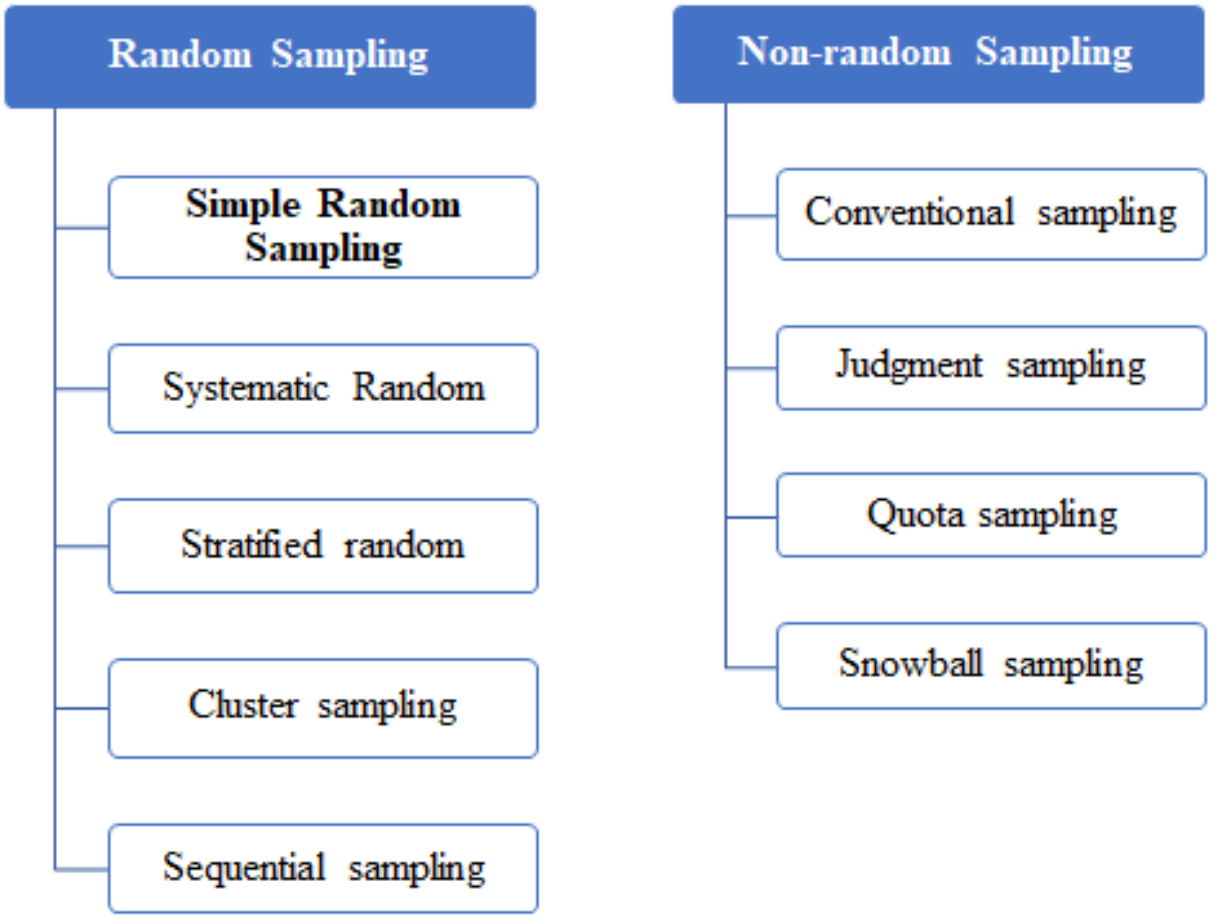
Sampling Method

The two methods of sampling are given below:

- Random Sampling Method
- Non-random Sampling Method

Simple random sampling is a type of probability sampling in which the researcher randomly selects a subset of participants from a population. Each member of the population has an equal chance of being selected. Data is then collected from as large a percentage as possible of this random subset.

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From the above the Simple Random Sampling method of sampling is applied for the present research study.

Hypothesis

In this research study for the purpose of drawing the correct result the two hypotheses are assumed which are given below.

H0: Most of the people of Amravati district are not satisfied with E-marketing services

H1: Most of the people of Amravati district are satisfied with E-marketing services

Discussion

The present research study has been done for understanding the satisfaction level of the people of Amravati district. For this purpose, the exploratory method of research is applied. In this process, a questionnaire which contains the technical questions related to E-marketing and consumer satisfaction are asked to 150 respondents from the entire district including all the tehsils. The sample size which is obtained from the entire district is 150. This means 150 respondents are asked the questions. After this, whatever the data is obtained is analysed by applying Chi-Square Test by using IBM-SPSS Ver.24.0 software. The data is collected through google forms from 14 taluka places of Amravati district. The sample size is equally distributed among all the taluka places i.e. 20 sample units from Amravati city and 10 sample units from remaining each taluka place. Based on this analysis the following interpretation is done.

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Data Analysis- Empact of E-marketing on Consumer Satisfaction

Consumer Satisfaction		Amravati District with All Tesils						
		1 Amravati	2 Achalpur	3 Anjangaon Surji	4 Bhatkuli	5 Chandur Bazar	6 Chandur Railway	7 Morshi
1. Fully Satisfied	Count	5	3	4	2	2	1	3
	% with Fully Satisfied	15.60%	9.40%	12.50%	6.20%	6.20%	3.10%	9.40%
	% with Tehsil	25.00%	30.00%	40.00%	20.00%	20.00%	10.00%	30.00%
2. Satisfied	Count	11	6	5	5	6	8	2
	% with Fully Satisfied	13.60%	7.40%	6.20%	6.20%	7.40%	9.90%	2.50%
	% with Tehsil	55.00%	60.00%	50.00%	50.00%	60.00%	80.00%	20.00%
3. Averagely Satisfied	Count	4	1	1	3	2	1	3
	% with Fully Satisfied	14.30%	3.60%	3.60%	10.70%	7.10%	3.60%	10.70%
	% with Tehsil	20.00%	10.00%	10.00%	30.00%	20.00%	10.00%	30.00%
4. Not Satisfied	Count	0	0	0	0	0	0	2
	% with Fully Satisfied	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	22.20%
	% with Tehsil	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%
Result	Consumer Satisfaction Level	20	10	10	10	10	10	10
		13.30%	6.70%	6.70%	6.70%	6.70%	6.70%	6.70%
		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Consumer Satisfaction		Amravati District with All Tesils							
		8 Chikhaldara	9 Daryapur	10 Dhamangaon Railway	11 Dharni	12 Teosa	13 Nandgaon Kh.	14 Warud	Total
1. Fully Satisfied	Count	1	3	0	3	2	1	2	32
	% with Fully Satisfied	3.10%	9.40%	0.00%	9.40%	6.20%	3.10%	6.20%	100.00%
	% with Tehsil	10.00%	30.00%	0.00%	30.00%	20.00%	10.00%	20.00%	21.30%
2. Satisfied	Count	5	4	8	4	7	7	3	81
	% with Fully Satisfied	6.20%	4.90%	9.90%	4.90%	8.60%	8.60%	3.70%	100.00%
	% with Tehsil	50.00%	40.00%	80.00%	40.00%	70.00%	70.00%	30.00%	54.00%
3. Averagely Satisfied	Count	3	1	2	2	1	1	3	28
	% with Fully Satisfied	10.70%	3.60%	7.10%	7.10%	3.60%	3.60%	10.70%	100.00%
	% with Tehsil	30.00%	10.00%	20.00%	20.00%	10.00%	10.00%	30.00%	18.70%
4. Not Satisfied	Count	1	2	0	1	0	1	2	9
	% with Fully Satisfied	11.10%	22.20%	0.00%	11.10%	0.00%	11.10%	22.20%	100.00%
	% with Tehsil	10.00%	20.00%	0.00%	10.00%	0.00%	10.00%	20.00%	6.00%
Result	Consumer Satisfaction Level	10	10	10	10	10	10	10	150
		6.70%	6.70%	6.70%	6.70%	6.70%	6.70%	6.70%	100.00%
		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

The above table makes the analysis of the collected data from the respondents of Amravati district and after applying the Chi-Square Test a statistical tool to find out the significant relationship between tow variables are given blow.

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Chi-Square Test

	Value	d.f.	Asymp. Sig. (2-Sided)
Pearson Chi-Square	35.966[b]	39	0.409
Likelihood Ratio	40.174	39	0.418
Linear-by-Linear Association	4.166	1	0.041
N of Valid Cases	150		

a. District= 1 Amravati
b. 42 cells (75.0%) have expected count less than 5. The minimum expected count is .60.

Result

The above table shows the significant relationship between two variables after testing the Chi-Square Test with the help of SPSS Ver.24.0. This shows that the P value of table is less than 0.05. Therefore, here Null hypothesis (H0) is rejected and Alternative hypothesis (H1) is accepted that most of the people in Amravati district are Satisfied with buying and selling through E-marketing.

Conclusion

E-marketing, which encompasses digital strategies to promote products and services online, significantly impacts consumer satisfaction in Amravati district. A key aspect of successful e-marketing is creating engaging and personalized experiences that meet customer expectations. Research consistently shows that factors like website usability, ease of navigation, responsiveness to customer inquiries, and the availability of detailed product information influence consumer satisfaction in the entire district.

Recommendations and Suggestions

1) **Improvement in E-marketing Services:** While collecting the primary data after talking people it is noticed that even though the majority of people are satisfied but in some cases the frauds are found, also some of the people are not satisfied with E-marketing services. Therefore, it is suggested that there is a little scope for the improvement in E-marketing services in Western Vidarbha.
2) **Amendment in Competition Act 2002:** From the present research study it is noticed that the internet plays a very vital role in E-marketing and consumer satisfaction. And the internet cost is very high due to a kind of monopolistic oligopoly of Jio and Airtel in Indian market. This adversely impacts heavily on the market of Western Vidarbha too. So, for the purpose to control such monopolistic oligopoly, it is suggested to government to amend the existed Competition Act 2002.
3) **Improvement in CRM:** It is recommended to E-marketing services providers to improve the customer relationship management by rapid complaint resolution, proper communication with customer, providing real guidelines to consumer, providing after sales services, implementing fast replace and or refund policy etc. this will help to bring the growth in E-marketing and consumer satisfaction in the region of Western Vidarbha.
4) **To Overcome the Stock Outs:** In the present research study, while having interviews in the process of primary data collection, many people said that there is stock out position i.e. customer is present but stock is not available on the websites or applications often. This stock out condition is not good for the business and consumer too. So, it is suggested to remove and overcome the stock outs of products while selling through E-marketing services.
5) **Necessity to Build Confidence among Consumers:** Western Vidarbha is a backward region of Maharashtra state. Even after the majority of people are positive about E-marketing but still many of the people have number of doubts in their minds and are suspected about payment mode and product delivery. So, it is suggested to businessmen and government to build up the confidence in the mind of consumers by many good ways in this region.

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Original Article

Public Health and Well Being: Mental Health Awareness, Global Strategies, Emerging Technologies and health Innovation in the Post pandemic Era

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Abstract

The COVID-19 pandemic has served as both a crisis and a catalyst for transformation in global public health, particularly in mental health awareness and healthcare innovation. This synthesis examines the current landscape of post-pandemic health strategies, focusing on four critical areas: mental health awareness, artificial intelligence (AI) applications, telemedicine advancements, and genomic medicine breakthroughs. The pandemic exacerbated existing mental health challenges, with global anxiety and depression rates increasing by 25% in its first year alone. This mental health crisis has highlighted the urgent need for innovative solutions, including technology-enabled interventions and global solidarity approaches. Emerging technologies such as AI, telemedicine, and genomics are playing pivotal roles in reshaping healthcare delivery, while global strategies emphasize reciprocal learning between high income and low income countries to address systemic inequalities. Key innovations include AI-powered predictive healthcare systems, immersive telemedicine platforms leveraging extended reality, and precision medicine approaches enabled by CRISPR gene-editing technologies. However, these advancements face challenges including digital divides, data privacy concerns, and the need for standardized global practices. The World health Organization's comprehensive mental health report underscores the importance of transforming mental healthcare systems, particularly through community-based networks and task-sharing approaches that can deliver a 5:1 benefit-cost ratio for treating common conditions like depression and anxiety. This overview demonstrates how the convergence of heightened mental health awareness, technological innovation, and global collaboration strategies are creating new paradigms for public health and well being in the post pandemic era. the integration of these element offer promising pathways to address both the immediate consequences of the pandemic and long standing systems challenges in healthcare delivery worldwide.

Key word*: Public Health, Mental Health Awareness,Post Pandamic,Artificial Intelligence Telemedicine, Genomic, Health Innovation,Digital Health.*

Introduction

The COVID-19 pandemic has served as a defining moment for global health systems, pushing the boundaries of innovation while revealing critical vulnerabilities in healthcare infrastructure and mental health services. As the world transitions into a post-pandemic era, there is a growing recognition that traditional approaches to public health are no longer sufficient. The crisis highlighted the urgent need for mental health awareness and accelerated the adoption of digital health solutions, including artificial intelligence (AI), telemedicine, and genomics.

Governments, health organizations, and innovators worldwide are now focused on building more resilient, equitable, and technology-driven healthcare systems. responses, and examines how emerging technologies are reshaping public health and

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This paper explores the transformative impact of the pandemic on mental health priorities, evaluates the effectiveness of global strategic health well-being for the future.

1. Mental Health Awareness in the Post-Pandemic Era

On March 11, 2020, the World Health Organization (WHO) characterized the coronavirus disease 2019 (COVID-19), which is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), as a pandemic. The novel coronavirus disease has originated as a cluster of unexplained cases of pneumonia in Wuhan, China, and it has scaled to new heights of mortality by affecting people both physically and mentally.The context of unpredictability and uncertainty associated with the lockdown, the numerous restrictions, unemployment, and changes in the standard of living, have limited the already precarious access to mental health services. In addition, these issues have been imposed a great psychological burden on the population. Consequently, an increase in the prevalence of mental disorders in previously healthy individuals were observed, as well as the aggravation of pre-existing mental disorders. In the general public, there was an increase in the incidence of depression, anxiety, stress, panic disorder, obsessive-compulsive disorder, somatic symptoms, sleep disorders, delirium, psychosis, self-mutilation, and suicide. In addition to the factors already mentioned, insecurity about the future, fear of contracting the disease, fear of the negative economic effects due to the pandemic, the lack of information and scientifically proven treatment are some of the factors responsible for these mental issues. In response, countries and international organizations launched campaigns to reduce stigma and expand access to mental health services. Digital platforms offering counseling and psychological support gained rapid popularity, especially among youth and urban populations. Schools, workplaces, and governments began integrating mental wellness programs as essential components of recovery strategies. Despite these positive developments, significant challenges persist. Access to mental health care remains uneven, particularly in low- and middle-income countries where services are underfunded or unavailable. Digital solutions, while promising, are limited by disparities in internet access and digital literacy. Furthermore, there is a growing need to train mental health professionals and embed culturally relevant approaches into care delivery.The post-pandemic landscape presents a critical opportunity: to transform how societies perceive and prioritize mental health—not as an afterthought, but as a foundational pillar of public health.

Global Strategic Responses to Health Innovation

The COVID-19 pandemic served as a wake-up call for governments and global institutions, prompting swift re-evaluation and adaptation of healthcare strategies. In response, countries implemented a range of policies to foster innovation, improve resilience, and ensure equitable access to healthcare services. These strategic shifts have laid the groundwork for a more proactive, technology-enabled approach to public health.

The WHO's Global Strategy on Digital Health (2020–2025)

The WHO has taken a leadership role in promoting global digital health strategies. Its Global Strategy on Digital Health (2020–2025) outlines a framework for integrating digital solutions, including AI and telemedicine, into national health systems. Key pillars include promoting digital health governance, advancing interoperability, protecting patient data, and fostering international collaboration.

National Government Strategies

Several countries have launched innovation-driven health initiatives:

The United Kingdom's NHS Long Term Plan prioritizes digital-first primary care, personalized medicine, and AI-powered diagnostics.

The United States accelerated digital health adoption through regulatory flexibility and federal investments in telehealth during the pandemic.

India's Ayushman Bharat Digital Mission aims to create a unified digital health ID system and expand telemedicine in underserved regions.

International Collaboration and Funding

Global partnerships have played a pivotal role in driving innovation. Organizations like Gavi, the Global Fund, and CEPI supported rapid vaccine development and distribution. Meanwhile, funding bodies such as the Gates Foundation and Wellcome Trust invested in digital health infrastructure and genomic research.

Focus on Health Equity and Access

A key goal of these strategies is to reduce disparities in healthcare access. Efforts have included increasing funding for digital literacy, expanding rural health networks, and ensuring language and cultural inclusivity in technology design

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Challenges and Gaps

Despite progress, global strategic responses face obstacles such as regulatory fragmentation, data privacy concerns, and unequal access to technology. Sustained investment, cross-border cooperation, and inclusive policy frameworks are essential to address these challenges.

Emerging Technologies in Healthcare

In recent times, the growth of the Internet of Things (IoT), artificial intelligence (AI), and Blockchain technologies have quickly gained pace as a new study niche in numerous collegiate and industrial sectors, notably in the healthcare sector. Recent advancements in healthcare delivery have given many patients access to advanced personalized healthcare, which has improved their well-being. The subsequent phase in healthcare is to seamlessly consolidate these emerging technologies such as IoT-assisted wearable sensor devices, AI, and Blockchain collectively. Surprisingly, owing to the rapid use of smart wearable sensors, IoT and AI-enabled technology are shifting healthcare from a conventional hub-based system to a more personalized healthcare management system (HMS).

Artificial Intelligence (AI)

AI in healthcare refers to the use of machine learning, natural language processing, deep learning and other AI technologies to enhance the experiences of both healthcare professionals and patients. The data-processing and predictive capabilities of AI enable health professionals to better manage their resources and take a more proactive approach to various aspects of healthcare. With these technologies, doctors can then make quicker and more accurate diagnoses, health administrators can locate electronic health records faster and patients can receive more timely and personalized treatments.

Uses For AI In Health Care

Improving medical diagnosis

1. Speeding Up Drug Discoveries
2. Transforming Patient Experience
3. Managing Health care data
4. Performing Robotic surgery

Telemedicine

The rapid expansion of telemedicine during the COVID-19 pandemic has transformed health care delivery. However, it remains unclear whether telemedicine utilization is equitable across different demographic groups and whether the high levels of adoption during the pandemic have persisted in the post-pandemic period. This study investigates telemedicine use and patterns of use in the initial phases of the post-pandemic period and explores the impact of socioeconomic factors, social determinants of health, and patients' health-related factors on telemedicine utilization.

Genomics

Being the first pandemic in the post-genomic era, advancements in genomics contributed a lot to scientific understanding and the public health response to the COVID-19, to a greater degree which was not feasible during the past outbreaks like 2002–2003 severe acute respiratory syndrome (SARS) epidemic. Genomic technologies have been employed by researchers all over the world to better understand the viral origin, outbreak dynamics, transmission, and evolution. Genomics is a branch of biology that focuses on the study of structure, function, mapping, and editing of the entire genome of an organism (McKusick and Ruddle, 1987). The advent of next-generation sequencing platforms has transformed genomics from a discipline into a technology that is commonly used in labs around the world to solve scientific problems. Genomics is now widely employed in medicine, research, biotechnology, and agriculture.

Integrating Innovation into Public Health Systems

Sustainable integration requires multi-sector partnerships, health workforce training, and inclusive policies.

Review of Literature

Public health and well-being are influenced by a complex interplay of biological, social, and environmental factors**.** According to the World Health Organization (WHO, 2021), health disparities persist due to unequal access to healthcare, education, and economic resources. Research by Marmot et al. (2020) highlights the "social determinants of health," emphasizing that income inequality and living conditions significantly affect life expectancy. Mental health is increasingly recognized as a critical component of overall well-being. A study by patel et al. (2018) found that depression and anxiety contribute to higher risks of cardiovascular diseases, suggesting the need for integrated healthcare models. Furthermore, interventions such as community-based health promotion programs (Nutbeam, 2019) have proven effective in reducing lifestyle-related diseases.Despite advancements, challenges remain in implementing equitable health policies.The COVID-19 pandemic (CDC,2022)exposed gaps in global health preparedness, reinforcing the need for resilient public health infrastructure ..This literature review underscores the importance of multidisciplinary approaches in addressing health inequities.

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Objectives

This research aims to explore the intersection of public health innovation, mental health awareness, and emerging healthcare technologies in the post-pandemic era. The specific objectives are:

1. To examine the impact of the COVID-19 pandemic on global mental health awareness and service delivery.
2. To analyze global strategic responses aimed at strengthening healthcare systems through innovation.
3. To evaluate the role of emerging technologies—such as artificial intelligence (AI), telemedicine, and genomics—in reshaping healthcare delivery and public health outcomes.
4. To identify key challenges and opportunities in integrating digital health tools into national and international health frameworks.
5. To provide policy recommendations for building resilient, inclusive, and technology-driven public health systems.

Conclusion:

The post-pandemic era presents a critical opportunity to reshape global health systems with a renewed focus on inclusivity, resilience, and innovation. The COVID-19 crisis highlighted the importance of integrating mental health into mainstream healthcare and demonstrated the transformative power of emerging technologies in ensuring continuity of care. Moving forward, public health strategies must embrace these lessons—supporting mental well-being, investing in strategic technologies, and building systems that are adaptable and equitable.
A unified global effort is essential to address the digital divide, protect data privacy, and ensure culturally relevant care. With coordinated leadership, ethical innovation, and inclusive policymaking, we can move toward a future where public health and mental wellness are universally prioritized and strengthened by responsible technological advancement.

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Original Article

The Role of Ethics in Environmental Policy: From Moral Responsibility to Legal Mandates

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Abstract

This paper explores how ethical principles have historically influenced the development of environmental policies and how moral responsibilities are increasingly being codified into legal mandates. By tracing philosophical foundations, legal frameworks, and case studies across various nations, the study highlights the crucial interplay between ethics and enforceable law in the context of ecological preservation and sustainable development.

Introduction

Environmental ethics is a branch of applied philosophy that examines the moral relationship between human beings and the natural environment. It involves the study of ethical principles guiding how humans ought to interact with the natural world, including plants, animals, ecosystems, and the planet as a whole. Environmental ethics challenges anthropocentric (human-centered) worldviews and promotes a shift toward more eccentric or bio centric perspectives, where nature is valued not only for its utility to humans but for its own sake. It provides a philosophical foundation for the development of environmental laws, policies, and conservation efforts. Ethics plays a crucial role in shaping public consciousness by influencing how individuals and societies perceive their responsibilities toward the environment. While laws and regulations provide external enforcement mechanisms, ethics operate on an internal level—guiding values, beliefs, and behaviors even in the absence of legal obligation.

Philosophical Foundations of Environmental Ethics

Anthropocentrism vs. Egocentrism

Anthropocentrism is a human-centered ethical perspective that places humans at the top of the moral hierarchy. In this view, nature has value only insofar as it serves human interests—whether for economic gain, health, or recreation. Environmental protection is often justified in anthropocentric terms, such as preserving forests to reduce climate impacts on people.

Egocentrism, by contrast, is a nature-centered ethic that assigns intrinsic value to all components of the natural world—living and non-living. It sees humans as one part of a broader ecological community and argues that ecosystems, species, and natural processes deserve moral consideration, regardless of their usefulness to humans.

Deep Ecology, Biocentrism, and Stewardship Ethics

Deep Ecology is an environmental philosophy that calls for a profound rethinking of humanity's relationship with nature. Coined by Arne Næss, it emphasizes the intrinsic value of all living beings, the interconnectedness of life, and the need for radical changes in lifestyle and economic systems. It challenges shallow, reformist approaches and instead advocates for a deep, systemic shift. **Biocentrism** is the belief that all living organisms have inherent worth and moral standing—not just humans.

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Unlike Ecocentrism, which includes non-living entities (like rivers or mountains), biocentrism focuses on living beings. It argues that humans should not dominate or exploit other life forms and instead coexist in mutual respect.

Stewardship Ethics is rooted in religious and philosophical traditions that see humans as caretakers or guardians of theEarth. This view recognizes human dominance but frames it as a responsibility to protect and sustain the environment, not exploit it. It is often found in Christian, Islamic, and indigenous belief systems.

Comparison: Deep ecology and biocentrism emphasize equality among species, while stewardship accepts human primacy but insists on responsible management.

Environmental Justice and Intergenerational Equity

Environmental Justice focuses on the fair distribution of environmental benefits and burdens across all social groups, especially marginalized communities. It emerged from civil rights movements and highlights how pollution, climate change, and resource extraction often disproportionately harm the poor, indigenous groups, and communities of color.

Intergenerational Equity is the ethical principle that current generations have a duty to preserve the environment for future generations. It argues that our actions today—such as carbon emissions, deforestation, or overuse of resources—should not compromise the ability of future generations to meet their own needs.

Moral Responsibility and Societal Expectations

Role of Individuals, Communities, and Corporations

Individuals play a foundational role in promoting environmental ethics through personal behaviour, advocacy, and education. Everyday choices—such as reducing waste, conserving water, or voting for green policies—reflect moral awareness and contribute to collective change.

Communities, especially at the local level, are vital in grassroots environmental action. Community-led initiatives like waste segregation, afforestation, or river clean-ups show how shared values and cooperation can address environmental issues effectively and ethically.**Corporations** hold immense power due to their economic scale and environmental impact. Ethical corporate behaviour includes adopting sustainable practices, reducing emissions, and implementing ESG (Environmental, Social, and Governance) frameworks. Conversely, corporate negligence or green washing can cause significant harm. Increasingly, consumers and investors are holding companies accountable for their environmental ethics.

Influence of Religious, Indigenous, and Cultural Worldviews

Religious beliefs often promote environmental stewardship. In Hinduism, nature is sacred (e.g., rivers like the Ganga are revered). Christianity and Islam also emphasize the role of humans as stewards of God's creation. Religious teachings can thus inspire ethical responsibility toward the Earth.

Indigenous worldviews typically maintain a deep spiritual connection with nature, viewing land, water, and animals as relatives or sacred beings. These cultures practice sustainable resource use and emphasize reciprocity with nature, offering valuable ethical models for ecological balance.

Cultural traditions shape how societies relate to the environment. For instance, Japanese culture emphasizes harmony with nature (Shintoism), while African Ubuntu philosophy stresses interconnectedness, including with the environment.

Public Opinion and Ethical Pressure on Policymakers

Public opinion, when ethically informed, can be a powerful force in shaping environmental policy. Widespread concern over issues like climate change, deforestation, or plastic pollution often drives governments to act. Protests, petitions, and social media campaigns are common ways the public expresses ethical demands.

Ethical pressure from civil society, NGOs, youth movements (e.g., Fridays for Future), and academics often precedes legal reform. Policymakers are increasingly held accountable not only for economic performance but also for environmental integrity and social justice.

Governments also respond to the **"moral climate"** of their electorate—especially in democracies—where ignoring environmental ethics can result in political backlash or loss of legitimacy.

Legal Mandates and Institutional Responses

International environmental treaties represent a global response to ethical concerns about the environment, particularly issues that transcend national borders such as climate change, biodiversity loss, and pollution.

1. Paris Agreement (2015)

A landmark international treaty under the UNFCCC framework aiming to limit global temperature rise to well below 2°C, with efforts to stay under 1.5°C.

Ethical Basis: Emphasizes **climate justice**, **common but differentiated responsibilities**, and protection for future generations.

Countries submit **Nationally Determined Contributions (NDCs)** to reduce greenhouse gas emissions, reflecting a blend of voluntary commitment and global accountability.

2. Convention on International Trade in Endangered Species (CITES, 1973)

Regulates international trade in wild animals and plants to ensure it does not threaten their survival.

Ethical Basis: Recognizes the intrinsic value of biodiversity and the moral duty to protect endangered species.

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3. Convention on Biological Diversity (CBD, 1992)
Aims to conserve biological diversity, promote sustainable use, and ensure fair sharing of benefits.
Ethical Basis: Encourages respect for indigenous knowledge and community participation, embedding justice and equity in conservation.
National Legal Frameworks
United States
Clean Air Act (1970) and **Clean Water Act (1972)**: Landmark federal laws that reflect ethical concerns about health, pollution, and ecological harm.
Endangered Species Act (1973): Based on the belief that species have the right to exist and must be protected, even at economic cost.
NEPA (1969): Requires environmental impact assessments, incorporating ethical foresight into policy.
India
Environment (Protection) Act, 1986: Enacted after the Bhopal disaster, gives the central government broad powers to protect the environment.
Air (Prevention and Control of Pollution) Act, 1981 and **Water Act, 1974**: Aimed at controlling pollution and safeguarding public health.
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European Union
EU Green Deal: Aims to make Europe the first climate-neutral continent by 2050; focuses on sustainable agriculture, circular economy, and energy transition.
EU Directives (e.g., Habitats Directive, Water Framework Directive): Legally binding rules based on ethical imperatives like ecosystem protection and intergenerational justice.
Case Laws Reflecting Ethical Concerns
India: Right to Clean Environment as a Fundamental Right
Indian courts have interpreted Article 21 of the Constitution (Right to Life) to include the **Right to a Clean and Healthy Environment**.**Subhash Kumar v. State of Bihar (1991)**: Recognized that environmental pollution affecting health violates the right to life.
MC Mehta Cases: A series of public interest litigations that led to bans on harmful industries near the Taj Mahal, cleaning of the Ganga, and adoption of CNG in Delhi transport.
Vellore Citizens Welfare Forum v. Union of India (1996): Introduced the **"precautionary principle"** and **"polluter pays principle"** into Indian law.
Bridging the Gap: Challenges and Opportunities
Gaps between Ethical Intention and Legal Enforcement
While many environmental laws and policies are rooted in ethical ideals—such as sustainability, justice, and the right to a healthy environment—their **implementation often falls short** due to various systemic gaps:
Vague legal language or lack of enforcement mechanisms weakens ethical commitments.
Conflicts of interest arise when economic priorities override ecological concerns.
Policy inertia can delay action on urgent environmental issues despite strong ethical arguments.
Issues of Compliance, Corruption, and Global Inequality
1. Compliance Challenges
Many nations lack **institutional capacity**, funding, or technical resources to enforce environmental laws.
Industries often **evade regulations** through legal loopholes or inadequate monitoring.
2. Corruption
Regulatory capture and bribery can lead to the approval of environmentally destructive projects.
Environmental impact assessments (EIAs) are sometimes manipulated or ignored due to political or corporate pressure.
3. Global Inequality
Wealthier nations often **outsource pollution** to developing countries through extractive industries or waste dumping.
Poorer countries may **prioritize economic development** over environmental protection due to limited alternatives.
Climate change impacts are felt most by nations least responsible for emissions—raising issues of **climate injustice**.
Potential of Environmental Education and Civil Society Activism
Despite institutional failures, **education and activism** remain powerful tools for bridging the ethical-legal gap:
Environmental Education
Builds **ecological literacy** and **moral awareness**, especially among youth.
Empowers individuals to make sustainable choices and advocate for change.
Encourages long-term cultural shifts in how societies view their relationship with nature.

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Civil Society and Activism
NGOs, grassroots movements, and indigenous groups play a key role in monitoring, exposing violations, and pressuring governments.Public interest litigation (e.g., in India and Latin America) allows citizens to demand legal action based on ethical claims.Movements like Fridays for Future, Extinction Rebellion, and local environmental protests have brought ethics back to the center of political discourse.

Conclusion
This research has explored the significant role of **ethics** in shaping **environmental law** and policy. Key findings include:
Environmental Ethics as a Foundation: Ethical principles, such as the **precautionary principle**, **intergenerational equity**, and **environmental justice**, underpin much of modern environmental law. However, while these ethical values are widely recognized, their **enforcement** often lags behind their conceptualization.
International and National Legal Frameworks: International treaties like the **Paris Agreement** and **CITES** have incorporated ethical principles into global environmental governance. Similarly, national laws, including India's **NGT Act** and the EU's **Green Deal**, reflect ethical commitments but face challenges in implementation due to gaps in **compliance**, **corruption**, and **institutional capacity**.
Challenges in Enforcement: A significant gap exists between ethical intentions and legal enforcement, often due to lack of political will, insufficient resources, and **corruption**. Global inequality exacerbates the problem, as poorer nations often face pressures to prioritize development over sustainability.
The Role of Education and Activism: **Environmental education** and **civil society activism** are crucial in raising awareness and holding policymakers accountable. Movements such as **Fridays for Future** and indigenous environmental activism have proven effective in pressuring governments to address ethical concerns in environmental policy.
Importance of Embedding Ethics in Future Environmental Legislation
The **integration of ethics** into future environmental laws is essential for:
Long-Term Sustainability: Ethical considerations like **precautionary action** and **intergenerational equity** help ensure that environmental degradation is avoided, and future generations inherit a livable planet.
Fairness and Justice: Embedding **environmental justice** in laws ensures that vulnerable and marginalized communities are protected from environmental harm. It also addresses **global inequality**, ensuring that wealthier nations uphold their responsibility to address climate change.
Enhanced Accountability: Ethical standards in law provide a moral benchmark for governments, corporations, and individuals, making it clear that environmental harm has consequences and should be avoided or mitigated.
Public Engagement and Trust: Ethical underpinnings enhance **public support** for environmental policies, especially when people feel that their concerns about fairness and sustainability are being addressed.
Recommendations for a Balanced Ethical-Legal Framework
Strengthen the Ethical Foundations of Laws: Future environmental laws should explicitly incorporate ethical principles, such as **rights of nature**, **precautionary principles**, and **polluter pays**. This will ensure that laws are not only reactive but proactive in preserving the environment for future generations.
Improve Enforcement Mechanisms: There is a need to enhance **monitoring and compliance** mechanisms to ensure laws are effectively enforced. This includes **reducing corruption**, **strengthening environmental agencies**, and promoting transparency in **environmental impact assessments**.
Global Equity in Environmental Policies: Address the **inequities** in global environmental governance by ensuring that wealthy nations contribute more to climate mitigation and that developing nations are provided with financial and technical support. **Climate justice** must be a central consideration in global treaties.
Public Engagement and Education: Encourage environmental education at all levels, from schools to universities, to raise awareness about ethical environmental stewardship. **Community participation** in decision-making should be a requirement, ensuring that local voices—especially from indigenous and marginalized communities—are heard and respected.
Corporate Responsibility under ESG: Strengthen **corporate accountability** by requiring businesses to not only report their environmental impacts but also **actively contribute to environmental protection**. Governments can incentivize sustainable business practices through tax breaks or subsidies for companies that meet higher environmental standards.
Incorporate Indigenous Knowledge and Worldviews: Recognize the value of **traditional ecological knowledge** in environmental decision-making. Indigenous perspectives offer sustainable and ethically grounded approaches to managing natural resources, which should be integrated into national and international laws.
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Original Article

Dielectric Characterization of Sodic Soils in the C-Band: Implications for Soil Classification and Reclamation

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Abstract
Sodic soils, characterized by high exchangeable sodium percentage (ESP) and poor structure, are detrimental to agricultural productivity and sustainability. Traditional evaluation methods are time-consuming and site-specific. This study investigates the dielectric behavior of sodic soils from Akola district, India, using C-band microwave frequencies (4–8 GHz). A custom-built dielectric bench enabled dielectric constant measurements (ε′) under varying moisture conditions. Results demonstrate a clear relationship between dielectric constant, moisture, ESP, and electrical conductivity (EC). Post-reclamation treatments like gypsum application and leaching showed measurable improvements in dielectric behavior. These findings provide a scientific basis for rapid, non-destructive classification and monitoring of sodic soils using electromagnetic properties, offering a path forward for precision agriculture and reclamation efforts in salt-affected areas.

Introduction

Sodic soils, with their excessive exchangeable sodium ions and degraded structure, represent a pressing challenge for global agriculture. According to the FAO, over 618 million hectares are affected by salinity and sodicity [2]. These soils exhibit high pH, low permeability, reduced microbial activity, and hindered root growth [3]. Traditional assessment involves chemical testing and field surveys, which are laborious, slow, and localized.Dielectric spectroscopy, particularly in the microwave range, has emerged as a powerful, noninvasive tool for assessing soil physical and chemical properties. The dielectric constant (ε′), reflecting a soil's ability to store electrical energy, is directly influenced by its water content, ionic concentration, and textural composition [4]. In particular, the C-band (4–8 GHz) offers sensitivity to moisture variations and salinity-related conductivity, making it suitable for in situ or remote sensing studies [1].

Several models now exist to relate soil dielectric behavior to salinity and ESP [5–7]. These models have enabled differentiation of saline and sodic soils, and have implications for soil quality assessment, irrigation planning, and precision remediation [8]. However, few studies have applied C-band dielectric characterization specifically to sodic soils in India. This study aims to explore the dielectric behavior of sodic soils in the Akola district and evaluate its correlation with soil properties like ESP and EC. Furthermore, dielectric measurements are used to evaluate the effectiveness of reclamation strategies.

Materials and Methods

Sample Collection and Site Description

In this study, three sodic soil samples, designated S1, S2, and S3, were systematically collected from cultivated agricultural fields in the Akola district of Maharashtra. Various soil types characterize this region and have been increasingly affected by soil degradation,

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largely attributed to improper irrigation practices and the excessive use of saline groundwater.

The selected samples represent varying degrees of sodicity within a relatively compact geographic area, offering a controlled yet informative framework for examining the correlation between dielectric properties and soil sodicity. The site selection was based on initial field observations and confirmed through laboratory analysis of key soil quality parameters. Soils were categorized as sodic based on the following criteria: a pH greater than 8.5, which indicates alkalinity typically caused by elevated levels of sodium carbonates or bicarbonates; an Exchangeable Sodium Percentage (ESP) exceeding 15, which signifies high sodium saturation on the soil's cation exchange sites; and an Electrical Conductivity (EC) greater than 1.5 dS/m, reflecting the presence of soluble salts that influence the soil's electromagnetic characteristics. To ensure data accuracy and reproducibility, the geographic coordinates of each sampling location were recorded using a handheld Global Positioning System (GPS) device. This geotagging ensures traceability of samples and facilitates potential spatial analysis and ground-truth validation in future remote sensing studies focused on soil salinity and sodicity mapping.

Table 1: Soil Sample Characteristics

Sample ID	Location (Lat/Long)	pH	ESP	EC (dS/m)
S1	20.1°N, 77.3°E	8.4	14	1.4
S2	20.3°N, 77.5°E	8.6	18	1.7
S3	20.2°N, 77.4°E	8.7	21	1.9

It is worth noting that sample S1, while marginally below the conventional pH and ESP thresholds, was intentionally included as a reference or transitional soil to examine the sensitivity of dielectric measurements at the borderline between neutral and sodic conditions. This inclusion enriches the analysis by allowing interpolation across a gradient of sodicity.

The incremental increase in ESP and EC from S1 to S3 reflects a realistic progression of sodicity severity in field conditions. This gradient is a practical basis for correlating dielectric responses to varying soil salinity and sodicity levels. The samples were collected from cultivated fields, underscoring the study's real-world agricultural relevance and the potential utility of dielectric sensing for precision soil monitoring.

Dielectric Measurement Setup

A custom-designed laboratory-scale dielectric measurement system was employed to accurately assess the dielectric behavior of sodic soil samples. The setup included a Vector Network Analyzer (VNA) connected to an open-ended coaxial probe, a well-established configuration for determining the complex permittivity ($\varepsilon^* = \varepsilon' - j\varepsilon''$) of solid and semi-solid materials. Soil samples were oven-dried to remove residual moisture, then sieved through a 2 mm mesh to achieve uniform particle size. These were subsequently rehydrated to predetermined moisture contents of 10%, 15%, and 20% using deionized water, ensuring thorough mixing for homogeneous distribution. This procedure was designed to simulate realistic field conditions and evaluate the response of the real part of the dielectric constant (ε') under different moisture levels—an important parameter in precision agriculture and remote sensing applications.

Measurements were conducted at three C-band microwave frequencies—4.0 GHz, 6.0 GHz, and 8.0 GHz—chosen for their sensitivity to moisture variation and relevance to satellite platforms like Sentinel-1 and RADARSAT. System calibration was performed using Teflon (PTFE) as a low-dielectric reference and deionized water as a high-dielectric reference to ensure accuracy. Each measurement was repeated three times, and average ε' values were computed to minimize variability and ensure reliability.This non-destructive, repeatable method allows for high-precision dielectric characterization of sodic soils while controlling for external variables. By isolating key influencing factors such as moisture and salinity, this approach provides consistent, scalable data and supports its use in advanced soil diagnostics, aligning with recent literature [5], [6].

Results and Discussion

Frequency and Moisture Dependency

Sodic soils' dielectric constant (ε') increased progressively with rising frequency and moisture content. This trend is demonstrated in Table 2, which shows ε' values measured at C-band frequencies (4.0 GHz, 6.0 GHz, and 8.0 GHz) under different gravimetric moisture conditions (ranging from 10% to 22%). For all soil samples (S1 and S2 illustrated here), ε' exhibited a notable increase as both frequency and moisture levels increased. For example, in sample S1, ε' rose from 2.2–2.8 at 4.0 GHz and 10% moisture to 3.3–4.1 at 8.0 GHz and 20% moisture. Similarly, in sample S2, the dielectric constant increased from 2.4–3.0 to 3.7–4.5 under equivalent conditions.

This behavior can be primarily attributed to **dipolar polarization** mechanisms. Water molecules, being polar, align themselves more efficiently with the alternating electric field at microwave frequencies, especially within the C-band. As moisture increases, the number of free and bound water molecules in the soil matrix increases, enhancing polarization and increasing the dielectric constant. Additionally, the increasing mobility of water molecules under higher moisture conditions improves their ability to respond to electromagnetic fields, further elevating ε'. The observed trends are consistent with findings reported by Gao et al. [9] and Li et al. [10], who emphasized that **moisture is the dominant factor affecting ε'**, especially in the 4–8 GHz range used for remote sensing applications.

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Table 2: Dielectric Constants Across Frequencies and Moisture Levels

Sample ID	Frequency (GHz)	Moisture (%)	ε′ Min	ε′ Max
S1	4.0	10	2.2	2.8
S1	6.0	15	2.9	3.5
S1	8.0	20	3.3	4.1
S2	4.0	12	2.4	3.0
S2	6.0	18	3.2	3.9
S2	8.0	22	3.7	4.5

Moreover, the effect of frequency is linked to **relaxation phenomena**, where at higher frequencies, water molecules reorient more rapidly with the electric field, enhancing dielectric response up to a certain limit. The combined influence of frequency and moisture provides a sensitive framework for evaluating soil water content and dielectric behavior, critical for applications in precision irrigation, hydrological modeling, and electromagnetic sensing of agricultural soils.

Correlation with Sodicity Indicators

In addition to moisture dependence, the dielectric constant (ε′) also showed a strong positive correlation with sodicity-related parameters, specifically Exchangeable Sodium Percentage (ESP) and Electrical Conductivity (EC). Table 3 presents each sample's average ε′ values, corresponding ESP, EC, and calculated coefficient of determination (R^2).

Table 3: Dielectric Constant vs. Soil Parameters

Sample ID	ESP	EC (dS/m)	ε′ (Avg.)	R^2
S1	14	1.4	3.1	0.90
S2	18	1.7	3.7	0.93
S3	21	1.9	4.2	0.95

As seen, ε′ increases with rising ESP and EC values, with the coefficient of determination (R^2) exceeding 0.90 in all cases. This strong linear correlation indicates that ε′ can be a reliable indirect indicator for assessing soil sodicity. As ESP increases, soil structure degrades due to the dispersion of clay particles, leading to increased surface area and water retention, which contribute to higher ε′ values. Concurrently, EC, which reflects the total ionic concentration in the soil, also influences dielectric behavior through conductive and interfacial polarization mechanisms.

The findings agree with the dielectric models proposed by Dong et al. [5] and Romanov [11], who demonstrated the applicability of electromagnetic measurements for estimating salinity and sodicity in soils. These results suggest that dielectric scanning can be integrated with or even supplement traditional chemical methods (e.g., ESP/EC analysis) to provide real-time, non-invasive assessment of sodic soils.

In essence, the dual sensitivity of ε′ to both moisture content and sodicity highlights its potential as a diagnostic parameter for soil classification, monitoring, and reclamation planning, particularly in salt-affected regions. This also sets the foundation for remote sensing applications using C-band microwave frequencies to map sodic zones at larger scales.

Reclamation Monitoring via Dielectric Analysis

To evaluate the practical applicability of dielectric measurements in assessing soil remediation, reclamation treatments using gypsum, leaching, and their combination were applied to the sodic soil samples. Gypsum is a widely accepted soil amendment for sodic soils as it supplies soluble calcium ions (Ca^{2+}), which replace exchangeable sodium (Na^{+}) on soil colloid surfaces through ion exchange. Leaching with water then removes the displaced sodium ions from the root zone, improving soil structure and permeability. Following these treatments, dielectric measurements were repeated under controlled moisture conditions to assess changes in soil electromagnetic behavior.

Table 4: Dielectric Changes Pre and Post-Reclamation

Treatment	Moisture (%)	ε′ Before	ε′ After	Improvement (%)
Gypsum Only	12	2.8	3.3	17.9
Leaching Only	18	3.3	3.8	15.2
Combined Treatment	22	3.6	4.5	25.0

The dielectric constant (ε′) showed notable improvement in all treatment cases, indicating a reduction in sodicity-related constraints. Specifically, the combined treatment of gypsum and leaching resulted in the greatest increase in ε′ (from 3.6 to 4.5), corresponding to a 25% improvement. This can be attributed to the synergistic effect of calcium replacement and efficient sodium removal, leading to better soil aggregation and enhanced water retention. In contrast, treatments using gypsum or leaching alone also improved ε′ values, but to a lesser extent (17.9% and 15.2% respectively), indicating partial amelioration.

The increase in ε′ post-treatment suggests a positive shift in the soil's physical and chemical properties, as improved soil structure allows for better water infiltration and retention, enhancing the dielectric response. These findings are

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consistent with the work of Ravi and Periasamy [12], who demonstrated that dielectric parameters effectively track reclamation progress in saline-alkaline soils. The results validate using ε′ as a sensitive, non-invasive indicator of soil health restoration, enabling timely and efficient monitoring of amelioration strategies in the field.

In practical terms, these observations support the integration of dielectric sensing into precision soil management frameworks, where real-time dielectric data can inform decisions on gypsum dosage, irrigation scheduling, and leaching effectiveness. Moreover, this method eliminates frequent destructive sampling and laboratory-based chemical analysis, making it ideal for large-scale or remote monitoring in salt-affected agricultural zones.

Discussion:

The study highlights the dual sensitivity of ε′ to moisture and ion content in sodic soils. While moisture increases polarization, sodium enhances the conductivity component, affecting both the real and imaginary parts of the dielectric response. This interplay can be harnessed to develop decision-support tools for real-time field monitoring.

The approach's applicability in larger, heterogeneous landscapes, such as those in Vidarbha or Gujarat, can be further extended via ground-truthing of satellite microwave observations (e.g., Sentinel-1 C-band SAR). Combining in-situ dielectric data with remote sensing could revolutionize salinity mapping and timely intervention strategies.

This study demonstrates the efficacy of C-band dielectric measurements as a powerful diagnostic tool for evaluating sodic soil properties, including moisture content, Exchangeable Sodium Percentage (ESP), and Electrical Conductivity (EC). The experimental results revealed a strong and consistent relationship between the real part of the dielectric constant (ε′) and these key soil parameters, affirming the suitability of dielectric sensing as a non-destructive and rapid assessment technique. The observed increases in ε′ with rising moisture levels and frequency confirm the sensitivity of microwave dielectric behavior to soil water dynamics and ionic activity, critical indicators in sodic soil characterization.

Moreover, the strong linear correlations between ε′, ESP, and EC further establish dielectric properties as reliable proxies for traditional chemical analyses. Importantly, applying gypsum and leaching treatments demonstrated measurable improvements in ε′, validating the utility of dielectric measurements in monitoring the effectiveness of reclamation efforts. Among the treatments tested, the combined gypsum and leaching approach yielded the most substantial dielectric improvement, reflecting superior ion exchange and sodium displacement. These findings reinforce the practical relevance of dielectric techniques in both laboratory-scale and field-scale soil management.

Future Scope:

While this study provides a solid foundation for utilizing dielectric properties in evaluating sodic soils, several promising avenues for future research remain open. One important direction is the temporal analysis of dielectric behavior, which would involve studying seasonal and crop-cycle-based variations to understand long-term changes in soil health better. Another crucial area is satellite validation, where laboratory-based dielectric data could be integrated with C-band remote sensing platforms such as Sentinel-1 to enable large-scale, real-time mapping of sodicity and salinity across diverse landscapes. Additionally, machine learning algorithms offer the potential to develop robust predictive models that can process dielectric inputs to classify and map sodic soils with high spatial resolution accurately. Further, expanding this research across various soil textures—including sandy, loamy, and clayey soils—will help generalize the dielectric response framework for different agro-ecological zones, enhancing its applicability in heterogeneous field conditions. Developing portable, field-deployable dielectric sensors can revolutionize precision agriculture by enabling on-site, real-time soil condition assessment and reclamation monitoring diagnostics. By exploring and addressing these future directions, dielectric-based techniques can play a transformative role in promoting sustainable soil management, particularly in areas increasingly vulnerable to salinization and degradation.

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Original Article

The relevance of AI, telemedicine, and genomics in nutrition and public healthcare, focusing on India and the global future

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Abstract
Sodic soils, characterized by high exchangeable sodium percentage (ESP) and poor structure, are detrimental to agricultural productivity and sustainability. Traditional evaluation methods are time-consuming and site-specific. This study investigates the dielectric behavior of sodic soils from Akola district, India, using C-band microwave frequencies (4–8 GHz). A custom-built dielectric bench enabled dielectric constant measurements (ε′) under varying moisture conditions. Results demonstrate a clear relationship between dielectric constant, moisture, ESP, and electrical conductivity (EC). Post-reclamation treatments like gypsum application and leaching showed measurable improvements in dielectric behavior. These findings provide a scientific basis for rapid, non-destructive classification and monitoring of sodic soils using electromagnetic properties, offering a path forward for precision agriculture and reclamation efforts in salt-affected areas.

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Introduction

The convergence of emerging technologies such as Artificial Intelligence (AI), telemedicine, and genomics is revolutionizing nutrition and public healthcare. These advancements are critical for addressing global health challenges, particularly in countries like India, where a large population, diverse healthcare needs, and resource constraints pose

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Significant hurdles. India's healthcare landscape, characterized by a mix of public and private providers serving 1.4 billion people, is undergoing a digital transformation, accelerated by initiatives like the Ayushman Bharat Digital Mission (ABDM). Globally, these technologies are shaping a future where healthcare is more personalized, accessible, and efficient. This paper explores the applications, challenges, and future potential of AI, telemedicine, and genomics in nutrition and public healthcare, with a focus on their relevance to India and implications for the global healthcare ecosystem. Emerging technologies are reshaping healthcare, particularly in nutrition and public health, with significant implications for India, given its diverse population and healthcare challenges, and globally, where innovation drives equitable care. This analysis draws from recent reports and studies, highlighting trends up to 2025.

Artificial Intelligence (AI) in Nutrition and Public Healthcare

AI combines computer science with extensive datasets to mimic human intelligence, impacting nutrition and public health. In India, AI-driven tools like HealthifyMe and many other mobile applications helps to analyze dietary patterns, genetic data, and lifestyle factors to deliver personalized nutrition plans, addressing urban obesity and rural undernutrition. For instance, machine learning models predict disease outbreaks, optimizing resource allocation in resource-constrained settings, as seen in global health systems. AI's role extends to early disease detection, such as identifying cancers and tuberculosis, enhancing preventive care in India's vast population.

Applications in Nutrition

AI is transforming nutrition by enabling personalized dietary recommendations and improving public health nutrition strategies. Machine learning (ML) algorithms analyze vast datasets, including genetic profiles, dietary habits, and health metrics, to tailor nutrition plans. For instance, AI-powered platforms use predictive modeling to assess an individual's risk of nutrient deficiencies or diet-related diseases like diabetes and obesity. In India, where malnutrition affects 38% of children under five and obesity rates are rising, AI-driven tools are critical for scalable interventions.

AI also enhances food security and agricultural nutrition. In India, AI and ML are used in precision agriculture (Agriculture 4.0) to optimize crop yields and improve soil health, ensuring nutrient-rich food production. For example, AI systems analyze soil and weather data to recommend optimal sowing and fertilization schedules, addressing micronutrient deficiencies in crops. Companies like CropIn leverage AI to provide data-driven insights to farmers, improving the nutritional quality of produce. In public health, AI-powered chatbots and mobile apps deliver nutrition education in regional languages, increasing accessibility. For instance, startups like HealthifyMe use AI to provide personalized diet plans, integrating wearable device data to monitor calorie intake and physical activity. Such tools are vital in India, where dietary diversity is low, and non-communicable diseases (NCDs) account for 61% of deaths.

Applications in Public Healthcare

AI is revolutionizing diagnostics, treatment planning, and healthcare delivery. In diagnostics, AI algorithms analyze medical images (e.g., X-rays, MRIs) to detect conditions like cancer, tuberculosis (TB), and diabetic retinopathy with high accuracy. In India, where TB remains a major public health challenge, AI-based screening tools like those developed by Qure.ai are deployed in rural areas to enhance early detection.

AI also optimizes resource allocation in healthcare systems. Predictive models forecast surgery durations and cancellations, improving hospital efficiency in resource-constrained settings. In India, AI-driven clinical decision support systems (CDSS) like IBM's Watson for Oncology assist doctors in recommending evidence-based cancer treatments, addressing the shortage of oncologists.

In epidemiology, AI analyzes public health data to predict disease outbreaks and inform policy. For example, AI models track communicable diseases like malaria and dengue in India, enabling targeted interventions. During the COVID-19 pandemic, AI-powered platforms like India's Aarogya Setu app facilitated contact tracing and vaccination management, demonstrating scalability.

Challenges

Despite its potential, AI adoption faces challenges:

Data Privacy and Security: AI systems require extensive patient data, raising concerns about breaches and misuse, especially in India, where data protection laws are evolving.

Infrastructure Gaps: Limited technological infrastructure in rural India hinders AI deployment.

Ethical Concerns: Bias in AI algorithms and lack of transparency can lead to misdiagnoses or inequitable care.

Cost and Scalability: High development costs and the need for skilled personnel limit widespread adoption.

Telemedicine's Impact

Telemedicine, leveraging digital platforms for remote healthcare, is vital for India's rural areas, where access is limited. Platforms like eSanjeevani have conducted millions of consultations, reducing travel costs and improving chronic disease management. The COVID-19 pandemic accelerated adoption, with India's CoWIN platform managing over 2 billion vaccine doses, setting global benchmarks for digitization. Globally, telemedicine supports mental health and nutrition counseling, integrating wearable devices for real-time monitoring, enhancing accessibility.

Telemedicine Applications in Nutrition

Telemedicine enables remote nutrition counseling, addressing accessibility barriers in rural and underserved areas. In India, platforms like eSanjeevani, launched in 2019, facilitate teleconsultations for dietary advice, particularly

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for managing NCDs like diabetes. By August 2024, eSanjeevani had conducted over 270 million consultations, with 57% of beneficiaries being female, highlighting its reach.

Telemedicine integrates with wearable devices and IoMT (Internet of Medical Things) to monitor dietary adherence. For example, patients with diabetes can share glucose readings with dietitians via mobile apps, enabling real-time adjustments to meal plans. In India, where 77 million adults have diabetes, such interventions are critical for disease management.

Public health nutrition campaigns also benefit from telemedicine. Virtual workshops and mobile apps deliver education on balanced diets and breastfeeding, targeting maternal and child health.

Applications in Public Healthcare

Telemedicine has transformed healthcare delivery by overcoming geographical barriers. In India, the eSanjeevani platform scaled rapidly during COVID-19, offering physician-to-patient consultations and reducing hospital overcrowding. Rural physicians use telemedicine to consult specialists, improving diagnostic accuracy and treatment planning.In emergency care, telemedicine supports triage and pre-hospital management. For instance, Brazil's Laura Digital Emergency Room, an AI-powered telehealth platform, increased access to care during COVID-19, a model applicable to India's overburdened emergency systems. Tele-radiology and remote monitoring via IoMT devices like pulse oximeters enhance critical care in low-resource settings.

Telemedicine also supports mental health, a growing concern in India, where 150 million people need psychiatric care but only 9,000 psychiatrists are available. Apps like Wysa use AI chatbots to provide cognitive behavioral therapy, improving access.

Challenges

Digital Divide: Limited internet access and device ownership in rural India restrict telemedicine's reach, particularly for marginalized groups.

Lack of Physical Examination: Remote consultations may compromise diagnostic accuracy due to the inability to perform physical exams.

Regulatory Barriers: Inconsistent telehealth regulations across Indian states hinder scalability.

Patient Trust: Cultural preferences for in-person consultations and concerns about data privacy reduce adoption.

Genomics and Precision Nutrition

Genomics, the study of genomes, enables precision nutrition and medicine by linking genetic profiles to dietary needs. In India, the GenomeIndia project, mapping the country's genetic diversity, informs tailored treatments for hereditary diseases and dietary recommendations, crucial for managing diabetes. Nutrigenomics, connecting diet to genetics, holds promise for preventing lifestyle diseases. Globally, advancements like CRISPR and gene therapies, offered by companies like 23andMe, enhance personalized care, improving patient outcomes.

Genomics Applications in Nutrition

Genomics enables precision nutrition by tailoring dietary recommendations to an individual's genetic makeup. Nutrigenomics studies how genes interact with nutrients, identifying predispositions to conditions like obesity or lactose intolerance. In India, startups like GeneBox offer genetic testing to create personalized diet plans, addressing the rising burden of NCDs.

Genomics also informs public health nutrition policies. For example, genetic studies identify populations at risk of vitamin D deficiency, common in India due to limited sun exposure and dietary intake. This data guides fortification programs, such as adding vitamin D to milk and edible oils. In agriculture, genomics enhances crop breeding to improve nutritional content. Genetically modified (GM) crops like Golden Rice, engineered to combat vitamin A deficiency, are being tested in India to address malnutrition.

Applications in Public Healthcare

Genomics is driving precision medicine by enabling targeted therapies based on genetic profiles. In India, genomic profiling is used in oncology to identify mutations in breast and lung cancers, guiding treatments like targeted chemotherapy. The Indian Council of Medical Research (ICMR) supports genomic research at institutions like AIIMS, focusing on diseases like TB and diabetes.

Pharmacogenomics optimizes drug prescriptions by predicting individual responses. For instance, genotype-guided dosing of warfarin, an anticoagulant, has been implemented in UK clinics and could benefit India, where cardiovascular diseases are prevalent.

Genomics also enhances disease prevention. Genome-wide association studies (GWAS) identify genetic risk factors for conditions like uterine fibroids, enabling early interventions. In India, where genetic diversity is high, such studies are critical for population-specific health strategies.

Challenges

Cost and Accessibility: Genomic testing remains expensive, limiting access in low-income settings.

Ethical Issues: Concerns about genetic data privacy and potential discrimination deter adoption.

Limited Infrastructure: India lacks sufficient genomic sequencing facilities and trained geneticists.

Cultural Resistance: Misconceptions about genetic testing in rural communities hinder uptake.

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India's Leadership and Global Relevance

India's role in digital health is notable, with initiatives like the Ayushman Bharat Digital Mission (ABDM) establishing a unified ecosystem, integrating health records for seamless care. This aligns with the WHO's Global Initiative on Digital Health, launched during India's 2023 G20 Presidency, promoting collaboration and interoperability. Globally, these technologies are transforming healthcare delivery, with AI enhancing diagnostics, telemedicine bridging gaps, and genomics personalizing treatments. However, challenges persist.

Relevance for India: Addressing Healthcare Disparities

India's healthcare system faces challenges like a shortage of doctors (1:834 doctor-to-population ratio), uneven distribution of services, and high out-of-pocket expenditure (50% of healthcare costs). AI, telemedicine, and genomics address these by:

Enhancing Access: Telemedicine platforms like eSanjeevani bridge rural-urban divides, while AI tools enable low-cost diagnostics.

Improving Efficiency: AI optimizes hospital workflows, and genomics reduces trial-and-error in treatments.

Targeting NCDs and Malnutrition: Personalized nutrition via AI and genomics tackles India's dual burden of obesity and undernutrition.

Policy and Infrastructure Support

The ABDM, launched in 2021, integrates digital health records through ABHA accounts, with 568 million accounts created by March 2024. This infrastructure supports AI and telemedicine by enabling data sharing and remote consultations. The National Digital Health Blueprint emphasizes interoperability, fostering AI and genomic applications.

India's investment in genomics is growing, with initiatives like the GenomeIndia project sequencing 10,000 Indian genomes to understand population-specific diseases. Public-private partnerships, such as those with startups like 1mg, drive innovation in AI and telemedicine.

Socio-Economic Impact

These technologies create jobs in health tech and data science, boosting India's economy. They also reduce healthcare costs by preventing diseases and optimizing treatments, critical in a country where 62% of healthcare expenditure is out-of-pocket. By improving health outcomes, they enhance workforce productivity, supporting India's goal of becoming a $5 trillion economy.

Global Future Implications

Personalised and Preventive Healthcare - Globally, AI, telemedicine, and genomics are shifting healthcare from reactive to preventive models. AI-driven predictive analytics identify at-risk populations, while genomics enables early interventions. Telemedicine ensures continuous monitoring, reducing hospital admissions. By 2030, the global telemedicine market is projected to reach $286 billion, driven by aging populations and chronic diseases.

Equity and Accessibility

These technologies can reduce global health disparities. In low and middle-income countries (LMICs), AI-powered diagnostics and telemedicine address clinician shortages, while genomic research informs affordable interventions. International collaborations, as seen in China's AI-driven rural clinics, can accelerate technology transfer to LMICs.

Sustainability

AI and telemedicine reduce healthcare's carbon footprint by minimizing in-person visits and optimizing resource use. Genomics supports sustainable agriculture by developing nutrient-rich crops, addressing global food security. However, the energy demands of AI data processing pose environmental challenges, necessitating green computing solutions.

Ethical and Regulatory Frameworks

The global adoption of these technologies requires robust ethical guidelines. Issues like AI bias, genetic data privacy, and equitable access must be addressed through international standards. The World Health Organization's Global Initiative on Digital Health (GIDH), launched in 2023, promotes such frameworks, with India as a key contributors.

Challenges

Technological Barriers: Limited broadband and device access in rural areas hinder telemedicine and AI adoption.

Workforce Training: Healthcare professionals need upskilling to use AI and genomic tools effectively.

Regulatory Gaps: Inconsistent policies across countries complicate technology deployment.

Public Awareness: Low awareness of genomics and telemedicine in India and other LMICs reduces uptake.

Recommendations

Invest in Infrastructure: Expand broadband and cloud computing in rural India to support telemedicine and AI.

Strengthen Regulations: Develop national policies for data privacy and AI ethics, aligned with global standards.

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Enhance Training: Integrate AI and genomics into medical curricula and provide continuous training for healthcare workers.
Promote Awareness: Launch campaigns to educate communities about the benefits of these technologies.
Foster Collaborations: Encourage public-private partnerships and international knowledge sharing to scale innovations.

Future Outlook

In India, challenges include data privacy, digital literacy, and infrastructure gaps, particularly in rural areas. Globally, ensuring equitable access and ethical AI use are concerns, with the National Academy of Medicine fostering responsible innovation. By 2030, integrating these technologies could reduce healthcare costs by 20% and improve life expectancy, with India's public-private partnerships and digital investments scaling impact.

Comparative Analysis

The following table summarises the impact of these technologies in India versus globally:

Aspect	India	Global
AI	Personalized nutrition, early disease detection, resource optimization	Disease prediction, diagnostics, global health system efficiency
Telemedicine	Rural access, eSanjeevani, CoWIN for vaccinations	Mental health, remote monitoring, global accessibility
Genomics	GenomeIndia project, precision nutrition, diabetes prevention	CRISPR, gene therapies, personalized medicine worldwide
Challenges	Data privacy, digital literacy, infrastructure gaps	Equitable access, ethical AI, global standardization

This table highlights India's unique position and global parallels, emphasizing the need for tailored strategies.

Conclusion

AI, telemedicine, and genomics are reshaping nutrition and public healthcare, offering solutions to India's complex health challenges and setting a blueprint for the global future. In India, these technologies address disparities, improve efficiency, and support economic growth, backed by robust digital health initiatives. Globally, they promise personalized, equitable, and sustainable healthcare. However, realizing their potential requires overcoming infrastructure, regulatory, and ethical barriers through strategic investments and collaborations. As India continues to lead in digital health innovation, its experiences will inform global strategies, paving the way for a healthier, technology-driven future.

AI, telemedicine, and genomics are pivotal for advancing nutrition and public healthcare in India and globally. India's leadership, through initiatives like Ayushman Bharat and GenomeIndia, positions it to enhance health outcomes and influence global standards. The future lies in responsible integration, addressing challenges to ensure benefits reach all, fostering a healthier world by 2030.

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Original Article

Gender Equality and Social Inclusion in a Changing World: Perspectives from South Asia

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Abstract
Gender equality and social inclusion are essential for sustainable development in South Asia, a region characterized by deep-rooted socio-economic disparities. This paper examines the evolving landscape of gender equality and social inclusion, analysing historical trends, current challenges, policy frameworks, and successful interventions. By integrating case studies and policy analysis, the paper highlights the intersectionality of gender, caste, class, and disability in shaping inclusion efforts. The paper concludes with recommendations for strengthening gender-responsive policies and fostering inclusive development.

Keywords*: Gender equality, Trauma, social inclusion, South Asia, intersectionality, policy frameworks, economic empowerment,*

Introduction

South Asia, home to nearly two billion people, has witnessed transformations in recent decades, driven profound socio-economic transformations by rapid urbanization, technological advancements, and policy reforms. Yet, despite these strides, gender inequality and social exclusion remain deeply entrenched, shaping the lived experiences of millions, particularly those from marginalized communities.

Women, who constitute nearly half of the region's population, continue to face systemic barriers in education, employment, and political representation. While legal frameworks have evolved to promote gender equity, cultural norms and patriarchal structures often hinder meaningful progress. In many rural areas, women's mobility is restricted, their access to healthcare and financial independence remains limited, and gender-based violence persists as a pervasive issue. Even in urban centres, where opportunities have expanded, women frequently encounter wage disparities, workplace discrimination, and glass ceilings that curtail their professional growth.

Persons with disabilities, too, grapple with exclusion, often finding themselves on the fringes of economic and social life. Limited accessibility in public spaces, inadequate healthcare provisions, and societal stigma create formidable obstacles to their full participation. While some countries in the region have introduced disability rights legislation, implementation remains inconsistent, leaving many without the support they need to lead dignified lives. Education and employment opportunities for persons with disabilities remain scarce, reinforcing cycles of dependency and marginalization.

Caste-based discrimination, though officially outlawed in several South Asian nations, continues to shape social hierarchies and economic opportunities. Lower-caste groups, particularly Dalits and indigenous communities, frequently face systemic exclusion, restricted access to land and resources, and social ostracization. In many cases, caste intersects with gender and disability, compounding the challenges faced by individuals who belong to multiple marginalized identities.

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The persistence of these inequalities underscores the need for comprehensive policy interventions, grassroots activism, and shifts in societal attitudes. While South Asia has made notable progress in economic development, true inclusivity remains an ongoing struggle—one that demands sustained efforts to dismantle structural barriers and create a more equitable future for all.

Historical Evolution of Gender Equality and Social Inclusion

The historical trajectory of gender equality and social inclusion in South Asia has been shaped by colonial legacies, socio-political movements, and policy interventions. During colonial rule, patriarchal structures were reinforced, restricting women's access to education and economic participation. Post-independence reforms in India, Pakistan, Bangladesh, and Nepal introduced constitutional protections for gender equality, yet systemic barriers persisted.The feminist movements of the 1970s–1990s played a crucial role in advocating for legal reforms and political representation, leading to landmark policies such as India's Women's Reservation Bill and Bangladesh's National Women's Development Policy. In recent decades, the focus has shifted towards economic empowerment, digital inclusion, and intersectionality, recognizing the compounded challenges faced by Dalits, tribal communities, and persons with disabilities (Asian Development Bank 2023). Despite policy advancements and grassroots movements, gender equality and social inclusion in South Asia continue to face structural challenges that hinder progress.

Current Challenges in Gender Equality and Social Inclusion

Economic Disparities in Women's Labor Force Participation in South Asia

Despite economic growth, women's labour force participation in South Asia remains below 30%, significantly lower than the global average. According to the World Bank Research Observer, gender disparities in employment have remained largely unchanged over the past half-century, with social norms playing a crucial role in limiting women's economic participation (Bussolo 124). Women in South Asia are disproportionately engaged in informal, vulnerable, and low-paid jobs, with over 80% of non-agricultural female workers in informal employment (Mukhopadhyay 74). Additionally, wage gaps persist, with women earning significantly less than men for equivalent work. Structural barriers such as limited access to formal employment, restrictive cultural norms, and inadequate legal protections further exacerbate economic exclusion. Addressing these disparities requires policy interventions, financial inclusion programs, and gender-responsive labour laws to create equitable opportunities for women in the workforce.

Gender-Based Violence and Discrimination

Gender-based violence (GBV) remains a major barrier to achieving gender equality and social inclusion in South Asia. Despite legal frameworks aimed at protecting women and marginalized communities, high rates of domestic violence, honour killings, workplace harassment, and intimate partner violence persist. The United Nations Sustainable Development Goal 16 (SDG 16) emphasizes the need for fair and inclusive societies, yet patriarchal norms and discriminatory practices continue to undermine progress. Research highlights that India, Pakistan, and Bangladesh struggle with deeply entrenched gender biases, limiting access to justice for survivors of violence (Maharaja 137). Additionally, the COVID-19 pandemic exacerbated GBV, as economic instability and lockdown measures led to increased domestic violence cases (Sustainable Development Policy Institute 2021). Addressing GBV requires comprehensive legal protections, community-based interventions, and gender-sensitive governance mechanisms to ensure safety and empowerment for vulnerable populations.

Intersectionality: Caste, Class, and Disability

Intersectionality plays a crucial role in understanding social inequalities in South Asia, where caste, class, and disability intersect to create multiple layers of discrimination. The caste system, deeply embedded in South Asian societies, continues to marginalize Dalit and tribal communities, restricting their access to education, employment, and healthcare.Gender further compounds these inequalities, as Dalit and lower-caste women face higher rates of violence and economic exclusion compared to upper-caste women. Additionally, persons with disabilities encounter barriers in accessibility, social inclusion, and employment, often exacerbated by caste-based discrimination. Research highlights that disability studies in India have historically overlooked caste and class as critical factors, limiting the effectiveness of policy interventions (Narayan 45; Gulyani 187; Kothari 2019). Addressing these disparities requires an intersectional approach to governance, legal protections, and grassroots activism to ensure inclusive development for all marginalized groups. Policy Frameworks and Government Interventions in South Asia.

Policy Frameworks and Government Interventions

South Asia has implemented various policy frameworks and government interventions to address gender equality and social inclusion. The 2030 Agenda for Sustainable Development, adopted by world leaders, provides a transformative framework for ending poverty, promoting equity, and ensuring inclusive growth.

The United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) highlights that South Asia must mainstream Sustainable Development Goals (SDGs) into national development plans to accelerate gender equality and social inclusion (UNESCAP 2017). Additionally, regional cooperation through SAARC (South Asian Association for Regional Cooperation) has led to multi-sectoral programs focusing on agricultural development, economic inclusion, and gender-responsive policies. However, challenges such as limited political will, inadequate funding, and socio-cultural barriers continue to hinder effective implementation. Strengthening institutional capacity, legal

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frameworks, and regional collaboration is essential for achieving sustainable and inclusive development in South Asia (Shrestha 2019).

Instances of Gender and Inclusion Initiatives in South Asia

South Asia has witnessed several successful gender and inclusion initiatives that have contributed to economic empowerment, social inclusion, and policy advancements. Below are key case studies highlighting impactful interventions:Women's Economic Empowerment in IndiaThe Infrastructure Development Investment Program for Tourism in Himachal Pradesh and Punjab, supported by the Asian Development Bank (ADB), integrated gender-responsive policies to enhance women's participation in tourism-related enterprises. The project improved access to employment, skill development, and financial inclusion, enabling women to contribute to local economies (Asian Development Bank 2019).Enhancing Energy-Based Livelihoods for Women in Nepal

ADB's Gender Equality and Empowerment of Women Project in Nepal focused on economic, social, legal, and political empowerment of rural women. The initiative provided training, financial support, and legal assistance, helping women establish sustainable livelihoods (Asian Development Bank 2019).

Disability-Inclusive Education in South AsiaThe World Bank's Gender and Disability Inclusion in School Infrastructure Project emphasized accessible education for children with disabilities. The initiative introduced inclusive school designs, teacher training programs, and policy recommendations to ensure equitable learning environments (World Bank 2024).Community-Based Water Supply and Sanitation in Bangladesh

ADB's Community-Based Water Supply and Sanitation Sector Project expanded access to clean water and sanitation facilities in poor and remote areas. The project prioritized women's leadership in water management, improving health and hygiene practices (Asian Development Bank 2019).Digital Inclusion for Women in India

India's Digital India Initiative has played a crucial role in bridging the gender digital divide by expanding technology access, digital literacy, and online employment opportunities for women. Programs such as PMGDISHA (Pradhan Mantri Gramin Digital Saksharta Abhiyan) have trained millions of rural women in basic digital skills, enabling them to access e-governance services, financial platforms, and online education. Additionally, the rise of women-led startups and digital entrepreneurship has been supported by initiatives like Women Entrepreneurship Platform (WEP) by NITI Aayog, which provides mentorship, funding, and networking opportunities. Despite these advancements, challenges such as limited internet access in rural areas and socio-cultural barriers continue to hinder full digital inclusion (Government of India 2023; NITI Aayog 2023).

Recommendations for Strengthening Gender Equality and Social Inclusion in South Asia

To advance gender equality and social inclusion in South Asia, governments and organizations must implement comprehensive policy frameworks, economic and digital inclusion strategies, and intersectional approaches.

Policy Enhancements

Strengthening legal protections against gender-based discrimination and violence is crucial for advancing gender equality and social inclusion in South Asia. Governments must ensure the effective enforcement of laws and improve access to justice for marginalized communities. Increasing funding for gender-responsive programs, particularly in education, healthcare, and employment, will help bridge existing gaps and create equitable opportunities. Additionally, developing inclusive infrastructure in remote areas is essential to ensure that women, persons with disabilities, and lower-caste communities have equal access to public services. Institutional capacity must also be enhanced to mainstream gender equality and social inclusion across sectoral policies and governance, ensuring that policies are intersectional and responsive to diverse socio-economic challenges. By integrating these policy enhancements, South Asian nations can create a more equitable and inclusive society that fosters sustainable development and social justice.

Economic and Digital Inclusion

Expanding financial inclusion programs is essential for supporting women entrepreneurs and marginalized communities in South Asia. Governments and financial institutions must provide accessible credit, microfinance opportunities, and business development support to ensure economic empowerment. Additionally, promoting digital literacy initiatives will help bridge the gender digital divide, enabling women and persons with disabilities to access technology, online education, and financial platforms. Encouraging private sector participation in gender-inclusive employment policies, such as equal pay, workplace protections, and flexible work arrangements, will create more equitable job opportunities. Investing in skill development programs tailored to women and marginalized groups will enable their participation in STEM fields, digital economies, and emerging industries, ensuring long-term economic sustainability.

Intersectional Approaches

Addressing caste and disability-based discrimination requires integrating affirmative action policies in education and employment to ensure equitable access for marginalized communities. Governments must develop targeted interventions for Dalit and tribal women, ensuring their inclusion in healthcare, education, and economic opportunities. Strengthening social protection programs for persons with disabilities, including accessible infrastructure, workplace accommodations, and legal safeguards, will promote their full participation in society. Additionally, fostering community-led inclusion initiatives will empower grassroots movements advocating for gender and social justice,

ensuring that policies reflect the lived experiences of marginalized groups. By adopting an intersectional approach, South Asian nations can create inclusive governance structures that address the complex layers of discrimination affecting gender, caste, class, and disability.

Conclusion

South Asia has made significant strides in gender equality and social inclusion, yet structural barriers persist. While policy frameworks and grassroots movements have contributed to progress, economic disparities, gender-based violence, and intersectional discrimination remain critical challenges. Strengthening inclusive governance, economic empowerment, and digital access will be essential in shaping a more equitable future. Governments, civil society, and international organizations must work collaboratively to mainstream gender equality and social inclusion across all sectors, ensuring sustainable and transformative change.

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Original Article

Constructivist Approach to Learning- An Effective Approach of Teaching

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Abstract
Constructivism is a philosophy or epistemology that explains how people come to know what they do. Constructivism essentially holds that individuals build their own knowledge and comprehension of the world by having experiences and thinking back on them. According to the constructivist approach, learning is a personal Endeavour for each student. According to this hypothesis, people will attempt to interpret all of the information they come across, and as a result, they will individually "construct" their own meaning from it. According to Driscoll (2000), constructivist theory maintains that knowledge does not have to correspond to any actual reality; rather, it can only exist in the human mind.
Students will be continuously attempting to use their impressions of the real world to create their own mental picture of it. Learners will continuously update their mental models to incorporate the new knowledge as they take in each new experience, leading them to create their own version of reality. The fundamental tenet is that learning, thinking, and development are all centred on problem resolution. People build their own understanding and gain a profound understanding of what they have created when they solve difficulties and learn the repercussions of their actions by thinking back on past and present experiences.
Constructivism is essentially a hypothesis about how people learn that is grounded in scientific research and observation. When we come across anything new, we must make sense of it in light of our prior knowledge and experiences. We may need to modify our beliefs or dismiss the new information as unimportant. Either way, we actively produce our own knowledge. We must investigate, evaluate, and pose questions in order to accomplish this. In light of these themes, the concept of constructivist learning, key characteristics of the constructivist learning approach, how it differs from traditional learning methods, the role of teachers and learners in the constructivist learning approach, and its implications have all been discussed in this paper.
Key words: *Constructivism, learning approach, observation, information, knowledge.*

Introduction:

Constructivism is commonly credited to Jean Piaget, who described the processes via which students internalize knowledge. He proposed that people create new knowledge from their experiences through processes of assimilation and accommodation. Assimilation occurs when people integrate a new experience into an existing framework without altering it. This can happen when people's experiences match their internal representations of the world, but it can also happen when they fail to alter a flawed understanding events, misinterpret other people's input, or conclude that an event is a fluke and, as such, is not significant as information about the world. In contrast, when individuals' experiences contradict their internal representations, they may change their perceptions of the experiences to fit their internal representations.

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It is crucial to remember that constructivism is not a specific teaching approach. Constructivism is actually a theory that explains how learning occurs, whether students are following directions to build a model aeroplane or applying their experiences to comprehend a lecture. According to constructivism theory, students build knowledge from their experiences in both situations.

Constructivism is an educational philosophy based on the idea that we create our own perception of the world by thinking back on our experiences. To make sense of our experiences, each of us creates unique "rules" and "mental models." Therefore, learning is basically the act of modifying our mental models to take into account novel experiences. Constructivism is guided by a number fundamental principles:

Learning is a search for meaning. Therefore, learning must start with the issues around which Students are actively trying to construct meaning.

Meaning requires understanding wholes as well as parts. Parts must be understood in the Context of wholes. Therefore, the learning process focuses on primary concepts, not isolated facts.

In order to teach well, we must understand the mental models that students use to perceive the world and the assumptions they make to support those models.

Learning that is constructivist is inductive. Concepts must come after the activity, not before, according to constructivist learning. The concepts do not lead to the activity; the activity leads to the concepts. Constructive learning basically flips the conventional classroom process by eliminating lectures, presentations, and demonstrations. Students participate in activities that help them learn concepts and build abilities right from the start. Good and Brophy (1994) list the following as components of constructivist learning:

Learners create meaning for themselves: Students are not passive objects. What they passively receive is difficult for them to process or transfer. Students must intentionally try to make sense of the information that is presented to them in order to apply their knowledge in a novel setting. It must belong to them. They have to produce, find, and manipulate information to support their worldviews.

Prior knowledge is built upon by new learning: Students must draw connections between new and old material in order to make sense of it. To advance, they must examine, compare, dispute, research, accept, or reject preexisting knowledge and ideas. Social interaction improves learning: Constructivist learning occurs most effectively in social contexts where students can compare and exchange ideas with others. Students learn as they try to reconcile opposing viewpoints. While social connection is often achieved through small group activities, class discussions give students a chance to share their expertise and gain insight from others.

"Authentic" tasks foster meaningful learning: This constructivist tenet is commonly misunderstood. By using realistic tasks, activities are selected to mimic those that will be experienced in an assignment or in real life. Constructivist learning theory serves as the foundation for constructivist teaching. Constructivist education is predicated on the idea that learning happens when students actively participate in the creation of meaning and knowledge rather than just passively absorbing it. Meaning and knowledge are created by learners. Constructivist education develops critical thinking skills and produces motivated, self-sufficient students.

According to this theoretical framework, learning always builds upon prior information, or what is known as a schema, that a learner already possesses. Constructivists contend that active participation in the learning process is more successful than passive trying to absorb information because all learning is mediated through pre-existing schemata. Constructivist learning theory is the purported foundation of several different approaches. The majority of these approaches rely on guided discovery, in which the instructor steers clear of most direct instruction in favour of guiding the student through exercises and questions to find, discuss, value, and express the new information.

Therefore children learn best when they are allowed to construct a personal understanding based on experiencing things and reflecting on those experiences. The following concepts are considered as central to the constructivist instructional design.

1. Learning is integrated into a rich, real-world problem-solving environment;
2. Learning contexts that are authentic rather than academic are offered;
3.Learnercontrolmechanismsareincluded;
4. Errors serve as a means of giving feeback on students' comprehension; and
5. Social experiences are a part of learning.

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History of Constructivism: Jean Piaget (1896–1980) laid the psychological foundations of constructivism with his developmental work. He created a theory known as the theory of genetic epistemology, which emphasised the adaptive role of cognition and compared the development of the mind to evolutionary biological development. The sensor motor stage, preoperational stage, concrete operational stage, and formal operational stage are the four phases of human development that Piaget identified. According to Piaget, human intelligence develops by organisation and adaptability. Assimilation and accommodation are the processes of adaptation, whereby outside events are absorbed into preexisting knowledge while strange events that conflict with preexisting information are incorporated into the mind, altering its structure.

Numerous research have either supported or refuted Piaget's developmental phases. It is now evident, for instance, that the majority of adults only employ formal operations in a small number of their areas of expertise. Piaget's theory that learning is a transforming process as opposed to a cumulative one is still crucial, nevertheless. Youngsters do not acquire knowledge about a subject piece by piece until it all makes sense. Rather, they start by making meaning of what they already know. As new information is learnt, particularly information that contradicts their prior thinking, this understanding is gradually altered. Neo-Piagetian research has significantly expanded this transformative perspective on learning.

According to American philosopher and educator John Dewey (1859–1952), learning is based on action; concepts and knowledge can only arise when students are forced to extract experiences that hold significance and meaning for them. Human thought, according to Dewey, is practical problem solving that involves evaluating competing theories. In a social setting, like a classroom, where students collaborate to manipulate things and see results, these problem-solving activities take place. In North America, Dewey developed the progressive education approach. One recent effort to implement Dewey's progressive education philosophy in the classroom is the Fostering Communities of Learners (FCL) program, which was created by Ann Lesley Brown and Joseph Campione

In summary, Piaget contributed the idea of transformation in learning and development; Vygotsky contributed the idea that learning and development were integrally tied to communicative interactions with others; and Dewey contributed the idea that schools had to bring real world problems into the school curriculum.

Characteristics of Constructivist Learning:

1. Various viewpoints and depictions of ideas and information are offered and promoted.
2. Students create their own goals and objectives or negotiate them with the system or teacher.
3.Teachersact as mentors, watchdogs, coaches, tutors, and facilitators.
4. Metacognition, self-analysis, self-regulation, self-reflection, and self-awareness are promoted by activities, opportunitiestools,andsurroundings.
5. Learning is mediated and controlled in large part by the student.
6. Learning tasks, scenarios, settings, abilities, and information are authentic, realistic, and pertinent; they reflect the inherentcomplexity of the "real world."
7. To maintain authenticity and the complexity of the real world, primary sources of data are used.
8. Emphasis is placed on knowledge construction rather than reproduction.
9. This construction takes place in individual contexts and through social negotiation, collaboration and experience.
10. The learner's previous knowledge constructions, beliefs and attitudes are considered in the knowledge construction process. 11. Problem-solving, higher-order thinking skills and deep understanding are emphasized.

Constructivist Learning and Its Difference from Traditional Approaches of Learning:

The objectivist paradigm, which is implicit in all behaviourist and some cognitive approaches to education, has been replaced by a constructivist approach to learning and instruction. According to objectivism, knowledge is a passive representation of the objective, outside world. This suggests a method of "instruction," guaranteeing that the student receives accurate knowledge.

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Traditional classroom	Constructivist classroom
Begins with parts of the whole – emphasizes basic skills.	Begins with the whole – expanding to parts.
Strict adherence to fixed curriculum.	Pursuits of student questions/ interests.
Textbooks and workbooks are used.	Primary sources/ manipulative materials are used.
Instructor gives/ students receive.	Learning is interaction-building on what students already know.
Instructor assumes directive/ authoritative role.	Instructor interacts/ negotiates with students.
Assessment via testing/ correct answers.	Assessment via student works, observations, points of view, tests.

In the constructivist classroom, students work primarily in groups and learning and knowledge are interactive and dynamic. There is a great focus and emphasis on social and communication skills, as well as collaboration and exchange of ideas. This is contrary to the traditional classroom in which students work primarily alone, learning is achieved through repetition, and the subjects are strictly adhered to and are guided by a textbook.

Some activities encouraged in constructivist classrooms are:

• Experimentation: students conduct an experiment on their own before gathering as a class to discuss the findings.
• Research projects: students can conduct research on a subject and then report back to the class on their findings.
• Field trips: These give students the chance to apply the theories and concepts they have learnt in class to real-world situations.Clasdiscussionswouldfrequentlyfollowfieldtrips.
• Movies: These provide another dimension to the educational process by offering visual context.

Constructivism is an Instructional Strategy:

Constructivism involves collaboration between instructors, students and others (community members), it is tailored to needs and purposes of individual learners. Through this approach, life-long learning takes place.

The function of the instructor in the constructivist method of instruction: In a constructivist classroom, the teacher's job is not just to lecture; they are also to be an expert learner who can help students adopt cognitive skills including self-assessment, comprehending articulation, asking insightful questions, and reflection. Organising material around broad concepts that pique students' interest, helping them gain fresh perspectives, and making connections to prior knowledge are all part of the teacher's job in constructivist classrooms. Students are encouraged to pose their own questions, conduct their own experiments, draw their own comparisons, and reach their own conclusions since the activities are student-centered. However, since most teachers have been trained to teach in the old, objectivist way, switching to constructivism may prove to be a challenging transition. According to Brooks & Brooks (1993), it "requires a paradigm shift" and "the willing abandonment of familiar perspectives and practices and the adoption of new onesThe role of the instructor in constructivist learning is to "arrange the conditions of learning" so that pupils will learn the targeted material (Gagne, 1985). Creating appropriate activities necessitates thorough planning and significantly lengthens preparation time. It takes a lot of hard, time-consuming work to find the ideal examples and situations that will cause pupils to have a suitable "Aha!" moment.

Jonassen (1991) notes that many educators and cognitive psychologists have applied constructivism to the development of learning environments. From these applications, he has isolated a number of design principles:1. Establish practical settings that make use of the situation in which education is pertinent;

Put an emphasis on practical methods to address issues in the actual world;

The teacher serves as a coach and examines the methods employed to address these issues;

Emphasise conceptual interconnectedness by offering many depictions or viewpoints on the subject matter;

Rather than being forced, instructional aims and objectives must to be negotiated;

Evaluation need to be a tool for self-analysis;

Offer resources and settings that assist students in understanding the world's various viewpoints;

The student should mediate and regulate their own learning.

Implications of Constructivism for Teaching and Learning:

The summary of "the implications of constructivism for instructional design" is provided by Jonassen (1994). The following guidelines provide examples of ways to support knowledge construction: Give a variety of depictions of

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reality; depict the inherent intricacy of the actual world; Put more emphasis on creating knowledge than replicating it. Provide real-world assignments that contextualise training rather than abstract it; Offer case-based, real-world learning environments as an alternative to preset lesson plans; Encourage introspection; Make it possible for knowledge to be constructed based on context and content; Encourage group knowledge construction through social negotiation.

Illustrations from curricular subjects:

Following illustrations explain that constructivist learning method can be used across the curriculum. Science: Students engage in a variety of sound-producing activities in their daily lives. For instance, students perform a variety of musical instruments. It's possible that some of them played the instrument's highest and lowest notes. Pupils may consider how each instrument produces sounds with varying loudness and pitches. Students might engage in tangible activities of the kind listed below to comprehend and find answers to their observations. First Activity: Take a glass Coca-Cola bottle that is empty. Blow across the bottle's top. Is there any sound it makes? Try again after adding some water to the bottle. Try again after adding more water to the bottle. In what way does the pitch change as you add more water?

Activity 2: Grab a can that is empty. Put a rope through the can's tiny opening. Another option is to use a sturdy cardboard box. To stop the string from escaping through the hole, tie a button at the end. To make the string scratchy, rub it with rosin. You might also utilise other materials. Hold the box between your feet while seated on a chair. Using your left hand, grasp the string's free end. Quickly and firmly run an iron nail or matchstick up the string. Does the box's size affect the pitch, or is there another factor at play?

Students may see that the lips in the bansuri cause the air to vibrate. The player manipulates the wooden tube by opening and closing various holes. By opening and shutting various holes, the tube's length can be altered, which alters the pitch. As more water is added in the bottle activity, the pitch also changes. Students will develop original ideas and test them against accepted theories.

Summary:

The philosophy of constructivism has a lengthy history. The word constructivism is thought to be synonymous with a group of epistemological theories that investigate some significant variants on the idea that people construct meaning in their brains through the cognitive processing of their interactions with the outside world. According to the constructivist paradigm, classroom culture, attitudes, beliefs, and practices must change. The idea that learning is active, social, and situated in specific physical, social, and cognitive contexts, that it entails the continuous development of intricate and interconnected mental structures, and that knowledge construction is, to a greater or lesser extent, distributed across people, tools, and artefacts are all significant components of constructivist theories.Constructivism is thought to have a number of effects on education, but the most important one is that it causes pedagogical design to reorient towards learner-centred, knowledge-centered, assessment-centered, and community-centered learning environments rather than instruction. Constructivism places a greater emphasis on learning than teaching; it emphasises the creation of knowledge rather than its replication; it assists students in developing processes, skills, and attitudes; it contextualises and individualises their learning experiences; it takes into account their learning styles; it engages students with authentic tasks; it encourages meaningful, problem-based thinking; it necessitates the negotiation of meaning and reflection of both new and prior knowledge; takes pupils beyond the material that is taught to them. Online learning can also make use of constructivist methods. For instance, learners can actively generate knowledge with the use of tools like blogs, wikis, and discussion forums. The constructivist paradigm creates a new classroom culture and atmosphere.

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Original Article

Improving Student Engagement with Technology Tools

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Abstract

The most effective educational uses of technology increase student involvement and engagement. Here, we go over the advantages and disadvantages of employing a range of technological tools for teaching, as well as how some of the difficulties were resolved. This article specifically explains how Bitstrips, Twitter, Kahoot, and infographics (Canva and Piktochart) were utilized in five distinct courses to increase student participation. Each has advantages and disadvantages. We'll highlight some of the difficulties that came with the selected tools, how they were resolved, lessened, or dealt with in some other way, and how well each tool worked to increase student participation and engagement.

Keywords*: technology, student engagement, digital literacy, technology benefits and challenges, infographics.*

Introduction:

There are now more chances to accommodate different learning styles because to digital technologies. Our joint objective is to employ technology in the classroom to increase student participation and engage them with the course materials. As a result, we believe that integrating technology into the classroom helps students learn more about the information and communication technologies they will need in the workplace. This subsequent realisation resulted from our involvement in the University of South Carolina Upstate's Student Technology Enrichment Program (STEP-UP), a program created to support our university's professors.

During a development institute in 2014, the five of us were given instructions on how to alter our courses to create "technology intensive" versions that would "enhance student learning" (https://www.uscupstate.edu/qep/). Although the primary goal of STEP-UP is to enhance students' use of technology, the Development Institute gave us the desire to use technology as a tool to enhance students' engagement with the entire curriculum rather than allowing it to be used solely for its own sake.Given big dreams and small budgets, the technology tools employed by the authors are all free-use, web based applications: Kahoot (https://getkahoot.com), Twitter (https://twitter.com), infographics (i.g., http:// piktochart.com/ and https://www.canva.com), and Bit strips (http://www.bitstrips.com). Each of these comes with benefits and challenges. We will demonstrate some of the challenges inherent in the tools chosen and also how they were overcome, mitigated, or otherwise ad dressed, as well as examine how well each tool served to improve student engagement with each other and with course concepts while simultaneously improving stu dents' digital literacy.

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Replacing PowerPoint with Video, and Quizzes with Kahoot

In LIBR 201: Techniques for Finding Information, Bre Anne and a colleague made the decision to employ a range of technological tools in order to increase student engagement and interaction in the course. In order to foster information literacy and technological literacy in the classroom and future workplaces, LIBR 201 aims to teach students search techniques and the research process. This objective relates to the University of South Carolina Upstate Library's information literacy standards, which can be found at http://uscupstate.libguides.com/ld.php? Content id=10338799. These complement Anderson and Krathwohl's Taxonomy of Cognition (Anderson & Krathwohl, 2001) and Bloom et al.'s Taxonomy of Educational Objectives (1956) effectively.

Throughout the semester, students are given a number of assignments that call on them to produce movies that demonstrate their comprehension, analysis, and assessment of the course material. By combining higher-level thinking and analysis to produce a cohesive film on a subject and by assisting students in developing their technology literacy through the use of these video creation tools, this assignment demands a critical evaluation of material and its sources. To achieve these goals, students finish a technological tools assignment close to the start of the semester to familiarise themselves with a range of video production tools that they will utilise for other class assignments. Last year, this assignment was overwhelmingly the students' favorite assignment, likely because they were able to explore and successfully use a new technology and employ their creativity to create a video that brought together what they learned in a new way.

After they got used to the new technology, some students reported that they found it more enjoyable to use than standard PowerPoint presentations, despite the stress and difficulty of learning how to use it. When students assisted one another in resolving technical problems, such properly downloading or exporting their movies, they demonstrated an improvement in their digital literacy. Using Animaker and Powtoon to create videos for class projects appeared to be enjoyable for the students. Their completed projects demonstrated their understanding of the course material. One student even showed us Knovio, a brand-new tool for making videos. Students felt more at ease using other new technologies for class tasks and daily life after learning how to use these tools.

Much has been written about both the benefits and potential drawbacks to gasification (Bruder, 2015; Deterding, 2013; Dicheva, Dichev, Agre, & Angelova, 2015; Giannetto, Chao, & Fontana, 2013), and the fi nal decision to use game-like elements in class ultimately resides with the instructor. For LIBR 201, we decided that the benefits outweighed the potential drawbacks in using Kahoot. Another librarian, Tracey Eatherton, also utilises Kahoot in her school and offers some advice on how to use it successfully (2014). Given that technology can malfunction, she advises treating the project as an adventure and points out that allowing for a buffer or grace period would help mitigate these issues (Eatherton, 2014).

We first experimented with Kahoot to learn how it operated and got acclimated to the technology before considering it as a potential multiple-choice evaluation tool. Compared to typical quizzes, Kahoot quizzes significantly boost student engagement and are fun for both teachers and students. The fact that Kahoot quizzes can be played on any device with an Internet connection is a huge plus. Therefore, students can participate using laptops, tablets, or smartphones even if the class is not in a computer lab.

As an additional benefit, Kahoot quiz grades are easily exported to an Excel spreadsheet. After using Ka hoot for two full courses, we strongly recommend this technology tool in face-to-face classes. When comparing Kahoot results with online quizzes in our campus' course delivery system (Blackboard) in a parallel section of the course, however, we did not notice any significant difference in information retention between Kahoot quizzes and traditional Blackboard quizzes. The value in the Kahoot style derives from the increase in student engagement and this increased student engagement made using Kahoot well worth the small amount of tech overhead involved (establishing an account and creat ing Kahoot quizzes). Student engagement was measured through our observation of student behavior during and in parallel courses as well as through a student survey at the end of the semester asking for feedback about technology tools used in the course, including Kahoot, PowToon, and others.

In the event that technical difficulties arise, Kahoot offers tech help through a FAQ website, tutorials, and contact details. Additionally, Kahoot quizzes might increase students' stress levels even though they are more thrilling and captivating than traditional quizzes. Two distinct students commented after submitting an answer on two different Kahoot quizzes that they had accidentally selected on the wrong option while they knew the right one, missing a question for which they knew the answer. To address this, we remind students several times during the semester to be certain before submitting a response and that choosing the right answer is more essential than being the fastest.

Despite this artificial loss of points in the Kahoot quiz, students overwhelmingly report preferring Kahoot. Kahoot is a worthy information technology tool that greatly improves student engagement and participation.

Blackboard versus Twitter: Promoting Class Discussion Online :

Twitter is a free technological tool that boosts student involvement with course information, much like Kahoot. In this section, Allison provides updates on Twitter, which is utilised in the American National Government course to discuss current events, boost participation, and draw students' attention to news that is happening in the real world right now. Presenting current events also exposes students to a variety of ideas and points of view that might

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contradict their own convictions, encouraging more deliberate participation from the students. In order to achieve the same level of participation as a typical classroom discussion and presentation of current events, Allison discusses in this section how she uses Twitter for the online edition of American National Government.

Agene conventional classroom activities is one of the difficulties of teaching online. Even though there are many tools accessible, choosing the best one to meet course objectives is not always simple. We used Blackboard's discussion board to facilitate student debates about current affairs in previous incarnations of the online course, but there was no indication that the students were actively participating. Compared to Blackboard, Twitter, a well-known social media platform, provides a way to interact with students about the course materials.

According to research, social and web-based technologies give students greater control over the course material and class discussion, which promotes active learning (Bryer and Seigler, 2012; Weimer, 2002). According to Bryer and Seigler (2012), asynchronous online courses offer students the greatest degree of control over the content, participation options, voice, rehearsal opportunities, and creativity. Students can connect and speak asynchronously through a Blackboard discussion board, although it is still a little artificial (Bryer and Seigler, 2012). Since students can write as much (or as little) as they choose, it might be challenging to mimic a true discussion because they might just make one post and never return to the thread, rather than following a conversation and making several responses.

Because of these benefits, some academics have concluded that Twitter is a more effective teaching tool than other popular discussion boards (Borau et al, 2009). Given that students can only write 140 characters or fewer, Twitter would also seem to be a better platform for promoting involvement. As a result, students may need to send out several tweets to illustrate their argument. Additionally, because users are alerted to activity and discussions can be searched by hash tag, following threads on Twitter is made easier.

The use of Twitter as a medium for class discussions has several drawbacks. One issue is that some students use Twitter for personal purposes and could feel uneasy utilising the same account for academic purposes. And there's the privacy issue. Although students have the option to create a unique account for coursework, some students may not want to spend the rest of their lives associated with class discussions on Twitter. Additionally, each student must follow every other student in the class in order to stay up to date on course posts. Last but not least, tweets from new accounts must be seen via Twitter's "Live" option rather than the regular "Top Results" tab.

Allison concluded that the potential advantages for increased student involvement exceeded these difficulties for the US government. Allison analysed two of her eight-week online courses on American National Government to see which platform better promotes class conversation and raises student interest in current affairs: Twitter or Blackboard. There were 25 students enrolled in the Twitter course and 26 in the Blackboard course. Students were expected to start at least three current event postings and reply to at least eight as part of the current event homework for both classes. Students were required to post an event with a brief synopsis and the link to the news article or video clip. On Twitter, students were also required to use a unique hash tag to allow their classmates to more easily find class discussions.

69 tweets started discussions about current events in the class using Twitter, and 162 tweets responded to those messages. This indicated that, on average, each student initiated 2.76 talks and answered 6.48, which is below the class minimum. The averages are little over seven responses per person and closer to three initiated postings per person when the two students who did not finish the assignment at all are taken into consideration. It's clear that some pupils exceeded the required number of tweets, while others fell short.

In contrast to what I had anticipated, the Black Board class outperformed the Twitter class with 206 postings responding to current events and 78 posts starting them. This indicates that all of the students completed the required three current event posts, and nearly all of them received the required minimum of eight answers (the average was 7.9). The higher calibre and depth of conversation that occurred on Blackboard as opposed to Twitter is even more intriguing. The amount of content that students could post on Twitter was restricted. But the majority weren't even making use of the 140-character limit. No one did this, despite the fact that students might have included more information in multiple tweets.

Almost none of the Twitter posts that were started had a synopsis or a comment. Rather, students were simply sharing the hash tag and the news link. Comparatively, when reporting current events on Blackboard, the majority of students used 1000 characters or more to further summarise the event and make a connection to the course subject. To offer themselves more room to talk about their current situation, some students even submitted a Word document. Allison concentrated on determining which platform best achieves the course objectives when determining which technology is ultimately ideal for online class discussions. Helping pupils understand the world around them and how politics and government affect their daily lives is the major objective of using current events.

Twitter or Blackboard can be used to accomplish these objectives. Nonetheless, this small-scale trial suggests that Blackboard facilitates higher-quality talks. Furthermore, even though they were more accustomed to Blackboard before the course, many students had never used Twitter before and expressed dissatisfaction with the platform. Therefore, in this instance, Blackboard more effectively fulfilled the course objectives of actively involving students in meaningful class discussion, which was in contrast to pre-test expectations.

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Infographics for Presentation of Data-Information-Knowledge-Wisdom:

pturing, distributing, and effectively using knowledge." In terms of a person's capacity to communicate and synthesise knowledge, these competencies will give pupils a competitive edge in the labour market. At the University of South Carolina Upstate's Informatics department, we advise students that they should graduate as knowledge and information managers. INFO 101: Survey of Information Technology, the department's introductory course, is based on these ideas. In this section, Deshia explains how students can use infographics as tools to show the results of their investigation and provide correct information about a topic of their choosing for this course. One of the last products of the Data-Information-Knowledge-Wisdom initiative was the infographic.

Although the project has long been a part of the course, the requirement to use an infographic for the presentation was added recently to encourage students to interact more directly with the material they have studied (Abilock & Williams, 2014). Additionally, using an infographic to present their paper helps to strengthen the marriage of visual and spoken messages. According to Abilock and Williams (2014), an infographic is "a claim expressed through visual metaphor, conveying the creator's fresh understanding of relationships, expressed through a judicious selection and arrangement of visuals, evidence, and text acquired during inquiry research within a discipline." As such they make a suitable companion to an oral presentation of the in depth research expected of students in this course.

Students had one hour in class to create an info graphic based on previously reviewed journal articles addressing a single topic of their choice. The time constraint allowed the professor to evaluate student-directed learning of a foreign technology. Initially students were frustrated. Because students today can be considered so-called digital natives (Palfrey & Gasser, 2008), Deshia expected her students to master the process quickly and easily, but their inclination was to appeal to me for help at every obstacle. When they discovered I would not solve their problems for them, they turned to each other, leading to collaboration and group problem solving. This embodied the project-based instructional model described by Gulek and Hakan (2005), in which students gain increased access to information through the use of technology in the classroom, and sharpen their research analysis skills. Further this approach en courages greater agency in students' learning and pro motes student engagement in problem-solving and critical thinking. At the end of the session, students were instructed to turn in what they were able to complete in one class session.

In the next class session, students discussed the pros and cons of the different tools they had used and identified the tools they felt were most user-friendly and had many free features. Some of the limitations that students noticed with the free accounts included the number of design templates, constraints on the number of images that could be uploaded, few design choices (e.g., fonts, clipart, etc.), whether a design could be kept private, and the file formats available for saving the infographic. One of the most important features was to be able to save the work to a file format that could easily be shared. For example, Canva supports free downloading in a PDF format; Piktochart allows free downloads in a .jpeg or .png format; and Infogram does not allow private sharing or downloads without a paid account.

Creating Language and Testing Digital and Linguistic Fluency

Since the days of "kill and drill" activities, when learning vocabulary and conjugating verbs were commonplace, teaching global languages has undergone significant transformation. In the past, there was less focus on language production in natural settings and more emphasis on the ability to extrapolate discourse from memory in real-world scenarios. These kinds of exercises and methods for teaching languages were frequently used with all of the students in the class, regardless of their level of ability or language background. The composition of Spanish classrooms has evolved along with the demographics of the United States, necessitating differentiation in instruction to interest students at their individual level. These demographic shifts, along with developments in contextualization theory and pedagogy for second language acquisition, have prompted educators to reevaluate their teaching methods to accommodate first-time language learners and "heritage speakers," who were raised speaking Spanish at home but frequently lack fully developed professional linguistic proficiency.

Engaging Students in Grammatical Analysis:

Academic courses are frequently perceived by students as abstract, dull, and disconnected from their everyday lives. Regretfully, these expectations have both historical precedent (Jespersen, 1924) and contemporary rationale (Minchew & Hopper, 2008; Brown, 2009), at least when it comes to grammar instruction. According to Marlow (2010) and Marlow et al. (2009), many students adopt a "give me the medicine" mentality as they wait for the teacher to impart knowledge. Using self-evaluation (Anderson & Krathwol, 2001), applying course concepts outside of the classroom (Castro-Schez et al., 2014), and making meaningful use of information technology tools (Palfrey & Gasser, 2008), David outlines the steps he has taken to engage students with grammar skills while also attempting to improve the transferability of classroom skills.

Conclusion:

We have shown how to use a range of technological tools in our classrooms to increase student involvement in the sections above. These tools successfully increased student participation in most classrooms, and they will be used in subsequent iterations of the courses. All technological tools have drawbacks, but when considering student involvement levels in particular, the advantages exceed the drawbacks. Both instructors and students can benefit from integrating

technology into the classroom, which can innovatively assist us all in achieving our teaching and learning objectives through increased student participation.

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Original Article

A comparison of Physical Properties between Plain and Madder Dyed Khadi Cotton Fabric using Harda as a Mordant

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Abstract
Any dyed khadi cotton fabric has more acceptance than plain khadi cotton fabric. But as we compare synthetic dye with natural dye, synthetic dye is harmful to human skin. Among these in this study madder is a natural dye with harda as mordant. Due to application of madder on plain khadi cotton fabric leads to change in their physical properties. Breaking strength, tearing strength, crease recovery and bending strength these physical properties studied in this research. Increase, decrease or stabled changes in physical properties was observed. In this way physical properties of plain khadi cotton fabric and dyed khadi cotton fabric compared in this research study.
Keywords: *Khadi cotton fabric, Madder dye, Harda.*

Introduction

Khadi also known as Khaddar, is a traditional textile from India that was promoted by Mahatma Ghandi prior to independence. Initial versions of khadi had coarse textures, but lately, khadi has been produced using cotton, silk, and wool, resulting in greater comfort and, therefore, increased popularity. One of the most unexpected features of Khadi fabric is its capacity to keep the user cool in the summer while also providing warmth in the winter. This material is improved through washing, rather than damaged by it, although starch needs to be applied to prevent easy wrinkling. It may endure for four to five years. Khadi is typically adorned with patterns and manual craftsmanship. In the past, Khadi was coloured with natural earth tones, but now, various colours and patterns can be found in the market. (Meenu Srivastava).

The term ‘natural dye’ is conventionally taken to apply to those products that are derived from plant sources, although dyes derived from insects, such as cochineal, kermes and lac, are also included. The natural dyes are complex mixtures of components derived extracted from natural substances such as plants, animals or minerals. A large number of herbs, shrubs, trees, insects, animals, microbes and minerals have been identified for extraction of colouring compounds. Red, yellow, brown, blue, black, green and orange colour can be obtained from natural dyes. (Mazharul Islam Kiron). Madder is the red colour producing natural dyes from the plants of various Rubia species. The dye is obtained from the roots of the plant. It is also popularly known as the ‘‘queen of natural dyes.’’ (Sujata Saxena). The madder root extracts yielded red to violet and orange shades. (Shahnaz Parveen Khattak, et.al.). In several regions of Asia, the Middle East and Europe, madder, was largely cultivated and also used to obtain pinks, oranges, purples etc. (Nusrat Jahan). The term Mordant is derived from the French ‘mordre’, meaning to bite. Mordant is a substance which has an affinity for both fiber and dye stuff and so is used to fix dyes on fibres. Most of the natural colourants are adjective in nature and have no substantivity on cellulose or other textile fibres, they require an intermediate to fix into the fibre, which is called a mordant.

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Mordants does not serve as a colour source on its own. Mordant is a substance which helps a chemical reaction to take place between a fiber and a dye. The mordants which are usually metallic salts form metal complex with the fiber during mordanting, and during the dyeing process it attracts the dyeand creates a coordinating bond and attaches the dye firmly to the fabric. Thus, for proper fixation of natural dyes on any textile fibre, mordanting is essential in most of the cases. (S. Karpagam Chinnammal).

Fruits of Terminalia chebula, most popularly referred to as "harda," are used to make myrobalan mordant. It gives textiles a soft yellow tint. The largest significant source of tannin is myrobalan. Myrobalan as an environmentally friendly mordant. Myrobalan used as a natural mordant for dyeing wool and silk fabrics with natural dyes. (Hüseyin Benli).

Materials And Methods

Material

Fabric: 100% pure khadi cotton fabric was selected, fabric was purchased from Garm Sewa Mandal, Gopuri, Wardha.
Natural Mordant: Harda (Terminalia chebula)
Natural Dye: Madder (Rubia tictorum)
Chemicals: Sodium chloride (NaCl)**,** Acetic acid (CH3COOH)

Method

Dyeing of khadi cotton fabric was basically done in four stages, pre-treatment, extraction of dyes from harda powder, mordanting and dyeing. The entire process of dyeing was done through control method.

Preparation of raw material

Scouring of khadi cotton fabric

Starch present in the fabric was removed by scouring. Fabric to be scoured was pre-weighed. Material to liquor ratio 1:20 fabric was soaked in normal water for 30 minutes. Then took warm water and 10 gm per liter salt was added and stirred well. After dipped soak fabric in warm water and stirred further for about 30 minutes holding the temperature at 30°C. Then fabric was taken out and dried in normal room temperature.

Mordanting

Pre-mordanting

Mordanting of the fabric was performed using Harda 15% of weight of the fabric. Material to liquor ratio 1:20 was taken. Mordant bath was maintained at 40°C temperature and then added scoured fabric. Temperature was maintained at 80°C with constantly stirring for about 30 minutes. Then fabric taken out from dye bath and fabric was dried without washing.

Extraction of dye

Used aqueous extraction method. Concentration of madder root powder 20% mixed with filter water and kept the mixture for an hour. Dye material to liquor ratio 1:30 and temperature 60°C for extraction of dye. Temperature was maintained at 60°C with continuous stirring for about 30 minutes. Throughout the process extraction was carried out to get optimum color of the solution. Solution was filtered to get clear extraction. Some drops of acetic acid were added to maintained pH value. pH value was 5.

Dyeing

Khadi cotton fabric was dying with extract using material to liquor ratio was 1:30. Some drops of acetic acid for pH value. Maintained pH value 5. Dye bath was at a temperature 40°C and salt was added 10 gm per liter, after adding mordanted fabric. Then temperature was maintained at 60°C with continuous stirring for about 30 minutes. Fabric was taken out from the dye bath and dipped in regular water and then washed gently in non-ionic soap solution (easy). Then dyed fabric was dried at normal room temperature.

Table I. Physical Properties of White Khadi Cotton Fabric

White khadi cotton fabric	% of Elongation	Tensile Strength (Kg.)	Bending Length (cm)	Tearing Strength (gm)	Crease Recovery (°) degree
	W-10.0 F-8.2	W-78.89 F-56.46	W-1.36 F-1.45	W-3942.40 F-3532.80	W-56.40° F-54.00°

Table II. Physical Properties of Dyed Khadi Cotton Fabric

Dyed khadi cotton fabric	% of Elongation	Tensile Strength (Kg.)	Bending Length (cm)	Tearing Strength (gm)	Crease Recovery (°) degree
	W-8.8 F-6.0	W-78.67 F-47.61	W-1.33 F-1.35	W-3558.4 F-2816.0	W-61.20° F-58.0°

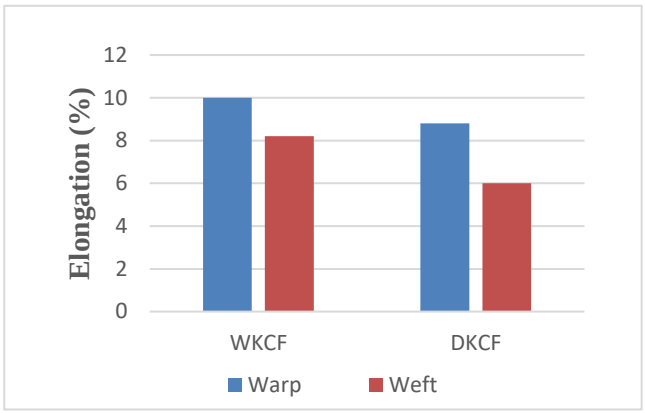
Note: - W-Warp, F-Weft

Results and Discussion

Results of Fabric Tests

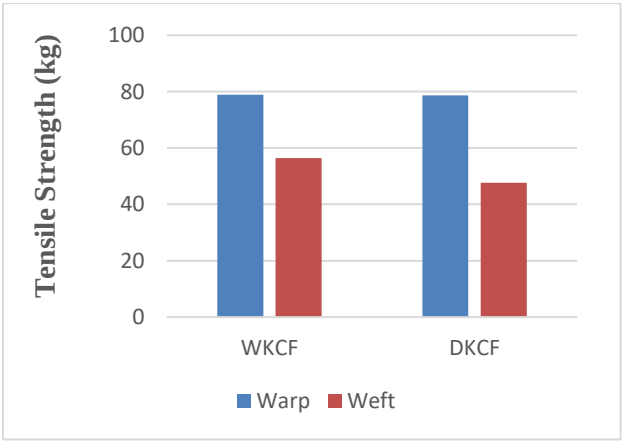
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Elongation



GRAPH I Elongation

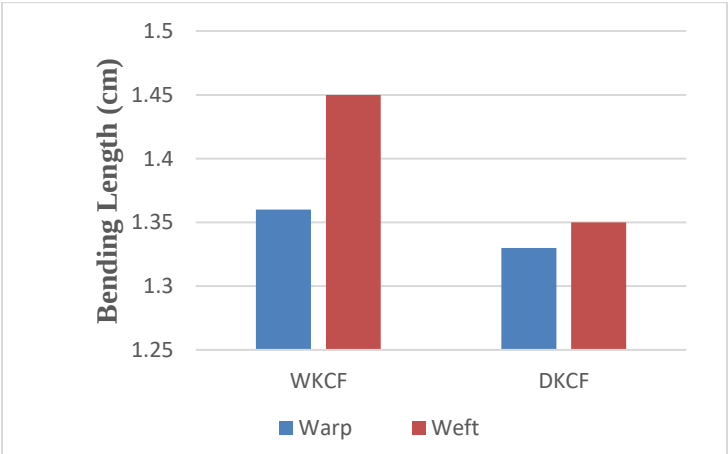
IS 1969:1985 test method was taken for the assessment of elongation of plain khadi cotton fabric. As sample was dyed with madder using harda as a mordant it shown changes in their physical properties as per table I the graph of I shows that elongation of sample before dye i.e. white khadi cotton fabric was 10.0% as warp and 8.2% as weft. But when the same sample was dyed with madder using harda as mordant their warp become 8.8% and weft become 6.0%.



GRAPH II Tensile Strength

Tensile Strength

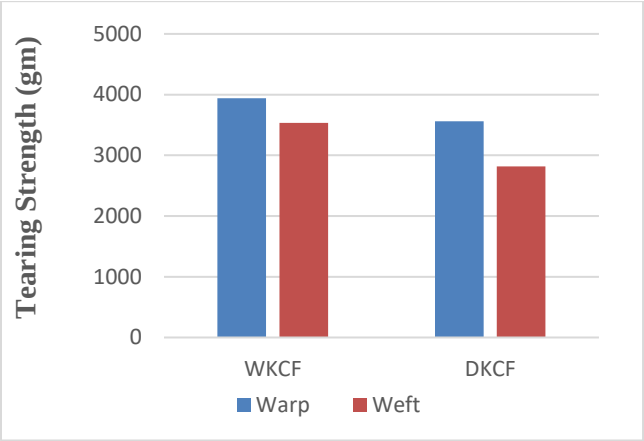
IS 1969-1989 test method was taken for assessment of tensile strength in kg plain and dyed khadi cotton fabric. When applied tensile strength test on same white khadi cotton fabric, as per graph II Tensile strength of warp was 78.89kg and tensile strength of weft was 56.46kg. Then after application of dye tensile strength of same dyed sample become 78.67kg on warp and 47.61kg on weft.



GRAPH III Bending Length

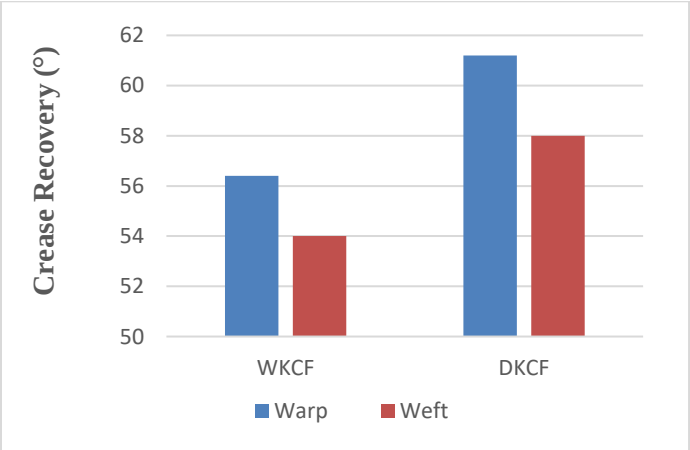
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Bending Length: IS 6490:1971 test method was selected for assessment of bending length in cm for plain khadi cotton fabric and dyed khadi cotton fabric. Graph IV shows that bending length of plain khadi cotton fabric for warp was1.36 cm and for weft was 1.45 cm. When it was dyed with madder using harda as mordant its bending length for warp become 1.33 cm and for weft become1.35.



GRAPH IV Tearing Strength

Tearing Strength: IS 6489:1993 test method for assessment of tearing strength was taken for plain and dyed khadi cotton fabric. As per graph III tearing strength of plain khadi cotton fabric was 3942.40 gm for its warp and 3532.80 gm for its weft. When same sample dyed with madder using harda as mordant its tearing strength become 3558.40 gm for warp and 2816.0 gm for weft.



GRAPH V Crease Recovery

Crease Recovery: IS 4681:1981 test method for assessment of crease recovery was selected for plain and dyed khadi cotton fabric. As per graph V it shows that crease recovery of plain khadi cotton fabric was 56.40° for warp and 54.00° for weft. When the same plain fabric was dyed with madder using harda as mordant its crease recovery become 60.80° for warp and 57.0° for weft.

Conclusion

Some physical properties of plain khadi cotton fabric and dyed khadi cotton fabric were tested. Results of these physical properties shown some fluctuations, but some properties remain same.

Reduction in the value of Elongation observed when plain khadi cotton fabric dyed with madder using harda as mordant. In the same way Tensile Strength was also decreased. Tearing strength of plain khadi cotton fabric and dyed khadi cotton fabric was measured in grams. Tearing strength of plain khadi cotton fabric also reduced when it was dyed with madder and used harda as mordant. Bending length of plain khadi cotton fabric was also slightly decreased when this fabric was dyed. Both plain and dyed khadi cotton fabric was tested to compare the change in crease recovery angle. It shown there was increase in crease recovery angle when plain khadi cotton fabric was dyed with madder using harda as a mordant.

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Original Article

Historical Elements in the Novels of Ashwin Sanghi

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Abstract:-

The purpose of this research paper is to analyze historical details found in Ashwin Sanghi's novels. One of the most common themes in Indian English literature throughout the past ten years has been the correction and reinterpretation of historical events. The thriller-style retelling of Indian historical fiction is called Sanghi's Chanakya's Chant. His Chanakya's Chant is mostly based on Chanakya, who was the subject of a political thriller having origins in Mauryan history. The Swastika symbol can be obtained using the Cartesian equation to an aquatic plain curve, as demonstrated in The Krishna Key. The use of mechanisms in these excavations is the focus of this paper, which occasionally appears too academic for general readers.

Keywords: *-Historical elements, Indian English fiction, Chanakya, History, Modern politics, and New Historism.*

Introduction:-

Renowned author of Indian literature Ashwin Sanghi has captivated readers with his gripping thriller and historical fiction series. Almost all Indian children have stories about history to listen to before bed. At first, both appeared to be shards of historical narrative that dealt with the protagonist's ascent, descent, and valiant accomplishments; this fantasy exhilaration was ingrained in the young minds. But as innocence fades, reasoning sets in, and the fine line separating legend from history is revealed.

John Jacob Andersen defined history as "a narration of the events which have occurred among mankind, including an account of the rise and fall of nations as well as of other great changes which have affected the political and social condition of the human race." Consequently, anything that is related to the field of history is knowledge that has been derived through research and investigation. On the other hand, the field of myths and mythology is primarily due to traditional dissemination and is not the product of any historical research or investigation. A fascinating topic for a long time has been how a land's history is shaped by the countless stories connected to its past, which is also true in the case of India.

The Ramayana and other ancient Indian scriptures such as the Rig Veda and the Skanda Purana are granted immortality as living characters. According to Sanghi, Hanuman is one of the nine unidentified persons Emperor Ashoka appointed to guard and preserve humanity's precious knowledge. *The Krishna Key* in Taj Mahal: Syamantaka (2012) Among the world's seven wonders It is customary to assume that the Mughal emperor Shah Jahan constructed the Taj Mahal as a memorial to his third wife, Mumtaz Mahal. However, historical revisionist P. N. Oak first refuted the widely held belief found in Indian history books regarding the Taj Mahal. According to the true account, the monument was originally known as Tejo Mahalaya, a Shiva temple that the Mughals had vandalized, a Hindu temple. The mythical stone is identified in Sanghi's novel as the holy cause for concealing Tejo Mahalaya's identity from Islamic paperwork. Sanghi skillfully grounds the concept of “Syamantaka" in popular history by placing it in the context of popular belief, drawing its origins from the medieval Hindu books Vishnu Purana and Bhagavata.

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The Rozabal Line centers on the widely held belief that Jesus traveled to India. This work is frequently referred to as historical fiction, and centers on a conspiracy theory regarding Jesus' purported survival from the crucifixion, his marriage to Mary Magdalene before the crucifixion, and his eventual settlement and death in what is now Kashmir, India. The world-famous "Da Vinci Code" by Dan Brown and this fast-paced book both discuss the marriage and subsequent daughterhood of Jesus and Mary Magdalene. However, this book goes much further and concludes that Jesus was influenced by Buddhism and Hinduism when he was younger and that these two religions' beliefs are consistent with his own.

Sanghi tells an aristocratic tale of religion, politics, and spirituality that is thrilling and exaggerated. The book touches on every major religion and establishes a connection between them all, supporting the idea that all religions sprang from a single source. Sanghi has done a fantastic job of fusing several mythological tales with modern reality. His writing is exceptional, and his research exudes the authority of a historian. The central idea of the book is that all of humanity thinks that salvation and redemption will occur when souls unite with the ultimate soul. That's the real rebirth or resurrection. If everyone understands the fundamental reality of humanity's oneness in religion, faith, and humanity, then sublime peace triumphs over all divides.

The book celebrates the divine feminine as a manifestation of Shakti and proclaims her power. The three main female characters Mary Magdalene's Indian-connected ancestors, Martha, Swakilki, and Alissa—are revealed to be their ancestors. It interprets religious symbols such as the Star of David and the Swastika differently, claiming that they are the same concept, just slightly different geometry! (Sanghi, 385) The narrative then goes on to explore the roots of all religions, which appear to be one. It is worthwhile to quote the original passage from the book to see Sanghi's insightful and brilliant interpretations.

The twenty chapters that make up Chanakya's Chant are outlined here. Agrawalji dispatched Gangasagar to Bihar capital of Patna to look for the iron ore that was buried there. Gangasagar saw that Patna's soil was rich in iron ore and soft, crimson, alluvial soil. After excavating the ground, he discovered a flawlessly polished granite block with writings in a script that Gangasagar could not read. Ganga's teacher had noted what was written on a piece of paper after seeing the block stone, and that was provided.

Four thousand days you shall pray.
Four hundred chants every day.
Chanakya‘s power is yours to take.
Chandragupta, to make or break.
If there‘s a lull, start once more.
King must be queen, to be sure.
Suvasini‘s curse shall forever halt
If you can cure Chanakya‘s fault (Sanghi, 32).

Chanakya made sure he stayed disguised while there to watch the Magadha court sessions. Rakshas, however, acknowledged him and declared that Magadha is fortunate to have Chanakya as a respected lecturer at the esteemed Takshila University. Rakshas questioned the wise teacher Chanakya about how society can cooperate for the advancement of the realm. As shudra, Chanakya responded by stating that a Brahmin's responsibilities include studying, imparting knowledge, and interceding with the gods on behalf of others. The people are supposed to be protected by the Kshatriyas. The purpose of the Vaishyas is to trade, manufacture, and create riches. All three of the upper varnas are intended to be served by Shudras. Retaining his poise, Dhanananda inquired, 'Acharya, what should be the attributes of a king? In response, Chanakya said, "An ideal king should be eloquent, bold, strong-willed, intelligent, able to lead an army, foresighted and willing to seize opportunities, support peace, know when to fight, maintain his dignity, be friendly and straightforward, avoid passion, anger, greed, determination, and vulnerability, and lastly, conduct himself by the advice of elders." Chanakya was asked by Dhanananda to be silent. Without delay, Chanakya stated that his counsel was intended for people with an innate ability to absorb. Remembering that Chanakya is the son of Chanak, Rakshas reminded his king.

The Krishna Key is less of a theological work and more of a mythical thriller. Nonetheless, given that it addresses some of the more nuanced religious ideas, such as avatar, it might fall into this category. This idea is evaluated in light of a young person who has been brainwashed and trained to think of himself as Kalki, the final manifestation of Lord Vishnu. This person is meant to "eliminate" the researchers who are going to investigate the reality behind the historical narrative that has been presented conveniently. All he does is commit serial killings. This looks at the religious conceptions that are based on egotistical ideas, criminal impulses, and individualized interests. Numerous historical, mythical, mathematical, archaeological, and scientific facts can be found throughout the book. This book, like his previous works, looks for the hidden connections between science, technology, and contemporary thought on the one hand, and religion, rituals, and beliefs on the other.

The investigated dates of Krishna's life, which come from planetary calculations, are mentioned in another place in the novel. These dates are further analyzed to determine "whether archaeological finds of Dwaraka are in sync with them (Sanghi, 60).The entire narrative centers on the hunt for the Krishna Key, or Syamantaka jewel, during

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which several murders occur. The elitist aspects of this book include the numerous presumptions and interpretations, as well as the arguments that follow. This book also addresses the question of defining the Mahabharata's historicity, providing well-researched historical, archaeological, and scientific justifications and proofs. For example, radiation associated with Brahmastra, if it is considered a nuclear weapon, will be detected in northern India.

The story of *The Krishna Key* poses the following queries about Oppenheimer's response to the first atomic bomb test: "Was Oppenheimer sending us a clue that the technology for atomic energy could previously have existed? Should we regard the Mahabharata as historical science fiction or should we regard it more seriously? (Sanghi, 120) It interprets Krishna's time as the 'entire agricultural way of life', as 'the name Krishna is derived from Krishi' and this culture's dependence on cows 'eventually transformed all parts of society.' (Sanghi, 167) the novel also provides various references to studies done on this culture. E.g. 'Yet another scholar, Dr F Lorinse, carried out a translation of the Bhagavad Gita but instead of admiring it for its original wisdom, he compared it to the New Testament and concluded that the Gita had mostly been inspired by the Bible!... But luckily, the big break in favor of Krishna's antiquity came from a book called Indica- written around three hundred years before Jesus Christ...' (Sanghi, 179)

The story also looks for similarities between different cultures using research findings. It is worthwhile to read the passage in its original form. It is known that about 3200 BCE, the Saraswati River began to dry up. The Saraswati civilization, which had prospered along its banks, split apart as a result. Some moved westward, towards Sumeria, and others moved eastward, towards the Ganges. As a result, people who went on to live in Vedic lands came to be known as Devas, and those who went west as Asuras. Those who made it to the Tigris-Euphrates Valley remained worshippers of the moon. Avestan, the region's later language, was almost exactly like Sanskrit. The religion that would eventually flourish in the area, Zoroastrianism, developed sacred texts known as the Gathas that included verses from the Rig Veda repeated exactly (Sanghi, 146). Numerous intriguing beliefs are mentioned throughout the book, like the ones that claim Tajmahal was formerly a Rajput temple and that Mount Kailash is a man-made mountain rather than a natural one. It talks about the Somanath Temple's historical specifics.

It goes into great length describing the entire process of nuclear transmutation while talking about it as a nuclear reactor. The narrative culminates in a philosophical resolution that transcends all fleeting concrete elements. The heroes discover that "the goal of alchemy is transformation from lower forms to higher forms, but it is the uninitiated who think that this means transforming lead to gold"

Conclusion: -

Sanghi's thrillers, which draw inspiration from the theologies of Islam, Christianity, Hinduism, and Buddhism, encourage readers to reflect thoughtfully on a range of issues affecting modern humanity and elevate the thriller subgenre. The central theme of the tale is conveyed by Chanakya to Gangasagar Mishra through a potent chant and an old Sanskrit ritual called caroling. Because "ends justify the means," he employs every conceivable—and often absurd—trick to achieve his objective. His winning of games in the interest of the larger good is governed by a single rule. While Gangasagar was just interested in political and intellectual supremacy, Chanakya wanted to exact revenge for the death of his father and terminate Dhananda's dominion in the Magadha Empire. The book expressed sentiments of retaliation, Chanakya's desire for a united Bharat in the past, and Gangasagar's equally committed goal of installing Chandni as India's first Prime Minister.

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Vivekananda's Vision for a Sustainable Future

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Abstract

The ideology of 'Vasudhaiva Kutumbakam' is rooted in Indian soil. India has a huge heritage of various saints, thinkers, and philosophers. All the influential personalities have suggested various ideas, education systems, and social structures to give a turn or improve Indian education and society. The society has been continuously guided through this diverse thought process. All social reformers have given good ideas to create an ideal and cultured society by giving up undesirable practices, traditions, and stereotypes. The United Nations has also proposed the Sustainable Development Goals (SDGs) to achieve justice for all and a sustainable future. It is expected to achieve these 17 global goals by 2030. A total of 17 goals (SDGs) have been proposed by the United Nations, namely poverty, inequality, climate change, environmental degradation, peace, justice and harmony. These goals are also reflected in the philosophy of Swami Vivekananda. An attempt has been made in this article to find similarities between the Sustainable Development Goals and the philosophical thoughts of Swami Vivekananda. Swami Vivekananda's Philosophical Thoughts. Interestingly, Swami Vivekananda's philosophical ideas align with the SDGs. This article explores the similarities between the two, highlighting the relevance of Vivekananda's thoughts on achieving a sustainable and equitable future. As we strive for sustainable development, it is essential to integrate emotional maturity and spiritual growth into our pursuit of progress. By embracing the timeless values of India's cultural heritage and the wisdom of thinkers like Swami Vivekananda, we can create a more.

Key words *- Sustainable, Education, Value, Society, India, Development, etc.*

Introduction

Considering the current development, human beings have reached the highest peak of progress. Various researches related to water, air, and land on Earth is bringing forward new developments, new ideas, and new knowledge every day. This knowledge gap has increased so much that it seems that every field is making a new cut. There has been a
Huge change in many fields such as education, technology, industry, space, communication, and daily necessities. Many countries are doing a lot of space research, too. With the help of satellites, humans are creating innovations every day.
India has made great strides in various types of research, like Param, Tejas, etc. In the current situation, almost 400 children are being born every month through test tube babies. Looking at this progress graph, it is seen that the sharpness of the intellect has increased miraculously. That is, the intellectual development of humans is at the level of excellence. But beyond this, the lack of emotional maturity in humans is visible in society. It is a very shameful thing That we are experiencing in this society that a generation should be created that rejects and alienates the parents who raised the children and fulfilled all their needs. Indian ideology and culture were ideal .Purushottam Ram, Shravan Bal, Raja Harishchandra, Bhishmacharya, Eklavya, and many other ancient examples give us an idea of the ideal Indian tradition. Examples of renouncing the kingdom for the sake of the mother's promise, sons who sacrificed their lives in the service of their parents, disciples who cut off their thumbs to honour their gurus,

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and kings who donated their entire kingdoms to fulfil their vows are all found in our ancient scriptures. Society expects us to pass on this ideal heritage to the next generation through education. For his purpose, the United Nations has set the goal of sustainable development.

While realising this goal of sustainable development, it is very important to shed light on the ideology presented by thinkers, social reformers, and educationists in the Indian knowledge tradition. When considering sustainable development, there is a lot of similarity between the values mentioned by the United Nations and the philosophy of Swami Vivekananda. The United Nations has given the Sustainable Development Goals (SDGs) as follows. No Poverty, Zero Hunger, Good Health and Well-being, Quality Education, Gender Equality, Clean Water and Sanitation, Affordable and Clean Energy, Decent Work and Economic Growth, Industry, Innovation and Infrastructure, Reduced Inequality, Sustainable Cities and Communities, Responsible Consumption and Production, Climate Action, Life Below Water, Life on Land, Peace, Justice and Strong Institutions, Partnership for the Goals, all these problems and their solutions are mentioned in the thinking of Swami Vivekananda. As we strive for sustainable development, it is essential to integrate emotional maturity and spiritual growth into our pursuit of progress. By embracing the timeless values of India's cultural heritage and the wisdom of thinkers like Swami Vivekananda, we can create a more harmonious and equitable world.

Healthy Mind and Healthy Spirit--

The objective of ensuring a healthy and safe life is included in the values of creating sustainable development. In this regard, Swami Vivekananda clearly states that mental development is necessary along with physical development. According to him, 'Be strong! My young friends requested you come closer to heaven through football than through the BhagwatGita; this is my progress. ``Even though these are my strong words, I must tell you this. I know where the slippers are. Because of the powerful blood in you, you can understand Krishna's mighty talent and mighty power very well. He has repeatedly shown his belief in 'strength is goodness' and 'weakness is sin'. The mind is enriched by reciting or reading the BhagwatGita. But the human body is enriched by coming into contact with football. A person with a healthy body can assimilate spirituality well and thereby gain mental strength. Physical strength and physical health can take you to spiritual heights; this is what Vivekananda expresses to the students. Physical and emotional development has also been given priority for sustainable development. Vivekananda believed that spiritual development is essential for achieving happiness and satisfaction. He advocated for education that fosters spiritual awareness, self-power, and self-development. Swami Vivekananda emphasised the importance of mental development alongside physical development. He believed that a healthy body and mind are essential for spiritual growth and self-realisation.

Poverty and Education

Education has to do the work of awakening the society living in rural areas. Education should reach the weaker sections of society and make them aware of their situation. To eliminate social instability and injustice, everyone needs to develop themselves physically, intellectually, and spiritually. Education should be such that it creates physical health, sharp intelligence, moral enrichment, religious generosity, social prosperity, spiritual enlightenment, and professional Competence in children. Vivekananda tried to realise all these ideas through the organization Ramakrishna Mission. Through this, various educational institutions, libraries, reading rooms, and clinics were established. The people working in this organisation were philanthropists who worked for the upliftment of society. However, since the entire society could not get the benefits of all these, the need for the concept of sustainable development is still felt at the global level. Vivekananda called the poor Mahatma. Consider the poor as God, think about them, and pray for them. Only through this will God show you your path. Only through this can the first goal of sustainable development be achieved. The United Nations set the goal of eradicating poverty. We see the solution to this problem in the thoughts of Swami Vivekananda Harmonious and equitable world.

Self-realization

The thinker and philosopher Swami Vivekananda, who asserted that religion is the attainment of self-realisation by controlling one's own emotions, was also a supporter of eternal development. That is why he advocated eternal values. All knowledge is within man. No knowledge comes from outside. The knowledge within man comes forward gradually. Man himself discovers his knowledge. The unlimited library of the universe is only in the mind of man. In support of these thoughts, Vivekananda reveals Newton's scientific experiments. After experiencing the process of an apple falling from a tree, the thought that came to Newton's mind was gravity. That is, the origin of knowledge is in Newton's (human) mind. Knowledge is in the mind of man, says Vivekananda. Therefore, the human mind is important. Love and sacrifice should be important elements in human life. Which is an indication of a universal concept. Hatred or ego leads to destruction. The egoism or hatred of one person destroys the nation. If man is not on earth, then there will be no use of material resources and wealth; this is a matter of contemplation. Therefore, love, affection, and closeness between humans are the things that build a nation. Vivekananda says that sacrifice is the result of love. In the current situation, the selfish and egoistic attitude of man seems to have increased to a great extent. The

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hostility between Bangladesh, Pakistan, and many such nations is felt everywhere. The solution to all these starts from the human heart. A balanced, contented, and altruistic feeling is the result of a pure heart. A pure heart occurs with spiritual development. Spiritual development is achieved through self-realisation. For this, spiritual development is important. There is no doubt that spiritual development can provide happiness and satisfaction to all living beings. According to Swami Vivekananda, education gives spiritual awareness to man. Due to this, self-power and self-development increase. Spirituality provides human beings with knowledge. He clearly states the idea that the process of human creation should take place through education. Vivekananda asserted that self-realisation is achieved by controlling one's emotions and that this is the true meaning of religion. He advocated for eternal values and believed that all knowledge lies within individuals, waiting to be discovered.

Swami Vivekananda was a believer in the Vedas. The main goal of human life is to unite with the creator of the universe. He says that the goal of human life should be to go beyond the material world and reveal the self, that is, to unite with the Supreme Power. Man's vow of service should be dedicated to God. His daily activities should also be towards God. Religion is the factor that guides human behaviour. All religions are the same. The basic objective or main elements of every religion are also the same. No religion considers any other religion inferior. Therefore, humans should also respect other religions and their values. Vivekananda does not accept disputes and arguments over religion. He teaches the teaching of universal harmony through his thoughts. He says that the highest goal of every religion is to attain love. Accepting love and receiving love is the greatest task. The feeling of love between individuals should increase. Enmity or hatred should not be created between humans. Vivekananda expresses the philosophy of achieving harmony between science and spirituality. There is no doubt that humans should acquire knowledge of science, but they should also try to convey spiritual knowledge. Efforts should be made to combine spirituality and science through education. Vivekananda supports the ideas of religion, God, love, science and spirituality. But at the same time, he was a supporter of humanity. The value of 'humanity' was advocated by Vivekananda. Humans should make life better by emulating other people because a man who cherishes humanity cherishes the feelings of others. Along with his happiness and sorrow, he has a deep or conscious awareness of the sorrows and sufferings of others. He cherishes benevolence and empathy. He strives to remove the sorrows of others. He takes pleasure in removing the sorrows of a sad person and putting a smile on his face. He considers himself blessed only in embracing kindness. In return, he becomes happy. This feeling should grow in everyone. This is what Vivekananda says.

Achieve gender equality and empower all women and girls.

Gender equality, empowerment of women and girls, and empowerment tools are mentioned in a total of 17 points of sustainable development. For the empowerment of women, it is important to provide them with educational facilities. These facilities should be extended to every girl. In this regard, more efforts should be made. Swami Vivekananda has mentioned women's education. While exploring Swamiji's knowledge and insight, there is a deep reflection on women and femininity, chastity, marriage, motherhood, and Indian womanhood. His profound thoughts on Sita to American women cannot be ignored. Swamiji throws important perspectives on the roles, capabilities, and challenges of women. Emphasising the importance of chastity as a powerful virtue, he recognised the sanctity of marriage and motherhood and considered the unique qualities of Indian womanhood. He was inspired by the immortal legacy of Sita and admired the freedom and mobility displayed by American women. From this, he believed that the power of women and the qualities of femininity would provide a vision for the upliftment and empowerment of women in society. The problem of women's empowerment was raised in the 19th century, the problem is still the same in the 21st century; this is the plight of society. The idea of women's empowerment has been raised. The same idea has been expressed earlier by Swami Vivekananda. According to Swami Vivekananda, 'A nation that does not respect women is not a good nation and it cannot become good in the future.'

Overall, achieving gender equality and empowering women and girls requires a multi-faceted approach that includes education, environmental awareness, and sustainable development. By implementing these strategies, we can create a more equitable and sustainable world for all.

Inclusive and sustainable development

Every ideology leads society toward sustainable development. Although there are differences of opinion, the goal is to lead all ideologies towards the best. The welfare and unity of the human race are the goals that all reformers have given to society through their thoughts and actions. Indian society is diverse. People of different castes, creeds, and religions live together in it. In it, each religion moves forward with the dominance of its respective ideas. Indian society is a collection of many religions, like Hindu, Muslim, Christian, Buddhist, and Jain. Although the values, principles, and ideas mentioned in the scriptures of each religion are different, the commonality among them is 'eternal development'. He suggests that vocational education should be linked with regular education. Although education is not a means of earning money, a student who possesses a specific educational qualification should at least be able to feed himself. The importance of vocational education is to create this ability through education. While emphasising this, Swamiji says. 'It would be better if people received technical education so that they could get work and earn a living.'

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These thoughts of Swami Vivekananda seem important. Perhaps if his thoughts had been implemented through the education process, the need and necessity of these thoughts would not have been felt by the World Organisation today.

Environmental awareness –

To maintain the balance of the environment, we should use only the necessary amount of environmental resources and try to preserve these resources for future generations. Global integrity is the essence of human life. The existence of mankind and the living world depends on the environment. 'Take care of the earth, take care of yourself. ‘These are the thoughts that Vivekananda has put forward ideas regarding the environment. The chain of humans, nature, and the universe has been fixed since before. Even if the balance of one of these is disturbed, all will be destroyed. Humans should be aware of this. For sustainable development, the first thing to do is to remove pollution from the earth and purify it. Ideal thought is the unity between Dharma (moral code of conduct) and Karma (right action). It is important to instil environmental awareness in the minds, otherwise nature is gradually showing its anger everywhere in the form of floods, earthquakes, global warming, irregular rainfall and diseases.

Educational process -

Vivekananda has given the message that education should be for everyone. Everyone should have equal rights to education. The entire Indian society should be able to access this education. He has a true vision of philosophy of education in India in its cultural and cultural heritage. Education is a lifelong process; it covers all the aspects of life, i.e. physical, mental, social, intellectual, moral, and spiritual, etc. Education is the training through which the flow and expression of willpower are brought under control and become fruitful. Education is not just about studying facts and collecting facts, but also about developing the ability to acquire knowledge by increasing the ability of concentration and detachment. Students should be trained to develop values from a cultural and spiritual perspective. This will strengthen the mind and willpower of the student. Swamiji says we need such an education that will build character, increase mental strength, broaden intelligence, and through the combination of all these, a person can stand on his own feet. Such a comprehensive and far-reaching the transformational educational process is very necessary today. Secular and spiritual education is necessary for the upliftment of society. The need of the hour is to present the ideal values of Indian religious tradition in front of the students in a consistent manner and thereby increase the value perspective. Self-realisation is the basic need of humanity, says Swami Vivekananda. For self-realisation, the understanding of the soul, the feelings

Peace and Harmony:

Vivekananda concluded at the end of his speech in Chicago that every religion should spread a good idea of 'harmony and peace'. A good kingdom with peace, harmony, and harmony should be established. We should forget our differences and enjoy the joy of diversity. Only when these ideas are brought into existence will the same principle be useful for everyone. First of all, everyone should think that everyone should dress the same, similarity in appearance, similarity in thoughts; this sameness everywhere will make life boring. Diversity gives a beautiful vision to man. Swamiji has put forward a high spiritual thought for the creation of global peace and harmony. He mentions the Vedic sentence 'Aham Brahmasmi Tatvamasi'. That is, I am God and you are God. Therefore, there is no relationship between high and low, master and servant. He gave the message of mutual respect and religious acceptance by abandoning the idea of religious supremacy. Swamiji's vision for universal peace and brotherhood is timeless. One should live in peace and harmony. Eternal peace is born from freedom. Swami Vivekananda gives the message that unity and harmony are important for creating an ideal world. If we follow the principles of Swami Vivekananda in our lives, more peace and harmony will be created. Harmony should be created between the self and others. Unity, inclusiveness, and respect for others should be created in a society made up of diversity.

Summary

From the above analysis, it is clear that all human values are essential for sustainable education or sustainable development. Education is an effective medium for social transformation. Vivekananda has clarified the thoughts that education can eliminate undesirable things in society, and these thoughts are also mentioned in the eternal values. Swami Vivekananda explains that 'self-realisation should be the aim of education'. Spiritual development is very important. The character should be built through education. As we strive for sustainable development, it is essential to integrate emotional maturity and spiritual growth into our pursuit of progress. By embracing the timeless values of India's cultural heritage and the wisdom of thinkers like Swami Vivekananda, we can create a more harmonious and equitable world. This deep thinking that gives far-reaching good results has become very necessary today. Living immorally and worthlessly is a great misfortune in the current situation. Society has been shattered due to the social horror and instability. In such a situation, Vivekananda's ideology is very important for society.

The Sustainable Development Goals also support these ideas, along with all 191 United Nations member states. Vivekananda, who started from self-realisation, proves the concept of universality with his statement. Sustainable development asks to instill the concept of universality by violating the limits of materiality. The global goal that the United Nations will come up with from 2015 to 2030 seems to be embedded in the values of Swami

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Vivekananda. Equality means the availability of comprehensive education. There should be no discrimination in education. Such a value is in line with Vivekananda's ideology. To remove inequality by developing cities and villages. To create a peaceful environment. Vivekananda's philosophy aims to promote humanity. The value of inclusiveness is found in eternal values. Where harmony is created between human beings, equality will be created. When the need of one is understood by the other. Efforts will be made through sensitivity to fulfil that need. Vivekananda has presented an advanced ideology that respects femininity. The ideas of environmental conservation and protection have been propagated by Swami since that time. Social harmony, peace are the needs of the entire world. There, interfaith harmony and charity will be created, the idea of high and low in society. Vivekananda considered education a powerful tool for awakening society and eliminating social instability. He believed that education should reach the weaker sections of society, making them aware of their situation and empowering them to develop physically, intellectually, and spiritually. Swami Vivekananda's ideology provides a foundation for sustainable development, emphasising education, unity, harmony, and social responsibility. His thoughts align with the Sustainable Development Goals, making his ideology a valuable resource for promoting sustainable development.

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Original Article

Analysis of Physico-Chemical Parameters of Water Quality in Malkhed Lake, Amravati District

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Abstract:

To understand the water quality of Malkhed Lake the various physico-chemical parameters ware studied for the period of one year i.e January 2020 to December 2020 to observe the seasonal and monthly changes in Physical and Chemical parameters such as Temperature, Turbidity, Total Dissolved Solids, Dissolved oxygen, Total Hardness, Alkalinity, Chlorides, Phosphate etc. The overall findings showed that in some physical and chemical parameters seasonal variations was noted, whereas the most of the parameters exhibit normal range which is positive indication of good water quality with very minimum pollution and can be used for irrigation and other purposes.

Key words: *Physico-Chemical Parameters, Malkhed Lake, Water Quality, Seasonal Variations.*

Introduction

Water - one of the most important and lifesaving compound of the ecosystem getting contaminated due to increased human population, in dustriali sation, heavy use of fertilizers and interference of manmade activities mainly grazing and deforestation, becomes an important and serious issue not only India but throughout the globe. According to the latest report published by WHO nearabout 65 % population of India is not getting the safe and good quality of drinking water. Malkhed lake is located at 20° 49' 0" N latitude and 77° 53' 0" E longitude, 20 km east of Amravati city.The lake comes under the Chandur railway tehsil of Amravati district in the Pohara-Malkhed forest reserve, and is surrounded by hilly areas. The prime source of water for Malkhed Lake is the Kholad River.

The Malkhed lake is a major source of watermainly used for irrigationand other purposes by the nearby villages. The present study was carried out to monitor the physico-chemical parameters of Malkhed Lake for the period of one year from January 2020 to December 2020. Many researchers in India still working on Physico-chemical and biological characteristics of Standing and Running Water Resources to understand the proper condition of lakes and rivers or water resources. Pandey et.al(1993), Trivedy & Goel(1986) and Kodarkar M.S.(1992).

The natural aquatic resources are causing heavy and varied pollution in aquatic environment leading to pollute water quality and depletion of aquatic biota.It is therefore necessary that the quality of drinking water should be checked at regular time of interval, because due to use of contaminated drinking water, human population suffers from varied of water diseases Doifode et.al.(2014). The area of present study is shown in Fig. 1.

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Fig: Malkhed Lake, Chandur railway, Amravati

Materials And Methods

Malkhed Lake located in the dense forest area surrounded by hills, grazing land, mixed types of trees, shrubs and agricultural land near Chandur railway tehsil district Amravati. The water samples were collected for a period of 1 year fromJanuary 2020 to December 2020. In the present study the water samples were collected from four different sites once in a month between 9 am to 10 am and the water samples were collected in polyethylene bottle. The collected samples then mixed to prepare an integrated sample. The spot parameters like Oxygen, pH, Humidity, Water temperature were directly recorded at sampling spot by using digital instruments such as thermometer and Pocket digital pH meter similarly the turbidity is measured by turbidity meter, whereas the analysis of other physico-chemical parameters like TDS, Dissolved oxygen, Chlorides, Phosphate etc were estimated as per standard methods prescribed by APHA(1998),APHA(2012) and Kodarkar (1992).

Results And Discussion

The monthly variations in physico-chemical parameters of Malkhed lake are given in Table No.1. In present study the atmospheric temperatureof study area was recorded lowest in the month of December 12º C and highest was recorded43ºC in May due to dryness, as it plays vital role in regulating all physical and chemical activities of water body.Kumar et.al (1996),Water temperature ranged from a lowest of 15ºC in December to highest of 27ºC in month of May which varied throughout the year, It showed that higher temperature in summer and relatively lowers winter. The variations in temperature are due to the atmospheric temperature and clear environment of surrounding area. Similar observations were recorded by Jayabhaye et.al (2006). The pH of lake water was slightly differs as change in season. According to Welch (1935) the pH of water is low in winter season and high during the summer season. In the present study, the values range from 7.34 to 8.10. The maximum value 8.10 was recorded in the month of May and minimum 7.34 in the month of November. pH plays very vital role in Physico-chemical analysis of water as it regulates most of the chemical and biochemical reactions Significant changes in the pH were due to change in air temperature secondly due to domestic waste.The turbidity of lake water fluctuates due to the human activities, depletion in water level and due to the suspended matter. The minimum value was observed (0.5 NTU) in winter season and maximum value (15.12 NTU) was recorded in April. According to Indian Standard Specifications of drinking water(1992) the TDS which is one of the most important parameterto analyse the quality of water. The maximum and minimum value of Total Dissolved Solids was ranged between 0.24 g/l to 0.29 g/l. It was minimum in the month of August . The similar finding was recorded by Musaddiq and Fokmare (2002). The values of concentration of Dissolved Oxygen in malkhed lake water ranged from 7.12 mg/l to 8.87 mg/l. As the water temperature rises the oxygen solubility decreases, similar finding was recorded in the present study. The minimum concentration of DO was recorded in the month of May and Maximum in January. Pandey et.al.(1993)and Jayabhaye et.al. (2006) recorded the similar observation in fresh water lake. According to them the low temperature and high aeration rate accelerate the rate of photosynthetic resulting the increase in the amount of oxygen in water. Alkalinity is composed primarily of carbonate and bicarbonate; it acts as a stabilizer for pH. Alkalinity, pH and hardness affect the toxicity of many substances in the water. Total alkalinity ranges from 102 mg/l to 194 mg/l. The maximum and the minimum were recorded in the month of January and June. Das and Chand (2003) recorded low alkalinity during monsoon, which may be the effect of heavy rainfall. Total hardness of water is the sum of the concentration of alkaline earth metal such as calcium and magnesium. The range of total hardness of lake water was 58 mg/l to121 mg/l. The maximum value was noted in the month of May and minimum value was noted in November. Similar findings were recorded by NEERI (1987) and WHO (1993). According to Spence (1964), waters with more than 60.0 ppm hardness are classified as ‘nutrient rich’ waters. Water quality of malkhed lake is nutrient rich. Chlorides, which is an essential

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element of life is present in both fresh water and salt water and elevate chloride level is a major indicator of pollution in water body. Chloride show high concentration during summer and low during winter (Munawar,1970),the same findings were recorded in the present study. Similar result was reported by Swarnalatha and Narsing Rao (1998). The value of phosphate was recorded maximum in the month of rainy season i.e August(10.54 mg/l) and minimum (0.24mg/l) in November in winter season. It was due to the rain, agriculture practices, man-made activities. Arvindkumar (1995) reported the similar observations.

Table – 1: Analysis of Physico-Chemical Parameters of Malkhed Lake during January2020 to December 2020.

Parameter/ Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Air Temp.º C	14.8	20.3	26.4	36.5	43	39	33.1	30	32.4	29.4	21.1	12
Water Temp.ºC	17.4	20.1	24.1	25.4	27	24.1	21.7	21.1	20.6	20.8	18.4	15
Turbidity(NTU)	4.19	8.16	11.14	15.12	13.17	10.01	7.15	4.06	2.10	1.14	0.5	0.59
TDS (g/l)	0.27	0.27	0.28	0.28	0.28	0.29	0.29	0.24	0.24	0.25	0.26	0.26
pH	7.82	7.91	8.01	8.05	8.13	8.09	8.00	7.96	7.45	7.25	7.2	7.61
Dissolved Oxygen	8.87	7.71	7.52	7.20	7.12	754	7.46	7.56	7.82	7.98	8.42	8.61
Alkalinity	194	180	172	161	155	127	102	130	136	148	172	175
Hardness	86.2	99	108	112.4	117.1	121	120.4	107.3	98.1	76.4	58	60.1
Chlorides	24.04	29.2	35.1	40.0	44.17	48.2	44.12	36.2	39.1	34.21	31.1	30.4
Phosphate	1.45	3.12	3.57	4.61	5.12	6.78	8.89	10.54	4.15	0.65	0.24	0.89

Conclusion

Most of the physico chemical parameters of malkhed lake were found within normal range indicating the good quality of water and ecologically balanced and is safe enough to be consumed by humans and used for other purposes.

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Original Article

The Legal Landscape of Ai in India: Existing Frameworks and Future Regulatory Needs

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Abstract

The rapid advancement of artificial intelligence (AI) presents both opportunities and challenges for India's growing technology sector. While India currently lacks dedicated AI legislation, existing frameworks like the Information Technology Act, 2000 address crucial aspects of data protection, privacy, and cybersecurity relevant to AI systems. The National Strategy for Artificial Intelligence (2018) and NITI Aayog's ethical guidelines emphasize fairness, transparency, and accountability in AI development. However, key challenges remain in balancing innovation with regulation, particularly in addressing algorithmic bias and ensuring equitable AI deployment. The debate continues between proponents of comprehensive AI-specific legislation and advocates for adaptive regulatory approaches using existing laws. As India's AI ecosystem evolves, developing tailored legal frameworks incorporating ethical principles, robust data governance, and clear accountability mechanisms will be critical to harness AI's transformative potential while safeguarding public interest. Strategic collaboration between policymakers, industry, and academia will be essential to position India as a global leader in responsible AI development.

Keywords: *algorithmic bias, artificial intelligence, data protection, ethical principles, public interest*

Introduction

The rapid advancement of Artificial Intelligence (AI) is transforming the world at an unprecedented pace, and India stands at a critical juncture where it must harness AI's benefits while mitigating its risks. AI holds immense potential to revolutionize key sectors such as healthcare, finance, education, and governance, driving efficiency and innovation. However, its unchecked growth also raises significant ethical, privacy, and accountability concerns. Currently, India lacks a comprehensive legal framework to regulate AI, creating ambiguity that could hinder responsible development and deployment. Without clear regulations, the risks of misuse, bias, and unintended consequences loom large, necessitating urgent legislative intervention The integration of AI systems across sectors presents India with three critical regulatory challenges that demand immediate legislative attention. First, data privacy concerns loom large as AI's insatiable appetite for personal information threatens individual rights, necessitating stronger safeguards beyond the existing Digital Personal Data Protection Act to prevent misuse and ensure transparent data practices. Second, the inherent opacity of AI decision-making processes creates accountability gaps, particularly when automated systems determine life-altering outcomes - a situation demanding legal mandates for algorithmic explainability and clear liability frameworks. Third, the impending workforce disruption from AI automation requires proactive policy measures including large-scale reskilling programs and labor market reforms to mitigate job losses while harnessing new employment Opportunities in AI-driven sectors.These interconnected challenges underscore the urgent need for comprehensive AI governance that balances technological progress with fundamental rights protection. India must develop nuanced regulations addressing data sovereignty, algorithmic accountability, and just transition policies to prevent exacerbating existing inequalities.

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The absence of such framework risks creating a technological scenario where innovation outpaces necessary safeguards, potentially harming vulnerable populations and eroding public trust in AI systems. A carefully calibrated regulatory approach could position India as a global leader in responsible AI deployment while protecting its citizens' interests in this transformative technological era.

India's Approach to AI Regulation:

As the global community moves to regulate AI systems, India's response will be pivotal, given the country's position as home to one of the world's largest consumer bases and technology labor forces. Over 10,000 deep tech businesses are expected to be based in India by 2030, according to forecasts, thus the country has taken the initiative to strengthen its AI ecosystem. The India AI mission has been approved with an allocation of ₹10,300 crore, with the goal of strengthening public-private collaborations and advancing the startup ecosystem. The large multi-models, 10,000 Graphic Processing Units, and other creative projects and collaborative research including AI will all be supported by the funds.India's reaction to its growing economy must be consistent with its commitment to the Sustainable Development Goals and to ensure continued economic progress. In order to provide answers that may advance innovation while lowering its hazards, this would necessitate the prudent application of AI systems. It appears that India's efforts to create an equitable and inclusive AI system would be better served by a progressive, phase-led approach. An important impediment to responsible AI development in India is the lack of a centralized regulatory framework for evaluating, rating and controlling the application of various AI tools. As Google's GenAI model, Gemini, recently showed, the laws in place in India are likewise unable to completely prevent the spreading of deepfakes, fake news, and the bias and prejudices built into AI tools. It is also untested in India to assign liability to an AI tool that is designed to generate AI worms that steal data or spread malware, such as the Morris II worm, or that uses AI to produce plagiarism or defamatory content without human intervention because Indian law limits criminality to human minds, not AI tools. Furthermore, no court ruling has established the guidelines for the appropriate application of AI. A few more restrictions on AI regulation are mentioned below:

The Copyright Act, 1957

The Indian Copyright Act presents significant challenges for recognizing AI-generated works, as it maintains a strictly human-centric approach to authorship. Under current provisions, copyright protection is exclusively granted to "natural persons," with legal entities only able to obtain rights through assignment agreements with human creators. This framework becomes particularly problematic when examining works created using generative AI tools, as demonstrated by the failed copyright registration attempt of Ankit Sahni's AI-generated artwork "Suryast" produced through the Raghav painting app.[1]

The 1994 amendment to Section 2(d)(vi) of the Act attempted to address computer-generated works by designating the person who initiates the creation process as the author. However, this provision falls short when applied to contemporary AI systems, as merely providing prompts to an AI tool fails to meet the threshold of originality required for copyright protection. Indian jurisprudence maintains that copyrightable works must demonstrate sufficient human creative input and 'sweat of the brow' - standards that simple AI prompting cannot satisfy.

This legal landscape creates a protection gap for AI-assisted creations, where the current framework neither recognizes the AI system as an author nor the human prompter as sufficiently creative to qualify for authorship. The situation calls for comprehensive legislative reforms to develop nuanced criteria for copyright eligibility that can accommodate the evolving nature of human-AI collaborative creativity while maintaining the fundamental principles of intellectual property law. Until such reforms are implemented, AI-generated content remains in a legal limbo within India's copyright regime.The case of "

University of London Press Ltd v. Tutorial Press Ltd."

[2] provides insights into the concept of originality in copyright law. When a publisher reproduced examination papers created by university faculty, the institution claimed copyright infringement. The publisher contended that these papers lacked sufficient originality for protection, as they were derived from established academic knowledge. However, the court upheld the copyright claim, establishing that the professors' substantial intellectual labor and careful selection of questions met the threshold of originality - a standard based on the "sweat of the brow" doctrine rather than novel invention.

This precedent creates a significant contrast when applied to AI-generated content. While human academics receive copyright protection for compiling and formulating examination questions from existing knowledge, AI systems face different legal scrutiny. Merely providing basic prompts to an AI tool - regardless of how innovative or unique the output may appear - fails to demonstrate the necessary human intellectual effort required for copyright

[1] Rahul Kailas Bharati, "AI and Intellectual Property: Legal Frameworks and Future Directions" 4 *International Journal of Law, Justice and Jurisprudence* 209 (2024).

[2] [1916] 2 CH 601.

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protection under current Indian law. The judicial reasoning suggests that copyrightability hinges not on the novelty of the content itself, but on the demonstrable human creative investment in its production. This distinction underscores the need for legal frameworks to evolve in addressing the unique challenges posed by AI-generated works while maintaining the fundamental principles of intellectual property law.

Significant Input Test

The "Significant Human Input" test offers a balanced approach to evaluating copyright claims for AI-generated works while preserving the fundamental principles of intellectual property law. This test builds upon the existing "Skill and Judgment" framework but introduces a crucial additional criterion: assessing whether the final creative output would exist in substantially similar form without meaningful human contribution.[3]

The test operates through a two-pronged evaluation: First, it examines whether the AI-generated product meets traditional standards of originality in copyright law. Second, and more critically, it assesses the degree and nature of human involvement throughout the creative process. This second prong evaluates factors such as the specificity of human inputs, the iterative nature of human-AI collaboration, and the substantive creative decisions made by human contributors.

Only when both conditions are satisfied, demonstrating both originality and substantial human creative direction would copyright protection be granted. This approach maintains copyright's human-centric foundation while pragmatically acknowledging the evolving nature of creative processes involving AI tools. The test provides much-needed clarity for determining copyrightability in human-AI collaborative works, ensuring protection extends only to outputs where human creativity plays a decisive, rather than merely incidental, role in shaping the final product.

Originality and AI

The Supreme Court of India's landmark judgment in *Eastern Book Company v. D.B. Modak*[4] established crucial principles regarding copyrightability that have significant implications for AI-generated works. In this case, the Court examined whether legal publications containing Supreme Court judgments along with editorial enhancements like headnotes, paragraph numbering and cross-references qualified for copyright protection. Rejecting both the overly simplistic "sweat of the brow" doctrine (which granted copyright for mere labor) and the stringent American "modicum of creativity" standard, the Court adopted the Canadian "skill and judgment" test as the appropriate threshold for originality. This middle path requires that a work demonstrate non-mechanical intellectual contribution from its author. Applying this standard, the Court held that while the raw judicial decisions themselves remained in the public domain, the publishers' editorial additions reflected sufficient human skill and legal judgment to merit copyright protection.

This precedent creates a complex landscape for AI-generated content under Indian copyright law. The fundamental requirement of human authorship poses challenges when assessing works where AI systems perform the bulk of creative labor with only minimal human input, such as simple text prompts. While AI-assisted creations demonstrating substantial human creative direction - through iterative refinement, selective curation or transformative modification - might satisfy the "skill and judgment" standard, purely AI-generated outputs risk falling into a protection gap. The current framework thus creates uncertainty regarding the copyright status of works where the line between human and machine contribution becomes blurred. As AI systems grow more sophisticated in generating creative content, India's copyright regime may need to evolve to address these emerging challenges while maintaining the balance between incentivizing innovation and protecting genuine human creativity that lies at the heart of intellectual property law. Additionally, a copyright claim on a list generated by a computer was denied in the

Navigators Logistics Ltd. v. Kashif Qureshi case,,

[5] because there was insufficient human interaction. In India, copyright protection is contingent upon human involvement in the creation process, as the courts have consistently held. Two essential criteria are established under the "Significant Human Input" test to determine if an author can assert copyright over a work for which they received AI aid. The first evaluates whether or not humans were involved in the creative process in any way. The second looks at the level of human engagement, or how much of the author's expertise, judgment, and labor were required to produce a work that would either not exist at all or be significantly different as a result of their substantial contribution. In other words, this test evaluates the sufficiency of the human input relative to the AI's role in the creative process.

Data protection

[3] Mehak Mathur, "Intersection of AI and Copyright Law" 2 *International Journal of Legal Studies and Social Sciences* 163 (2024).

[4] (2008) 1 Scc 1.

[5] **Air Online 2018 Del 1483.**

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Organizations are only allowed to process digital personal data with an individual's consent or for clearly specified legal purposes, according to the "The Digital Personal Data Protection Act of 2023.[6] It's unclear how autonomous AI programs that get users' personal information through unaffiliated apps in violation of the DPDP Act will be handled. Because of the difficulties in extracting such private information from an AI tool's pre-fed training parameters and the AI's innate ability to unlearn, it is also challenging for an AI tool to modify or remove personal information when a user withdraws consent. The intersection of India's Digital Personal Data Protection Act, 2023, and the evolving landscape of AI regulation is a pertinent area of discussion. While the DPDPA itself does not explicitly mention "Artificial Intelligence," its principles have significant implications for AI systems that process personal data.

The Act's provisions build upon the foundational privacy principles established in *Justice K.S. Puttaswamy (Retd.) v. Union of India*[7], which recognized privacy as a fundamental right under Article 21 of the Constitution. The Digital Personal Data Protection Act (DPDPA) establishes critical guardrails for AI development in India through three fundamental provisions. First, its principle of purpose limitation and data minimization requires AI systems to use only specifically defined, legitimate datasets, compelling developers to move beyond indiscriminate data scraping to intentional, ethical data curation.[8] Second, by granting individuals rights to access, correct and erase their data, the Act creates new imperatives for explainable AI systems that can account for their data processing activities in human-understandable terms. Third, the mandatory impact assessment requirement for high-risk processing activities effectively captures most AI applications, given their inherent complexity and automated decision-making capabilities, forcing organizations to implement robust safeguards.

However, implementing these provisions for AI systems presents unique challenges. The Act's current definition of personal data remains ambiguous when applied to AI-specific scenarios like model training datasets or inferred personal information. India must strike a delicate balance - crafting regulations that protect privacy without creating innovation-stifling compliance burdens. This will require developing specialized regulatory expertise to navigate technical complexities like algorithmic accountability and dataset provenance. The DPDPA provides a crucial foundation, but its success in governing AI will depend on supplementary guidelines that address these emerging challenges while maintaining India's competitive edge in artificial intelligence development.

Key Areas for AI Legislation in India

India's journey toward establishing a comprehensive legal framework for artificial intelligence must address five critical dimensions to ensure responsible development and deployment. First and foremost, the framework requires precise legal definitions of AI and its various applications - from natural language processing to deep learning systems - as different technologies demand tailored regulatory approaches. Equally crucial is strengthening data governance through robust privacy protections, including clear guidelines on permissible data collection practices, stringent consent mechanisms, and enhanced individual control over personal information used in AI systems.

The framework must mandate algorithmic transparency by requiring explainable AI systems and establishing audit mechanisms to detect and mitigate biases in automated decision-making processes. Parallel to this, it needs to create clear liability structures that determine accountability when AI systems cause harm, specifying whether responsibility lies with developers, deployers, or other stakeholders. Finally, the legal architecture should actively promote ethical AI development through institutional mechanisms like ethics review boards and funding for responsible AI research, ensuring alignment with principles of fairness, transparency, and human oversight.[9]

Together, these interconnected components would create a balanced ecosystem that fosters innovation while protecting fundamental rights - positioning India as a global leader in developing AI governance models that reconcile technological progress with societal values. The framework's success will depend on its ability to remain technologically neutral yet application-specific, future-proof while addressing current concerns, and rigorous without stifling the creative potential of India's growing AI ecosystem.Conclusion

India stands at a critical inflection point where artificial intelligence could either become the great equalizer that propels national development or an unchecked force that exacerbates existing inequalities. While AI's transformative potential is undeniable, its trajectory must be consciously shaped through thoughtful governance. The establishment of a comprehensive legal framework is not merely bureaucratic compliance but a civilizational necessity - one that will determine whether this powerful technology serves or subjugates our society.

[6]*Government Of India*. The Digital Personal Data Protection Act, 2023 (Act No. 22 Of 2023).
[7] [2017] 10 S.C.R. 569
[8] Supra Note 6, Ss.4&5.

[9]Kshitija Kashik, *Navigating the Future: India's Strategic Approach to Artificial Intelligence Regulations* 22-24 (National Centre for Good Governance (NCGG), Ministry of Personnel, Public Grievances & Pensions, Government of India, New Delhi, 2023).

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Effective AI legislation must serve as both compass and anchor guiding ethical development while grounding innovation in Indian values. Such regulation should mandate algorithmic transparency to demystify machine decision-making, institutionalize accountability mechanisms, and foster an ecosystem where technological progress aligns with human dignity. By embedding these principles in law, India can create a template for responsible AI that respects our cultural context while positioning the nation as a global standard-bearer.

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Original Article

The Impact of Literature in Social Change with Reference to Select Indian Authors

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Abstract
Literature has historically functioned as a transformative force, reflecting and influencing social structures, norms, and ideologies. In the Indian context, literature serves not only as a cultural mirror but also as an agent of progressive change. This study explores how leading Indian authors such as Mulk Raj Anand, Raja Rao, R.K. Narayan, Salman Rushdie, Arundhati Roy, and Chetan Bhagathave used the literary form to interrogate issues like caste, gender, communalism, colonial legacy, and globalization. Through the critical examination of selected novels, the paper demonstrates how literature becomes a powerful medium for addressing social inequalities and envisioning innovative futures.
Key words: *Literature, Social change, globalization*

Introduction

Literature has always played a vital role in shaping public consciousness and critiquing dominant social orders. In India, where tradition and modernity often coexist in tension, literature provides a critical space for questioning social injustices and proposing reforms. Through imaginative storytelling, Indian authors have examined caste hierarchies, gender roles, religious divisions, and economic disparities. This paper explores key contributions by top Indian writers whose works have influenced social thought and sparked dialogue on reform and innovation. As Edward Said argues, "Literature is a cultural expression that serves to question Rather than reinforce the status quo" (Said 35). Applying this lens, we delve into the writings of India's major literary voices to understand how fiction has functioned as a tool of social *change.*

The Impact of Indian Literature in Social Change

Mulk Raj Anand's novel *Untouchable* (1935) is a foundational text in Indian English literature, highlighting the plight of the Dalit community through the character Bakha, a latrine cleaner. Anand's commitment to social realism is evident in his depiction of systemic oppression, humiliation, and hope for reform."They think we are dirt because we clean their dirt" (Anand 34). Through Bakha's story, Anand not only exposes the cruelty of casteism but also hints at emancipation through education and hygiene reform. Influenced by Gandhian ideals and progressive thought, Anand's work laid the groundwork for social critique in Indian fiction. Raja Rao's *Kanthapura* (1938) offers a Gandhian vision of resistance through the life of a South Indian village. Moorthy, the Brahmin protagonist, adopts Gandhian principles, fights against untouchability, and mobilizes villagers in the freedom movement. Rao innovatively uses the oral storytelling tradition to reflect India's cultural identity. "We are all one, we are all one and the same, because all castes and all religions are the same" (Rao 72).

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The novel emphasizes the transformative potential of collective action and spiritual unity, offering a model for rural empowerment and anti-caste solidarity.

In *The Guide* (1958), R.K. Narayan combines wit and realism to explore the evolution of Raju from a tourist guide to a spiritual figure. The novel subtly critiques traditional morality and emphasizes individual agency.

"He began to understand that he had a role in the lives of others, and that was not just by chance" (Narayan 201).

Narayan's portrayal of Raju's transformation reflects the idea that social change begins with self-awareness and personal growth—a theme relevant to post-independence India.

Salman Rushdie's *Midnight's Children* (1981) is a landmark novel that captures the trajectory of postcolonial India through the life of Saleem Sinai, born at the exact moment of independence. Rushdie uses magical realism to interweave personal and national histories.

"History is always written by those who survive it" (Rushdie 134).

Rushdie challenges the official narratives of nationalism, critiques political events like the Emergency, and introduces fragmented identities to reflect the postcolonial condition. His experimental form and hybrid language mark a literary innovation that reshapes how history and politics are imagined.

Arundhati Roy's *The God of Small Things* (1997) critiques patriarchy, caste discrimination, and state violence through the tragic story of Ammu and her children. The novel centres around the forbidden love between Ammu and Velutha, a Dalit man, which ultimately leads to their downfall.

"They all broke the rules. They all crossed into forbidden territory. They all tampered with the laws that lay down who should be loved, and how" (Roy 31).

Roy uses non-linear narration, poetic language, and Malayalam-English code-mixing to foreground silenced voices. Her novel is a powerful feminist and anti-caste statement, bringing private trauma into the realm of political discourse.

Chetan Bhagat's *Five Point Someone* (2004) may not hold literary prestige but has had undeniable cultural impact. The novel critiques India's rigid education system and the pressure to conform.

"If you try and screw the system, it tends to screw you back.
Not very inventive, but true" (Bhagat 45).

By writing in accessible English and focusing on urban youth, Bhagat has democratized reading and brought conversations about mental health, academic stress, and career pressure into the mainstream. His works connect literature to everyday concerns, thus contributing to on-going social dialogue.

Bama's *Karukku* (1992) and Omprakash Valmiki's *Joothan* (1997) are powerful autobiographical accounts that reveal the lived experiences of caste-based discrimination. These narratives go beyond fiction to present raw, unfiltered truths. Valmiki writes:

"Dalit life is exiled from dignity" (Valmiki 65).

These texts challenge the silence around Dalit lives in mainstream literature and advocate for social justice. Their testimonies function as both resistance and reclamation of dignity.

Indian authors have used linguistic hybridity as a form of cultural assertion. Rushdie, Roy, and Ghosh blend Indian vernaculars with English to reflect India's multilingualism. Arundhati Roy's language defies grammar rules to mirror psychological fragmentation, while Rushdie's wordplay expands narrative possibility.

"Language is the battleground where identities are forged and contested" (Ghosh 178).

Such innovations have allowed Indian literature to evolve beyond colonial conventions, creating new forms for new meanings.

Amitav Ghosh's *The Hungry Tide* (2004) explores the Sundarbans' ecological landscape and its intersection with cultural dislocation. His narrative brings environmental concerns into literary discourse.

"The tide country is like no other place on earth" (Ghosh 6).

Similarly, Anita Desai's *The Village by the Sea* (1982) addresses rural poverty, environmental degradation, and urban migration, highlighting the socio-economic dimensions of change.

Recent works of Sami Ahmad Khan's *Aliens in Delhi* (2017) present futuristic visions of India entangled in global crises, AI warfare, and authoritarianism. These novels expand the scope of Indian literature to include speculative innovation.

"Technology is power. But in whose hands it lies—that's the real question" (Khan 92).

Such narratives blend political critique with science fiction, encouraging readers to imagine alternative futures.

Conclusion

Indian literature, across genres and generations, continues to engage deeply with social issues. From the anti-caste realism of Mulk Raj Anand to the postmodern experimentation of Salman Rushdie and the contemporary relevance of Chetan Bhagat, Indian authors have persistently questioned social hierarchies, oppressive systems, and cultural taboos.

Through diverse styles, languages, and narrative forms, literature becomes not just a mirror of society but a site for critique and creativity. It preserves marginalized voices, proposes new social imaginaries, and initiates

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conversations essential for collective progress. In a country as complex and diverse as India, literature remains one of the most effective tools for social introspection and innovation.

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Original Article

Intelligent Disruption: How AI and Automation Are Transforming Work, Education, Communication, and Social Identity

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Abstract

The advancement of Artificial Intelligence (AI) and automation technologies is driving a profound transformation across key dimensions of modern society. This paper examines how these innovations are reshaping work, education, communication, and social identity. While AI improves operational efficiency and fuels innovation, it also raises ethical concerns, amplifies inequality, and challenges human cantered norms. In the professional realm, automation is redefining job structures demanding new skills while rendering some roles obsolete. In education, intelligent systems offer personalized learning experiences, yet also present issues around data privacy and equitable access. AI-driven communication platforms are influencing public discourse and contributing to ideologically be olated digital spaces. Meanwhile, algorithmic profiling and surveillance technologies are reshaping how individuals construct and express identity. The study calls for inclusive, transparent, and ethical governance frame work stone sure that the societal benefits of equitably distribute and align with core human values.

Keywords*: Artificial Intelligence, Automation, Algorithmic Bias, Social Identity, Workforce Inequality, Digital Ethics, Intelligent Disruption*

Introduction

Artificial Intelligence (AI) and automation are redefining the structures of modern society by replicating functions once exclusive to human cognition and labor. AI systems perform complex tasks such as pattern recognition, language interpretation, and data-driven decision-making, while automation uses technology to execute routine or rule-based processes with minimal human intervention. The convergence of these technologies is transforming how individuals work, learn, communicate, and form identities within digital ecosystems.

Their integration across industries enhances productivity, reduces error, and fosters innovation. However, this transformation also challenges established labour structures, demands new skillsets, and introduces complex ethical questions. From influencing workforce dynamics to reshaping educational methodologies and online discourse, the rise of intelligent technologies marks a shift not just in function but in societal values, behaviours, and expectations.

AI and Automation as Catalysts of Digital Transformation:

Artificial Intelligence (AI) and automation are reshaping the digital era by redefining how we work, learn, communicate, and form identity AI mimics cognitive processes such as reasoning, interpreting language, and making autonomous decisions This combination promotes. innovation, operational accuracy, and productivity improvements across sectors, but also challenging existing labor structures, skill requirements, and ethical norms

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Streamline customer experiences, and enhance predictive capabilities in areas performs tasks such as finance, logistics, and healthcare. While these advancements foster productivity, they also necessitate revaluation of workforce structures, digital ethics, and long-term sustainability.

Historical Context and Evolution:

The conceptual foundations of AI trace back to early computational theories and experiments in machine learning. Key milestones, such as the formulation of the Turing Test in the mid-20th century, laid the groundwork for intelligent systems. Despite early challenges, the field matured through iterative breakthroughs, particularly during the 1980s and 2000s, with the rise of neural networks and big data analytics. Today, AI stands at the intersection of engineering, data science, and social systems, with growing influence over decision-making and behavioural environments.

Core Roles and Applications in Digital Transformation:

Conversational AI: Virtual agents (e.g., Alexa, Siri) deliver personalized, context-aware customer support. AI Enhanced CRM: Platforms like Salesforce use AI to unify customer data, personalize experiences, and drive loyalty. Smart Sales Assistants: AI tools streamline e-commerce by anticipating user needs and facilitating transactions. Predictive Analytics: ML powered tools forecast trends, optimize performance, and detect anomalies. AI in Cybersecurity: Intelligent systems proactively identify and mitigate digital threats in real time.

The paper is organized as follows:

Section II addresses Research Problem, Section III defines Purpose and scope, Section IV is an Overview of Related Work, Section V gives an insight into Methodology, Section VI covers Impact of AI on Job Roles ,Workforce, and the Employment Section VII covers AI and the Future of Work, Section VIII covers Results, discussion ,and finally the conclusions are summarized in Section IX, and in Appendix A is given in section X

Research Problem

The proliferation of artificial intelligence (AI) and automation technologies presents a paradox of unprecedented opportunities and systemic risks. While AI has the potential to enhance operational efficiency, optimize decision-making, and drive innovation, its deployment also introduces significant socio-economic disruptions—most notably, the displacement of human labour and the reconfiguration of traditional institutional structures. This study seeks to critically evaluate the long-term societal ramifications of AI integration across organizational and cultural domains, with a particular focus on its dual capacity to both enable and destabilize. The central problem guiding this research is to determine whether the widespread adoption of AI technologies contributes to net societal benefit or exacerbates structural inequities and vulnerabilities.Key guiding inquiries include:What are the macro-level socio-economic transformations induced by AI adoption in business and society?What emergent societal risks and disruptions are associated with accelerated AI deployment?

Research Questions

What quantifiable impacts does AI adoption have on employee well-being, organizational productivity, and workforce sustainability?Which socio-ethical and cultural complexities emerge as organizations undergo AI-driven transformation?What strategic frameworks can organizations employ to facilitate human-centered AI integration and ensure broad stakeholder acceptance?

Purpose and Scope

This study conducts an integrative analysis of the systemic impact of AI and automation on four critical domains: labour, education, digital communication, and socio-digital identity. Employing a multidisciplinary methodology that synthesizes technological, ethical, and policy-oriented perspectives, the research investigates how intelligent systems are reconfiguring human agency, institutional roles, and socio-cultural norms.

Specifically, the scope includes:

The examination of labour market restructuring through AI-induced automation and algorithmic management. The evaluation of AI-enhanced pedagogical models and their implications for educational equity and data governance. The analysis of AI-mediated communication environments, including the dynamics of information personalization and human-machine interaction. The exploration of identity formation in algorithmically curated digital spaces, with attention to issues of autonomy, bias, and surveillance.

By foregrounding the interplay between innovation, equity, and governance, the study aims to inform evidence-based policy design, support organizational adaptation strategies, and advance theoretical discourse on intelligent socio-technical systems.

Related Work

This study builds on foundational research across four intersecting domains impacted by AI and automation:

Work: Brynjolfsson [1] & McAfee (2014) highlight how digital technologies are redefining employment dynamics and productivity. Autor [2] (2015) addresses job polarization and inequality due to automation, while the World Economic Forum [3]'s Future of Jobs reports underscore the rising demand for cognitive, non-routine skills.

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Education:

Holmes [4] et al. (2019) and Luckin [5] et al. (2016) explore the ethical, pedagogical, and adaptive potential of AI-enhanced learning systems. UNESCO [6] (2021) identifies global disparities in access to AI-powered education tools.

Communication:

Gillespie [7] (2018) examines algorithmic content moderation, while Pariser [8] (2011) warns of echo chambers created by algorithmic curation. Recent research on generative AI (e.g., ChatGPT) highlights evolving norms in human-AI interaction.

Social Identity:

Zuboff [9] (2019) investigates surveillance capitalism's effect on autonomy. Noble [10] (2018) and Eubanks [11] (2017) expose algorithmic bias and the systemic marginalization reinforced by automated decision-making systems.These works provide a theoretical foundation for analyzing the disruptive societal shifts examined in this paper.

Methdology

Literature Review and Theoretical Framework

A foundational component of this study is a structured literature review aimed at exploring current academic, industrial, and policy discourse. The sources span multiple disciplines including, Artificial Intelligence and Computer Science, Sociology and Social Psychology, Educational Technology, Communication Studies, Ethics and Philosophy

Data Sources: Peer-reviewed journals (e.g., Nature, AI & Society, Journal of Educational Technology), Reports from organizations such as OECD, UNESCO, World Economic Forum [3], White papers from industry leaders like Google, Microsoft, and IBM, The theoretical framing draws upon: Human-Cantered AI design principles, Socio technical systems theory, Critical algorithm studies, Theories of identity in digital culture

Thematic Analysis:

The core of this study is structured around four interconnected themes:
Transformation of Work: focusing on job automation, remote work, algorithmic management, and new labour models. Educational Innovation: examining personalized learning, digital inclusion, and AI-driven pedagogy [5]. Shifts in Communication: assessing AI's role in human interaction, online discourse, and content moderation. Reconstruction of Social Identity: analysing how AI technologies influence personal identity, digital presence, and algorithmic profiling. Thematic analysis was employed to synthesize insights from the literature and identify recurring patterns, challenges, and transformative impacts within each domain.

Case Study Integration

Case Examples Include:
Education: Use of Duolingo's AI-based adaptive learning
Work: Uber's algorithmic management of drivers
Communication: Twitter/X content moderation algorithms
Identity: TikTok's personalized feed and its influence on self-perception
Case studies were selected based on relevance, impact, and representation of broader trends.

Case Study References

To contextualize the findings, the study incorporates real-world examples and case references from multiple sectors. These include AI-based platforms in education (e.g., Coursera, Duolingo), Automation in gig economy platforms (e.g., Uber, Amazon Mechanical Turk), AI tools in communication (e.g., ChatGPT, Google Translate, moderation bots), Identity dynamics on social media platforms driven by algorithmic curation (e.g., Instagram, TikTok). These case references support the thematic analysis and provide tangible illustrations of the societal changes under discussion.

Ethical and Critical Analysis

In addition to descriptive analysis, the methodology also includes a normative procedure to evaluate ethical and societal consequences. This involves: Identifying risks of bias, discrimination, and exclusion, exploring implications of surveillance and data commodification, Assessing the erosion of agency and autonomy, The analysis is guided by established ethical frameworks such as: European Commission's Ethics Guidelines for Trustworthy AI, IEEE's Ethically Aligned Design, UN's Sustainable Development Goals (SDGs)

Workforce Evolution in the Age of Artificial Intelligence

While repetitive and manual tasks are increasingly automated to enhance efficiency, this also renders certain positions obsolete. Conversely, new roles such as AI developers, data analysts, and robotics technicians are emerging, requiring a combination of technical expertise and business insight. This evolving landscape demands workforce adaptability. Employees must continuously upskill in areas like data analytics, machine learning, and AI integration to

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maintain relevance. Effectively leveraging AI as a complementary tool to human capabilities, alongside ongoing professional development, is essential. Despite the innovation and productivity gains AI offers, concerns about job displacement, algorithmic bias, and data privacy persist.

Employment Dynamics in the AI Era

AI reshapes employment by phasing out routine tasks while creating new roles in data science, AI training, human-machine collaboration, and AI ethics. According to McKinsey [12], AI could generate between 20 and 50 million new jobs globally by 2030, especially in healthcare, manufacturing, and finance. Emerging positions demand strong analytical, creative, and problem-solving skills [15]. Moreover, AI enhances existing jobs by improving accuracy and reducing workloads, as observed in healthcare diagnostics and quality assurance. Nevertheless, the overall economic impact remains complex, with significant concerns about displacement, particularly in low-skill occupations. Proactive reskilling and robust ethical governance are essential to navigating this transition.

The Future of Work with AI

Automation driven by AI is replacing repetitive roles, particularly in manufacturing, logistics, and administrative sectors, decreasing demand for some traditional jobs. Simultaneously, AI fosters new opportunities in fields like AI development, data analytics, machine learning engineering, and digital services, all requiring advanced technical competencies and promoting innovation. Workers must adapt by acquiring new skills to remain competitive and harness AI to boost productivity.

Evolving Skill Requirements

AI and automation shift workforce needs toward digital literacy, critical thinking, and adaptability. Employees increasingly require proficiency in collaborating with AI technologies, solving complex problems, and adjusting to evolving workflows. Additionally, soft skills such as creativity, communication, and emotional intelligence gain importance as automation takes over routine tasks. This underscores the necessity of continuous learning and upskilling to meet future job market demands.

Workplace Transformation

AI and digital tools are revolutionizing workplaces by enabling remote work, increasing flexibility, and facilitating global collaboration. AI-powered productivity solutions automate routine activities, optimize processes, and enhance decision-making, thereby increasing overall efficiency. However, the rise of algorithmic management to monitor and direct employee performance raises concerns about surveillance and autonomy. Ethical challenges related to job security, precarious employment, and algorithmic biases affecting hiring, promotion, and evaluation processes also emerge. To maximize benefits while safeguarding worker rights and privacy, balanced policies and regulatory frameworks are essential.

Results

The thematic and case-based analyses highlight the following cross-sectoral effects of artificial intelligence (AI) and automation:

Workforce Transformation:

AI-driven automation is rapidly replacing routine and task-based roles, particularly in platform-based labor environments such as those facilitated by Uber and Amazon Flex. While these technologies enhance operational efficiency, they also contribute to increased labor stratification and emphasize the need for continuous reskilling and workforce adaptability.

Educational Impact:

AI applications in education—such as adaptive learning systems like Duolingo and Squirrel AI—are advancing personalized instruction. However, disparities in access and digital literacy remain significant challenges. Educators are transitioning toward roles as learning facilitators, yet issues related to data privacy and the commercialization of learning environments persist.

Communication Dynamics:

The integration of AI in communication technologies supports real-time language translation, personalized content delivery, and automated moderation. Nevertheless, these tools contribute to the formation of filter bubbles and reshape expectations of human interaction, particularly through the proliferation of chatbots and generative AI interfaces.

Social Identity and Data Use:

Algorithmic profiling plays a growing role in shaping online identities and personal expression. These systems often reproduce societal biases, disproportionately affecting marginalized populations. The commodification of behavioural data raises concerns over autonomy, consent, and the expansion of surveillance infrastructures.

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Ethical Implications:

Core ethical principles—such as transparency, equity, and inclusivity must guide the development and deployment of AI. Effective governance depends on inclusive policymaking, stakeholder collaboration, and frameworks that prioritize socially responsible and human-cantered technological innovation

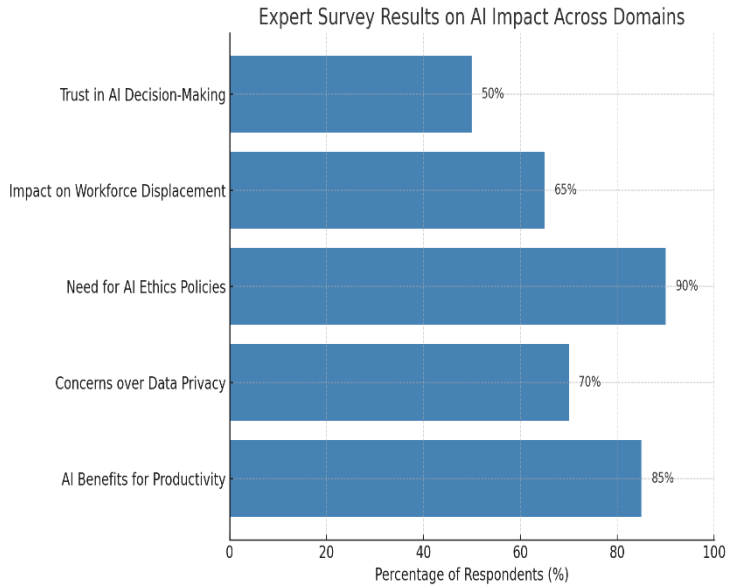


Figure 1: Simulated results from an expert opinion survey illustrating perceived impacts of AI across domains.

According to the chart, 90% of experts emphasized the urgent need for strong AI ethics policies, while 85% acknowledged productivity gains enabled by AI. At the same time, 70% of participants expressed concerns over data privacy, and 65% were apprehensive about potential job displacement due to automation. Notably, only 50% of respondents reported trust in AI systems to make fair and unbiased decisions, underscoring ongoing concerns about transparency and accountability in algorithmic processes.

Discussion And Conclusion

Discussion

This study demonstrates that while AI and automation drive productivity and innovation, they also disrupt employment patterns and amplify skill disparities, highlighting the need for forward-thinking workforce policies. In the realm of education, AI-powered platforms enhance personalization and engagement, yet they pose pressing challenges regarding accessibility, data ethics, and the evolving role of educators.

While AI enhances global connectivity, it also intensifies content silos and diminishes the quality of civic dialogue, necessitating regulatory oversight. Moreover, AI-based identity profiling raises concerns over systemic bias and the disproportionate marginalization of vulnerable communities. These findings emphasize that AI and automation are not Neutral Tools They Reflect And Reinforce Existing Social, Cultural, And Institutional Values.

Conclusion

This paper has explored how AI and automation are reshaping the domains of work, education, communication, and social identity. Through thematic analysis and real-world illustrations, the study highlights both the promises and pitfalls of intelligent disruption. Future research should adopt longitudinal and intersectional approaches to evaluate AI's evolving societal impact and prioritize the voices of marginalized communities. Ensuring inclusive, ethical, and sustainable AI integration will require collaboration among governments, academic institutions, industries, and civil society. Navigating intelligent disruption effectively demands a careful balance between technological innovation and ethical stewardship to ensure AI fosters inclusive and sustainable societal growth. Appendix A, Expert Opinion Survey Questions A structured 12-question survey was developed and distributed to professionals across education, technology, and communication sectors. The questions covered perceptions of AI's impact, workforce preparedness, ethical concerns, and the role of governance. The full list of survey questions is available here. Section A: General Perspective on AI To what extent do you believe AI has positively impacted your field of work? What concerns do you have about the rapid integration of AI in your industry? Section B: AI and the Workforce3. How prepared is your organization for workforce transitions driven by automation? What role should human cantered design play in implementing AI in professional settings? Section C: AI in Education5. Do you think AI enhances the quality of education through personalization? What risks do you see in AI- riven educational platforms (e.g., data privacy, teacher displacement)?

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Section D: AI and Communication How has AI altered communication and public discourse in your field? To what extent do algorithmic recommendation systems (e.g., YouTube, TikTok) shape your access to information? Section E: Identity and Ethics Do you believe AI profiling systems (e.g., facial recognition, behavioural targeting) reinforce bias? How important is ethical oversight (e.g., transparency, explainability) in deploying AI systems? Section F: Policy and Governance Should governments play a stronger regulatory role in guiding AI development? What is the most urgent ethical challenge related to AI that your field currently faces?

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Original Article

Interlingual and Intralingual Errors in Second Language Acquisition: A Study in Applied Linguistics

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Abstract:

Applied linguistics is an interdisciplinary field that bridges the theoretical knowledge of linguistics with practical applications in language learning, teaching, and communication. This paper explores the nature and sources of errors made by second language learners, specifically focusing on interlingual and intralingual errors. Drawing upon the theoretical frameworks of Corder, Nemser, Selinker, and others, the paper examines how learners construct approximative systems, how fossilization and contextual influences impede progress, and how communication strategies compensate for linguistic limitations. The paper also highlights the implications of these insights for pedagogy, curriculum design, and further research in applied linguistics.

Keywords: *Interlanguage, Error Analysis, Fossilization, Communication Strategies*

Introduction

Applied linguistics, as an evolving domain, serves as a bridge between linguistic theory and real-world language-related issues. It is inherently interdisciplinary, drawing from linguistics, psychology, sociology, pedagogy, and education to address practical challenges in language acquisition, language teaching, and cross-cultural communication. According to Corder (1973), applied linguistics is not concerned with the creation of theories, but rather with the application of linguistic theories to practical contexts. He characterises applied linguists as users—not producers—of theoretical knowledge.

Although applied and theoretical linguistics are conceptually distinct, they are deeply interdependent. Theoretical linguistics informs the development of methods, tools, and insights for applied practice, while applied linguistics tests and refines theory through real-world implementation. This symbiotic relationship is particularly evident in the domain of second language acquisition (SLA), where applied linguistics plays a critical role in error identification, learner analysis, and curriculum reform.

Interlingual Errors

Interlingual errors are rooted in the learner's native language (L_1) and arise due to the influence of L_1 structures on the second language (L_2) learning process. The contrastive analysis hypothesis, prominent in the 1960s, suggests that where L_1 and L_2 structures are similar, positive transfer occurs, whereas significant structural differences lead to negative transfer. For example, Hindi speakers learning English may produce the sentence *"I am reading since morning."* This form results from the transfer of Hindi temporal expressions (e.g., *मैं सुबह से पढ़ रहा हूँ*), which do not differentiate between the present progressive and the present perfect progressive tenses as English does. Similarly, *"Why you are late today?"*

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mirrors Hindi question structures, which lack auxiliary inversion, thus leading to errors in syntactic construction.
These examples illustrate that the learner does not randomly generate errors but does so based on an existing, well-established linguistic system. Such insights underscore the importance of understanding L_1–L_2 relationships in teaching.

Error Analysis:

In response to the limitations of contrastive analysis, error analysis emerged as a more learner-centred approach. Initiated by scholars like Corder (1971) and Richards (1975), error analysis views the learner as an active participant in language construction. Instead of focusing solely on L_1 interference, it seeks to uncover the cognitive and developmental processes underlying learner performance.
Error analysis posits that errors reflect transitional competence—a developmental phase in which learners form hypotheses about the L_2. These hypotheses may be informed by partial knowledge, overgeneralizations, or misapplied rules. By systematically studying such errors, educators and researchers can infer the learner's interlanguage, diagnose areas of difficulty, and adapt pedagogical strategies accordingly.

Approximative Systems and Idiosyncratic Dialects

Nemser (1971) describes the learner's grammar as an *approximative system*, a temporary linguistic state that evolves as the learner moves closer to target language norms. These systems are systematic and deviant, yet logical within the framework of the learner's current understanding.
Corder (1971) refers to these systems as *idiosyncratic dialects*, reinforcing the view that learner utterances are governed by internalised rules and are thus analyzable and predictable. This perspective transforms errors from being viewed as failures to being considered developmental milestones.

Intralingual Errors

Unlike interlingual errors, intralingual errors stem from the structure of the target language itself and the learner's interaction with it. These include:

a. Overgeneralization:

Learners apply rules beyond their appropriate context, leading to errors such as *goed* (instead of *went*) or *cheater* (instead of *cheat*). Overgeneralization reflects an effort to simplify and systematise the L_2 grammar, often resulting in the dropping of redundant markers as in:
"Yesterday I go to see my sister."
"Last year I pass the B.A. LL.B. exam."

b. Ignorance of Rule Restrictions:

Learners often misuse syntactic or semantic constraints.
For example:
"He explained me the book." (instead of *He explained the book to me*)
"We discussed about it." (instead of *We discussed it*)
These errors arise from analogical extension based on superficially similar structures.

c. Incomplete Application of Rules:

Here, the learner has partially acquired the rule system but fails to apply it completely, as in:
"What you are doing?" (instead of *What are you doing?*)
"When you came?" (instead of *When did you come?*)
Such errors indicate an intermediate stage in rule acquisition.

d. False Concepts Hypothesized:

Faulty teaching or misinterpretation may cause learners to misassociate forms and functions. For example:
"He was helped me."
"He is go to school every day."
These stem from learners assigning temporal or aspectual meanings inaccurately to auxiliary verbs.

Fossilization

Selinker (1972) introduced the concept of *fossilization*, where erroneous forms become permanent features of a learner's interlanguage. This phenomenon occurs when the learner achieves functional communicative competence despite linguistic inaccuracies. Factors contributing to fossilization include:
Language transfer from L_1
Transfer of training (instructional inadequacies)
Learning strategies (e.g., memorisation)
Communication strategies (e.g., circumlocution)
Overgeneralisation of rules
Fossilization is a significant barrier to attaining native-like fluency and presents challenges for corrective instruction.

7. Context of Learning

Learning context influences the nature and frequency of errors. Stenson (1975) identifies *induced errors*—mistakes caused by faulty teaching, misleading textbooks, or ambiguous classroom practices. For example, the overuse of the

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present progressive in classroom instructions may reinforce the false notion that it is universally applicable to describe all ongoing actions.

Additionally, socio-cultural factors shape language use. Indian learners, for instance, often exhibit *sociolinguistic interference* by transferring L_1 politeness formulas and discourse conventions into English, leading to stylistic or pragmatic deviations. Thus, understanding the context is essential for accurate error diagnosis.

Communication Strategies in SLA

Learners deploy various strategies to bridge gaps in linguistic competence. These include:

Approximation: using near-synonyms
Word coinage: inventing new words
Circumlocution: describing the concept
Code-switching: alternating between L_1 and L_2
Topic avoidance: steering clear of complex language

While these strategies often facilitate communication, they can also reinforce erroneous patterns if left uncorrected. Understanding these mechanisms allows educators to balance communicative fluency with structural accuracy.

Implications for Pedagogy and Research

This analysis of error sources offers valuable insights for applied linguists, language teachers, and curriculum designers. Pedagogical approaches should:

Emphasise contrastive grammar awareness
Encourage hypothesis-testing through meaningful tasks
Address fossilization via targeted feedback
Consider learners' socio-cultural backgrounds
Incorporate strategy training to improve self-monitoring and repair mechanisms

Further research is needed to understand individual learner variables, input quality, and longitudinal patterns of error retention and correction.

Conclusion

Errors are not merely flaws but essential components of the language learning process. They provide a window into learners' cognitive strategies, developmental trajectories, and sociolinguistic constraints. By examining both interlingual and intralingual errors, applied linguistics equips us to refine teaching practices, develop more effective curricula, and support learners in constructing accurate and fluent second language systems.

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Original Article

Village water survey and study of various parameters of different soil samples

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Abstract:
Soil puts food on our plates, purifies our water, protects us against flooding and combats drought. Human activities such as transportation, agriculture, and the disposal of industrial and domestic waste contribute significantly to the degradation of natural ecosystems. Among these, environmental pollution of the soil is a major concern resulting from various anthropogenic activities. Soil represents the transitional zone between the Earth's atmosphere, the lithosphere, and the underlying rock layers. It can be defined as the uppermost weathered layer of the Earth's crust, containing a complex mix of living organisms along with the remains of dead and decaying matter. In the present study, an investigation was carried out to analyse both the physical and chemical properties of soil samples. A total of seven representative soil samples were collected from various locations within the Karmoli village. The quality of these samples was assessed through a series of tests, including measurements of pH, electrical conductivity, temperature, moisture content, phosphates, Sodium, Calcium, Potassium, chlorides, alkalinity, carbonate, bicarbonate, and organic matter content.
Keywords: *degradation, analyse, ecosystems, organic matter, soil samples*

Introduction:

Clear and colorless water often gives the impression that it is safe for human consumption. However, this is not always true, as many harmful bacteria and objectionable substances may be present in forms that are not visible to the naked eye. These contaminants may enter the water either naturally or as a result of human activities. Therefore, it is essential to understand the environmental significance of these impurities.Water quality attributes are generally classified into three categories: physical, chemical, and biological. The quality of water is assessed using established standards. While there are existing standards for drinking water quality, these require periodic review for several reasons.The World Health Organization (WHO) has recommended guideline values for drinking water, especially for developing countries. These guidelines often serve as a basis for formulating local standards. In India, the Department of Rural Water Supply under the Rajeev Gandhi National Drinking Water Mission has recommended water quality standards in its publication titled *Operational Guidelines for Rural Water Quality Surveillance*.

Additionally, water found within the same geological stratum typically shares a common depositional history, and therefore, often exhibits similarities in terms of density and source characteristics.

Methodology:

Water samples were collected from four different locations in Karmoli village, covering a variety of water sources. At each water catchment location, three samples were taken. Additionally, four water samples were collected from various other locations within the village. The sampling sites were purposely selected to ensure they represent the entire range of water bodies in the area. During collection, the physico-chemical properties of each water sample—such

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as electrical conductivity, pH, Hardness, Turbidity and temperature—were measured on-site using portable meters. The samples were then placed into clean containers provided by the analytical laboratory and were immediately stored on ice to preserve their integrity until analysis.

Analysis of water samples:

Determination of pH

The pH of the water samples was determined using the Elico pH meter instrument. It was standardized with a buffer solution of pH range between 4 and 9.

Measurement of temperature

The temperature measurement was carried out at the sample collection site using a thermometer. This involved immersing the thermometer into the water sample and recording the reading once it stabilized.

Determination of conductivity

Electrical conductivity was measured using an Elico conductivity meter. The probe was immersed into the sample container, and the reading was recorded once it stabilized.

Determination of total dissolved solids (TDS)

The turbidity of different water samples was measured using a turbidometer.

Chemical analysis

Sulphate, chloride, sodium, and potassium present in the water samples were analyzed using different methods. Chloride content was measured through its reaction with silver nitrate, sulphate was determined using the gravimetric method, and sodium and potassium were analyzed using the flame photometric method.

Result:

The results for the different water samples are presented in the following table.

Conclusion:

Assessing water quality is essential to determine the suitability of a water source for its intended use. Various water quality parameters are evaluated and compared against standard values to judge whether the water is acceptable for use. Water is a vital resource that we cannot afford to contaminate. To detect and monitor pollution, it is necessary to conduct physical, chemical, and biological examinations. Physical examination includes parameters such as color, conductivity, temperature, odor, taste, turbidity, and hardness. Over the past few decades, environmental pollution has increased significantly, demanding urgent attention from humanity. Understanding and addressing this

1) Public Water supply

Sr. No	Property	Value
1	Conductivity	645mu
2	pH	4.93
3	Hardness	150
4	Turbidity	1.6
5	Sulphate	BDL
6	TDS	115 ppm
7	Chloride	6ppm
8	Alkalinity	130
9	Sodium	4.00 ppm
10	Potassium	1.12 ppm
11	Calcium	2.59 ppm

2) Bore Water:

Sr.No	Property	Value
1	Conductivity	545mu
2	pH	6.5
3	Hardness	80
4	Turbidity	66 NTU
5	Sulphate	BDL
6	TDS	310 ppm
7	Chloride	8ppm
8	Alkalinity	6.5
9	Sodium	1.35 ppm
10	Potassium	1.12 ppm
11	Calcium	2.97 ppm

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3) River Side

SrNo	Property	Value
1	Conductivity	625mu
2	pH	6.2
3	Hardness	90
4	Turbidity	9.6
5	Sulphate	BDL
6	TDS	129 ppm
7	Chloride	BDL
8	Alkalinity	155
9	Sodium	1.78 ppm
10	Potassium	1.92 ppm
11	Calcium	1.13 ppm

4)Common Drinking Water(Source well)

Sr. No.	Property	Value
1	Conductivity	689mu
2	pH	5.3
3	Hardness	140
4	Turbidity	3.7
5	Sulphate	BDL
6	TDS	150ppm
7	Chloride	16ppm
8	Alkalinity	135
9	Sodium	1.58ppm
10	Potassium	4.93ppm
11	Calcium	3.24ppm

Issue requires a basic knowledge of environmental chemistry, particularly environmental chemical analysis. The conclusion of different parameter is as follow:

1. Public **Drinking Water** Standards require **chloride** levels not to exceed 250 mg/L. Criteria for protection of aquatic life require levels of less than 600 mg/L for chronic (long-term) exposure and 1200 mg/L for short-term exposure.
2. **Hardness** is most commonly expressed as milligrams of calcium carbonate equivalent per liter. **Water** containing calcium carbonate at concentrations below 60 mg/l is generally considered as soft; 60–120 mg/l, moderately hard; 120–180 mg/l, hard; and more than 180 mg/l, very hard.
3. The **pH** of pure **water** is 7. In general, **water** with a **pH** lower than 7 is considered acidic, and with a **pH** greater than 7 is considered basic. The normal range for **pH** in surface **water** systems is 6.5 to 8.5, and the **pH** range for groundwater systems is between 6 to 8.5.
4. Na- **drinking-water sodium** not exceeds 20 mg/L. In order to avoid adverse effects on taste.

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Original Article

Communicative Language Teaching in the Age of AI: A Hybrid Model for Indian Classrooms

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Abstract

The advent of Artificial Intelligence (AI) is reshaping educational practices, offering unprecedented opportunities to enhance language learning. This paper examines the integration of AI tools into Communicative Language Teaching (CLT), a widely adopted method in English as a Second Language (ESL) instruction, to formulate a hybrid teaching model. Focusing on the Indian higher education context—particularly engineering institutions in Tamil Nadu—the study investigates how AI applications such as chatbots, speech recognition software, and grammar checkers can support CLT's objectives: authentic interaction, fluency, and learner autonomy.

Through a synthesis of secondary research and illustrative classroom-based case studies, the paper analyzes the pedagogical benefits and potential limitations of AI-augmented CLT. The proposed hybrid model harmonizes technological support with task-based learning, collaborative engagement, and continuous feedback mechanisms, ensuring a balanced and learner-centered environment. Ethical considerations and infrastructural challenges are also addressed.

The paper concludes that, with strategic implementation and ethical oversight, a CLT-AI hybrid model can help bridge language proficiency gaps, cultivate independent learners, and equip students with communicative competencies essential for the digital age.

Keywords: *Communicative Language Teaching, Artificial Intelligence, Hybrid Learning, English Language Teaching, Indian Higher Education, ESL, Technology-Enhanced Learning*

Introduction

Communicative Language Teaching (CLT) has long been established as a learner-centric approach that emphasizes meaningful interaction and communicative competence over rote memorization. In India—especially within engineering colleges where English serves as the medium of instruction—CLT offers a much-needed shift from traditional grammar-translation methods. Parallelly, the increasing influence of Artificial Intelligence (AI) in education prompts a re-examination of how these technological advancements can complement rather than supplant proven pedagogical practices.

AI now enables functionalities such as real-time translation, voice recognition, grammar feedback, and personalized learning pathways. These capabilities align well with the tenets of CLT, which prioritize fluency, context-based usage, and student agency. However, effective integration demands deliberate design to ensure that technological enhancements amplify rather than detract from the social and humanistic elements of language learning. This paper proposes a hybrid instructional model that blends CLT with AI-powered tools, specifically within the Indian ESL context. Drawing attention to engineering colleges in Tamil Nadu, the study addresses both the pedagogical potential and the implementation challenges associated with such an integrative framework

Literature Review CLT's efficacy in the Indian educational landscape has been substantiated by multiple studies. Patel and Jain

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(2020) found that CLT fosters learner autonomy and boosts student participation. Similarly, Babu and Reddy (2019) reported enhanced oral proficiency and student motivation in CLT-based classrooms compared to traditional instruction.

Concurrently, AI is revolutionizing language learning through tools that personalize instruction and provide immediate, context-sensitive feedback. Applications such as Duolingo, Grammarly, and ChatGPT are increasingly utilized in both formal and informal educational settings. Kumar and Iyer (2022) demonstrated that AI integration in blended learning environments significantly improved student outcomes in Indian higher education institutions. Global research by Warschauer and Healey (1998) and Kukulska-Hulme (2020) also supports the transformative role of digital tools in fostering autonomous and interactive learning experiences.

Nevertheless, apprehensions regarding over-reliance on AI persist. Sharma and Mehta (2021) caution against the risk of diminished creativity, critical thinking, and human connection in AI-heavy classrooms. Issues related to digital equity, data ethics, and teacher preparedness further complicate the implementation of AI-enhanced pedagogy.

CLT Principles and AI Integration

CLT emphasizes the following core pedagogical strategies:

Pair and group work for interaction

Real-world language application

Fluency over grammatical accuracy

Learner-centered classrooms with teachers as facilitators

AI tools can be thoughtfully employed to reinforce these strategies:

Chatbots (e.g., ChatGPT): Simulate everyday conversational scenarios to enhance fluency.

Speech Recognition (e.g., ELSA Speak, Google Speech):

Offer feedback on pronunciation and spoken fluency

Writing Assistants (e.g., Grammarly, QuillBot): Provide instant corrections and stylistic suggestions.

Gamified Learning Platforms (e.g., Duolingo): Increase motivation through interactive challenges. These tools, when integrated into communicative tasks such as role-plays, debates, collaborative writing and

Group discussions, can deepen student engagement and language acquisition.

The Hybrid Model: AI-Enhanced CLT

The proposed hybrid model incorporates AI within the three phases of a communicative language learning cycle:

Phase 1: Pre-Class Preparation

Students Independently Engage With Vocabulary-building apps, pronunciation exercises, and grammar tutorials.

Chatbots facilitate preliminary conversation practice aligned with upcoming classroom discussions.

Phase 2: In-Class Activities

Teachers orchestrate group projects, peer interviews, and debates.

AI tools offer real-time support (e.g., pronunciation correction, vocabulary suggestions).

Shared platforms (e.g., Google Docs) integrated with grammar-checking tools enable collaborative writing and instant feedback.

Phase 3: Post-Class Reflection

Students compose reflective journals, essays, or summaries using writing assistants.

Teachers provide digital feedback, and peer reviews are facilitated through institutional LMS or email.

Follow-up tasks through gamified or chatbot interfaces reinforce in-class learning.

This tripartite model ensures continuity, personalization,and communicative rigor, while preserving the rreplaceable role of teachers as mentors and facilitators

Challenges and Ethical Considerations

The hybrid model is not without constraints:

Digital Divide: Inconsistent access to technology remains a significant barrier. Infrastructure investment and equitable resource distribution are essential.

Data Privacy: AI tools often collect sensitive data; institutions must establish transparent data-use policies and obtain informed consent.

Academic Integrity: Overdependence on AI tools can hinder skill development. Educators must promote responsible tool use and design assessments that encourage originality.

Teacher Preparedness: Many instructors lack exposure to educational AI. Structured training programs and continuous professional development are necessary.

Human Interaction: AI cannot replicate the emotional intelligence and cultural responsiveness of human educators. Its role must remain supplementary.

Conclusion and Recommendations

AI, when integrated with pedagogical mindfulness, holds the potential to enhance Communicative Language Teaching in meaningful ways. The hybrid CLT-AI model proposed here preserves the dialogic, learner-focused ethos

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of CLT while enriching it with AI-driven personalization, efficiency, and adaptability.To operationalize this model in Indian ESL contexts, especially in engineering colleges, the following steps are recommended:
Embed AI literacy and pedagogy in teacher education programs.
Formulate institutional policies on the ethical use of AI in classrooms.
Implement pilot initiatives to test and refine the hybrid model.
Encourage empirical research on AI's impact on language learning in diverse educational settings.
By aligning humanistic pedagogy with technological innovation, the Indian education system can advance toward inclusive, effective, and future-ready language learning ecosystems.

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Original Article

To Study the Impact of Management Education on Entrepreneurial Development on the Students of Urban Rajasthan

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Abstract

With the mushroom growth of management colleges in India, the quantitative improvisations gradually increased. The Indian management education contributions towards socio-economic considerations are typically not up to the mark due to many reasons. Basic objective of management education is to inculcate business knowledge both in terms of theoretical and practical, developing decision-making skills, developing entrepreneurial attitudes among students, filling gap between the demand and supply of human resources i.e. management professionals to the industries. The real picture of management education in India is quite different with the above said objectives. In this regard the role of university affiliated managed colleges, faculty, students are decisive.

Introduction

Qualitative aspects are least considered, simply sending the students out has become the prime motto of the management colleges. The problem areas in this regard are clearly visible; all these situations led to unmatched results of management education towards industry and society requirements. Indian society needs the entrepreneurs than the workers. Basically entrepreneurial attitude begins with the rightly tuned and directed aspirations. Indian government is ever ready to encourage the entrepreneurs through providing initial and developmental assistance. Here the user is not yet prepared! So, where is the problem lies here, it needs an in-depth thinking, analysis and presenting practical recommendations. Entrepreneurship Development: Indian Context The word, entrepreneur is originally taken from the French language where it originally means an organizer of musical or other entertainments. The word has been in use since the 16th century, where it was applied to those who were organized and engaged in military expeditions. In the 17th century the word has been extended to cover architects and contractors engaged in civil engineering activities such as construction, fortification and public works. The old oxford dictionary coined the term entrepreneur as “the director or a manager of a public musical institution, one who gets- up entertainment, especially musical performance”. It was only in the beginning of 18th century that the word was used to refertoeconomicaspects.

National Knowledge Commission’s Report (2006) on Indian Management Education in Brief:

National Knowledge Commission’s report on Management Education advocates a greater role of industry in promoting research programs in B-schools as they are the major beneficiaries in terms of steady supply of efficient manpower. Indeed, the industry can sponsor research programs, set up dedicated research chair professorships in specific domains, grant fellowships to doctoral candidates and open their gates for collaborative research projects. Besides, the corporate houses may also encourage some of their senior professionals to participate in research programs and pursue higher education. B-Schools are unlikely to handle the shortage

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Of faculty without active support from industry. The Government of India as well as state professionals to participate in research programs and pursue higher education. B-Schools are unlikely to handle the shortage of faculty without active support from industry. The Government of India as well as state governments should also strengthen doctoral research in Management by increasing intake of students in Ph.D. programs The statistics of Management Colleges in India shows that there are number of sufficient institutions which offering management education.

Table 2: *Growth of AICTE approved Technical Institutions in last five years*

Year	Management
2005-2006	1052
2006-2007	1132
2007-2008	1149
2008-2009	1523
2009-2010	1940

Source: www.aicte.ernet.in

The Intake of students into MBA and Ph.D. courses is increased at the rate of 179% i.e. 89,369 (during the period 2007-08 to 2011-12) for MBA Program at Post Graduation level, with the 98% growth rate in Ph.D. programs (during the period 2007-08 to 2011-12).

Management education in India formally began in 1953 at the Indian Institute of Social Welfare and Business Management (IISWBM) –the first B-School established by Government of West Bengal and Kolkata University. However, a few institutions like Tata Institute of Social Sciences (1936) and Xavier Labour Research Institute (1949) had already started training programmes for managers in personnel function well before the formal launch of first MBA programme at IISWBM. IISWBM experiment of offering two-year, full-time MBA programme was followed by Delhi University (1955), Madras University (1955), Bombay University (1955) and Andhra University (1957). A few other institutions like Administrative Staff College of India Hyderabad (1956), All India Management Association (1957), and National Productivity Council (1958) were established to promote excellence in management practices, research and education.The Government of India launched Indian Institutes of Management (IIMs) as centres of excellence in Management education in early 1960s. The first Indian Institute of Management was set up in Kolkata in 1961 and second in Ahmedabad in 1962. Elite club of IIMs added new members in 1973 (Bangalore), 1984 (Lucknow) and 1997-98 (Kozhikode and Indore). Currently there are 12 IIMs in the country. Over the years, IIMs have evolved as great brand in Management education across the globe and an enviable benchmark for other institutions in terms of quality of faculty, students, curriculum and placement.

Entrepreneurship education has been intensified in universities during the past four decades. In the sixties, less than ten universities in India were teaching in this field, 1990 there were already 400 universities. Many of these academic institutions have established majors on the graduate level or other kinds of concentrations. Entrepreneurship centers have been founded to coordinate the broad array of activities, programs and resources within universities. Very seldom, schools pashed back out of entrepreneurship once they had entered. This growth in interest and funding is accompanied by an increasing demand for legitimization of entrepreneurship education at the university level. Consequently, the impact of education on the creation of future entrepreneurs and the link between university training and the success of the new ventures have been subject of much discussion in the academic community. A review of the entrepreneurship literature reveals contradictory findings (see for a literature-review Gorman, Hanlon and King 1997). The results suggest to differentiate between general business and specific entrepreneurship education when exploring the role of university programs.

Most of the surveys show that *entrepreneurship* education encourages graduates to start their own business. In an early study, Clark surveyed a sample of students of a medium-sized American university who were enrolled in an introductory entrepreneurship course. He found that almost 80% of these students were considering to setup their own business. These plans were often turned into reality. Three out of four students who reported concrete plans for founding a company in fact started a new venture. Furthermore 76% of the respondents stated that the entrepreneurship course had a large or very large effect upon their founding decision (Clark, Davis and Harnish 1984). McMullan, Long and Wilson report a high rate of new venture creation among MBA students who attended more than three entrepreneurship-related courses at a Canadian university (McMullan, Long and Wilson 1985). A review of a graduate enterprise program in the UK suggests that the program provided an incentive to more than half of the participants to start their business sooner than intended. Thus, this initiative had an enabling and accelerating impact on the graduates' founding activities. (Brown 1990). Irish students who participated in a student enterprise award indicated that the initiative had a" very important" impact on their subsequent career choice (Fleming 1994).

Objectives of the Study

To find whether there is a relationship between Education of a respondent and Willingness to start a business.To find what factors motivate those who are willing to start a business.To find which factors are considered enablers to

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ntrepreneurial activity and draw a regression model depicting the relationship between those enablers and willingness to start a business.Scope of the Study

Data has been collected through questionnaires from students of various colleges and universities, such as, Central University of Rajasthan, Ajmer, M.D.S. University, Ajmer, IIM Udaipur, ISB Mumbai Etc

Respondents were mainly in the age group of 21-27 and all of them received management education at least once in their life, whether it was BBA, MBA or any other course inculcating some management skills into the students.

Research Design

Sample size and sample unit

Sample Size is 55 persons and sampling unit will be students who received management education at least once in their life.

Sampling Method

Non Probability Convenience Sampling method was adopted to collect the sample.

Data Source

Both primary and secondary data used for the study. Secondary data is collected from various websites and published articles in various national and international journals. Primary data is collected through questionnaire, which is specifically designed with an intention of getting responses towards entrepreneurial attitudes among management stude**Limitations of the Study**No other aspect other than entrepreneurial intention is included in the study.The sample size of 55 respondents may not necessarily represent the entrepreneurial behaviour of the whole opulation.

Chi-squaretesttodeterminerelationshipbetweeneducationofa respondent and willingness to start business.

For my first objective i.e., to check whether there is a relationship between education of a respondent and willingness to start a business, I have applied Chi-square test to find out whether there is a close association between Education of a respondent and willingness to start a business.

I have defined the null and alternative hypothesis as follows:

H_0: There is no association between Education and Willingness to start business H_1: There is an association between Education and Willingness to start business

Education (MBA,BBA etc) * willingness to start a business Cross lation

Count Here, we can see that the Chi-square value is 0.730. Therefore, our null hypothesis is rejected. Hence, it proves that there is a strong association between Education of a respondent and his/her willingness to start a business.

Second with Personal factors

		willingness to start a business		Total
		yes	no	
	0	1	1	2
	MBA	20	20	40
Education (MBA,BBA etc)	BBA	4	1	5
	Bcom	4	2	6
	Mcom	1	1	2
		30	25	55

Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
1	Caste+educational+Family[b]	.	Enter

a Dependent Variable: Willing to start a business All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.102[a]	.010	-.008	.505

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a. Predictors: (Constant), Caste+educational+Family
b. Dependent Variable: Willing to start a business

NOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	.141	1	.141	.553	.460[b]
1	Residual	13.495	53	.255		
	Total	13.636	54			

a. Dependent Variable: Willing to start a business
b. Predictors: (Constant), Caste+educational+Family

Majority of the respondents accepted (with higher degree of significance) the influence of factors like family and social groups, school and college environments, self-confidence, situations, frequent industrial visits, interactions with upcoming entrepreneurs, inspirational teaching, culture, entrepreneurial development programs, social media, risk-taking nature on developing entrepreneurial aspirations and attitudes among management students with regard to Indian management education.

The high influential facets which influences the students towards developing entrepreneurial aspirations and attitudes are industrial visits, well designed curriculum, participation in management games, effective assignments, learning aspect of the faculty and students, Entrepreneurship Development Program wing existing in the college, connectivity with local industries, interactions with successful entrepreneurs, project course work and case method of learning.

Risk-taking orientation considered as key step towards transformations of entrepreneurial aspirations into a reality. The students don't possess the social-learning-adjustment degree. Industrial visits are not effectively designed. Entrepreneurship attitude development element is least preferred in the academic assignments. Respondents are aware of usage of internet towards knowledge gathering. Teaching fraternity is unable to identify and manage student entrepreneurial aspirations and attitudes. No special attention on conducting sessions on entrepreneurial ideas development among the students. Existing management education system is not giving much scope for recognizing the need and developing the entrepreneurial interests among the young managers and not in a position to perform their role as mentor.

The present globalized business environment is peculiarly constant with dynamic changes. The role of management education is quiet vital in providing quality human resources with adequate business acumen. Beyond all these identifying, developing and sustaining entrepreneurial zeal among the management students is highly required. There are many challenges and issues in front of the management teaching fraternity and students towards adopting this dynamic. Therefore, with reference to above findings the following suggestions are recommended towards maximizing impact of management education system on entrepreneurial training and effective transformations from a student to entrepreneur:

Curriculum should be revised continuously with the changing business needs. The regulatory bodies like University Grants Commission (UGC) and Universities must involve continuously in designing new programs for entrepreneurship development. New specializations are needed to be implemented in the area of entrepreneurship development. Assessing the student ideologies on the entrepreneurial activities through focused assignments. Frequent Organizing of entrepreneurship games for developing entrepreneurial aspirations among management students. Planning and arranging sessions for entrepreneurial idea generation among the students through discussions and addressing rightly the concerned issues. Taking the assistance of successful and young (upcoming) entrepreneurs for organize those sessions.

Proper usage of social networking sites to develop entrepreneurial ideas. The management teachers have to change themselves as mentors to guide students. Analyzing the cultural-situational influences on the students; taking initiatives to convert highly negative influencers into positive. Project work period should be efficiently used through taking enterprising drafting, dream venture materialization, finalizing a proposed venture documentation etc. Entrepreneurial aspirations and attitudes should be considered in a socio-economic perspective of the nation.

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Original Article

Evaluation of Medicinal Plant Extracts As Potential B-Lactamase Inhibitors by Studying Their Synergistic Effect with B-Lactam Antibiotics to Combat Antibiotic Resistance

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Abstract

Antibiotic resistance via β-lactamase production is a major threat to worldwide healthcare and underscores the necessity of alternative therapeutic approaches. This research presents a novel approach by assessing the synergistic activity of medicinal plant extracts with β-lactam antibiotics to identify natural β-lactamase inhibitors. Methanolic extracts of Tinospora cordifolia (Giloy) and Calotropis gigantea (Milkweed) and aqueous extracts of six other medicinal plants, i.e., Garcinia indica (Kokum), Couroupita guianensis (Kailaspati), Bryophyllum pinnatum (Bryophyllum), Camellia sinensis (Green Tea), Carica papaya (Papaya), and Trachyspermum ammi (Ajwain) were screened against Klebsiella pneumoniae and Escherichia coli. Different in vitro Antibiotic susceptibility tests were performed to find out the zones of inhibition (ZOI). Of the extracts that were tested, Garcinia indica and Tinospora cordifolia showed considerable inhibition of Klebsiella pneumoniae and showed synergy with Penicillin as a beta lactam antibiotic, suggesting the presence of possible β-lactamase inhibitors. Phytochemical analysis indicated the presence of alkaloids, phenols, flavonoids and tannins in the extracts, which are known to possess antimicrobial and enzyme-inhibitory activity. These results indicate that such a synergy between the plant extracts and the β-lactam antibiotics could potentially increase the inhibition of bacteria, providing a natural solution against β-lactamase-associated resistance. Further compound isolation and β-lactamase inhibition assays are required to prove these observations.

Keywords: *Antibiotic resistance, β-lactamase inhibitors, medicinal plant extracts, Klebsiella pneumoniae, Tinospora cordifolia, Garcinia indica*, phytochemicals, synergistic effect.

Introduction

Antimicrobial resistance (AMR) is now a major global health issue, risking the efficacy of existing antibiotics and causing rising mortality. According to a study conducted by Murray et al. (2024) and published in The Lancet, estimated yearly deaths from antibiotic-resistant infections will rise from 3.9 million in 2024 to 8.22 million in 2050 if action is not taken quickly. Therefore, there is an urgent need to find alternative antimicrobial approaches. These include plant-derived β-lactamase inhibitors, which have been found to be effective since they can increase the efficacy of antibiotics by inhibiting the resistance mechanisms of bacteria (Hana Mohammed AlSeikh et al., 2020). B-lactam antibiotics include penicillins, cephalosporins, carbapenems, and monobactams that have a typical four-membered β-lactam ring which is responsible for their antibacterial activity. B-lactams act by binding to penicillin-binding proteins (PBPs), and inhibits peptidoglycan cross-linking, causing instability in the cell walls and subsequent lysis of bacteria. Yet, most bacteria have adapted to generate β-lactamase

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Enzymes that degrade the β-lactam ring, making the antibiotics inactive (Bush & Bradford, 2016; Fisher et al., 2005). This has increased the demand for β-Lactamase inhibitors such as clavulanic acid, sulbactam, and tazobactam, which irreversibly bind to β-lactamases and inhibit antibiotic degradation, and hence restore antibiotic activity.

Due to the drawbacks associated with synthetic medicines and the increasing resistance to them, plants serve as a source of novel antimicrobial compounds. Plant secondary metabolites, such as alkaloids, flavonoids, tannins and terpenoids, have been reported to inhibit β-lactamase and restrain the growth of resistant microbes. Thus, these compounds augment the potency of antibiotics (Newman & Cragg, 2020; Cushnie & Lamb, 2005; Rajendran et al., 2013). In this study, *Calotropis gigantea, Tinospora cordifolia, Garcinia indica*, *Couroupita guianensis, Bryophyllum pinnatum, Camellia sinensis, Carica papaya*, and *Trachyspermum ammi* were collected from Palghar, Maharashtra and were screened for β-lactamase inhibitory potential.

Prior to starting laboratory work, a systematic survey was done with five pharmacists in the Boisar area of Palghar district to know local antibiotic usage and resistance patterns. Amoxicillin + Clavulanic Acid, Azithromycin, and Cefixime were the most prescribed antibiotics, primarily because of their broad-spectrum activity against respiratory and urinary infections.Typically faced resistant pathogens were *Escherichia coli, Klebsiella pneumoniae, Staphylococcus aureus* (including MRSA), and *Streptococcus pneumoniae*. These observations informed the choice of antibiotics and bacterial strains for this work to assess the potential for synergism between plant extracts and Penicillins and Cephalosporins in countering β-lactamase-resistance.

Materials And Methodology

The plant samples of *Tinospora cordifolia* (Giloy) and *Calotropis gigantea* (Milkweed) were collected from Dream city Boisar (east) Palghar district Maharashtra 401501, while the plant samples of *Couroupita guianensis* (Kailaspati), *Garcinia indica* (Kokum), *Camellia sinensis* (Green Tea), *Carica papaya* (Papaya), *Bryophyllum pinnatum* (Bryophyllum) and *Trachyspermum ammi* (Ajwain) were collected from the Botanical garden of SDSM college Palghar Maharashtra 401404. All the plant samples were washed thoroughly with distilled water and were sun dried and then grinded into fine powder. For extraction of *T.cordifolia and C.gigantea,* methanol was used as a solvent. Soxchlet apparatus was used for the extraction of bioactive compounds from *C.gigantea* leaves, 50gm dried powder of *C.gigantea* with 400 ml of Methanol was used for the extraction process. After the soxhlet extraction 200 ml of crude extract of *C.gigantea* (250 mg/ml crude) was obtained. Same protocol was implemented for the extraction of bioactive compounds from *T.cordifolia* stem while 2.5 g leaves of *C.guianensis, G.indica, C.sinensis, B.pinnatum, C.papaya* and *T.ammi* were macerated in 10 ml of Distilled water and was filtered with Whatman filter paper the crude of each of these exact had concentration of 250 mg/ml. All the extracts were stored in a glass container at 4°C and were used throughout the Studies.

The bacterial cultures of *Escherichia coli* and *Klebsiella pneumoniae* used in this study were subcultured on Sterile NA plates from the laboratory stock cultures maintained by the Department of Biotechnology, SDSM college Palghar. These cultures were stored at 4°C and were used throughout the study. The antibiotics used in the study include: Penicillin G 400 mg (Pentids 400, Abbott Laboratories), Amoxicillin + Clavulanic acid as standard beta lactamase inhibitor (Clamufil 625, Filant Healthcare) and Amoxicillin (Almon 500, Alkem Laboratories Ltd.)

Iodometric test to check presence of beta-lactamase enzyme

The iodometric test was performed to detect β-lactamase production by bacterial isolates. In this method, 0.1 ml of Penicillin G solution was dispensed into a suspension tube, followed by the addition of the test organism to create a milky suspension. Two drops of starch solution were added, mixed, and incubated at room temperature (25°C) for 30–60 minutes. After incubation, one drop of iodine reagent was added and mixed, and color change was observed within 10 minutes. A fading of the blue color indicated β-lactamase activity, while retention of the blue color indicated its absence (Kuo SS, Feng TY, 1989).

Synergistic effect of *C. gigantea* and *T. cordifolia* with penicillin against β-lactamase-producing *E. coli*.

The Paper Disk Diffusion Method was used to assess if *Calotropis gigantea* and *Tinospora cordifolia* enhance penicillin activity against *Escherichia coli* by inhibiting β-lactamase. Disks soaked in crude extract, diluted extract, penicillin, and their combination were placed on inoculated Mueller-Hinton agar and incubated at 37°C for 18–24 hours. An increased Zone of Inhibition indicated β-lactamase inhibition and restored antibiotic efficacy.

Evaluation of Antibacterial and β-Lactamase Inhibitory Potential of Selected Plant Extracts Using the Agar Cup Method

To assess antibacterial and synergistic activity, *E. coli* and *K. pneumoniae* cultures were adjusted to 0.5 McFarland standard and mixed with sterile molten Nutrient Agar, then poured into Petri plates. After solidification, three wells were made per plate with a st. cork borer and filled with 100 µl of: crude extract alone, crude extract + penicillin (1:1), and crude extract + amoxicillin (1:1). This was repeated for all six plant extracts. Control plates contained penicillin alone, amoxicillin alone, and distilled water. Plates were incubated at 37°C for 24 hours, and zones of inhibition were measured to evaluate antimicrobial and synergistic effects.

Evaluation of Synergistic Action between Plant Extracts and Penicillin Using the Perpendicular Strip Method

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The Perpendicular Strip Method was employed to evaluate the synergistic interaction between selected plant extracts and penicillin against *Escherichia coli* and *Klebsiella pneumoniae*. Plant extracts from *Garcinia indica* (Kokum), *Calotropis gigantea*, *Tinospora cordifolia*, *Couroupita guianensis* (Kailaspati), and *Carica papaya* were chosen based on promising results from previous agar cup assays, suggesting potential β-lactamase inhibitory activity. Nutrient Agar (NA) plates were inoculated with a uniform lawn of bacterial culture using sterile cotton swabs. Two sterile filter paper strips , Strip A was dipped in penicillin (5 mg/ml) and placed horizontally, while Strip B, dipped in plant extract, was placed perpendicularly across it, intersecting at the center. After incubation at 37°C for 24 hours the Zone of Inhibition (ZOI) was observed and measured to assess possible synergistic effects, additive interaction, or antagonism between the plant extract and antibiotic. (Langeveld, W., Veldhuizen, E., & Burt, S. (2013)).

Qualitative Analysis of Phytochemicals

Qualitative phytochemical analysis was performed to detect the presence of bioactive compounds such as alkaloids, flavonoids, phenols, and tannins in the selected plant extracts. These phytochemicals are known for their antimicrobial, antioxidant, and enzyme inhibitory activities, which may enhance the efficacy of antibiotics when used in combination. Qualitative tests for tannins, flavonoids, alkaloids and phenols were done. Identifying these compounds helps establish a correlation between their presence and the synergistic effects observed in earlier tests.

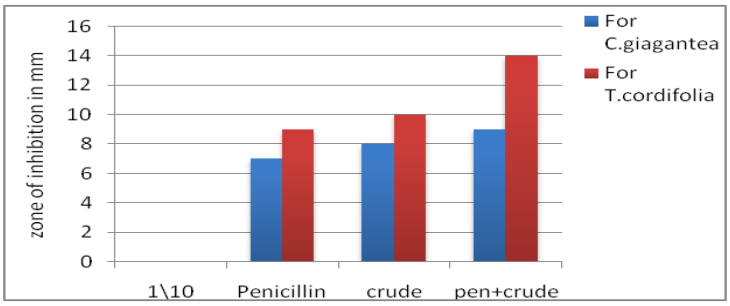
Observation



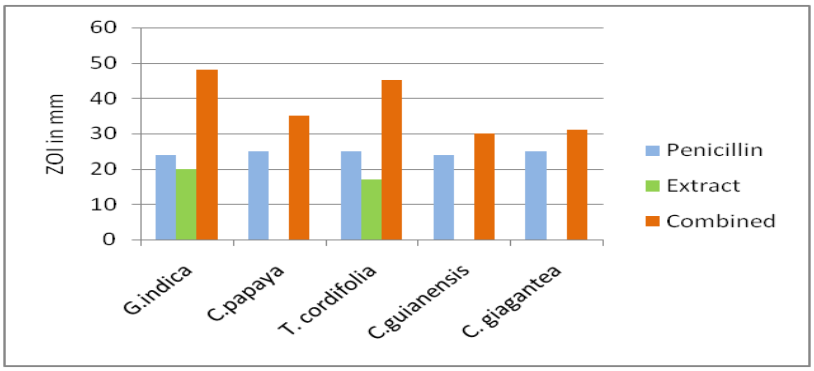
Perpendicular strip assay assessing the synergistic effect of methanolic extract of Garcinia indica with penicillin against K.pneumoniae . Strip A is impregnated with penicillin, while strip B contains the plant extract



Perpendicular strip assay assessing the synergistic effect of methanolic extract of T.cordifolia with penicillin against K.pneumoniae . Strip A is impregnated with penicillin, while strip B contains the plant extract



Graph 1: Graph showing the individual and the combined effect of the plant extract and penicillin against *E.coli*



Graph 2: Graph showing the individual and combined effect of the plant extracts with penicillin and amoxicillin.

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Results and Discussion

1. Iodometric test to check presence of beta-lactamase enzyme

The iodometric test confirmed β-lactamase production in both *Klebsiella pneumoniae* and *Escherichia coli*, with all tubes showing complete discoloration by 8 minutes. Among them, *E. coli* showed the highest β-lactamase activity with rapid discoloration, followed by *K. pneumoniae*.

2. Paper disk method to test for the synergy between *C. gigantea* and *T. cordifolia* with Penicillin against *E. coli.*

	Zone of inhibition (in mm)	
	C. gigantea	***T.cordifolia***
1\10	0	0
crude	8	10
pen	7	9
pen+crude	9	14

3. Agar Cup Method to test the antibacterial and synergistic action of aqueous extracts of additional six plant extracts with penicillin and amoxicillin.

	Zone of inhibition in (mm)		
Plant Extract	**Crude (C)**	**C+ Penicillin**	**C + Amoxicillin**
Bryophyllum pinnatum	1	17	18
Couroupita guianensis	9	19	19
Garcinia indica	15	16	16
Camellia sinensis	8	18	18
Carica papaya	3	19	18
Trachyspermum ammi	3	17	18

The control results showed that distilled water had no effect (nil), penicillin had a 16 mm inhibition, and amoxicillin had a 17 mm inhibition against *K. pneumoniae.*

	Zone of inhibition in (mm)		
	Extract	Penicillin	Combined
Garcinia indica	20	24	48
Carica papaya	0	25	35
T. cordifolia	17	25	45
Couroupita guianensis	0	24	30
C. giagantea	0	25	31

4. ***Evaluation of Synergistic Action Between Plant Extracts and Penicillin Using the Perpendicular Strip Method***

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Plant Extract	A (Penicillin)	B (Extract)	C (Combination)	A + B	Interpretation
Garcinia indica	24 mm	20 mm	48 mm	44 mm	Synergistic (A+B < C)
Tinospora cordifolia	25 mm	17 mm	45 mm	42 mm	Synergistic (A+B < C)

Enhanced Antibacterial Activity of Penicillin in Combination with Plant Extracts

Against *E.coli* the aqueous crude extracts of the plant did not show any zone of inhibition suggesting the multidrug resistance nature of the bacteria.

5. Phytochemical analysis

	Alkaloids	**Flavonoids**	**Tannins**	**Phenols**
Garcinia indica	+	-	+	-
Carica papaya	+	+	+	-
T. cordifolia	+	+	+	+
Couroupita guianensis	+	-	-	-
C. giagantea	+	+	+	+

Key: + Presence, - Absence

Conclusion

This research proves the efficacy of aqueous extracts of *Garcinia indica* and the methanolic extract of *Tinospora cordifolia* as β-lactamase inhibitors with the ability to augment the action of β-lactam antibiotics against resistant strains of bacteria, especially *Escherichia coli* and *Klebsiella pneumoniae*. The iodometric assay validated β-lactamase production in *E. coli*, and *K. pneumoniae*, attesting to the clinical significance of inhibiting this enzyme. The agar cup and perpendicular strip tests conducted in vitro confirmed a significant synergistic increase in the zone of inhibition upon blending plant extracts with antibiotics.

Phytochemical testing established the existence of alkaloids, phenols, flavonoids and tannins in the plant extracts substances known to be antimicrobial and enzyme-inhibitory. These results validate the postulation that secondary metabolites from plants inhibit β-lactamase activity, thus maintaining antibiotic effectiveness. Isolation of the active compounds and determination of their modes of action of the bioactive compounds present in *Garcinia indica* and *Tinospora cordifolia* should be the focus of future studies. Enlarging this study to cover a larger number of resistant strains and in vivo testing will be key processes toward creating new therapies to tackle antimicrobial resistance.

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Original Article

Cultural Heritage and Socio-Economic Significance of the Karvat Kathi Saree: A Comprehensive Awareness Study

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Abstract

The Karvat Kathi saree, an exquisite example of traditional Indian handloom weaving, originates from Maharashtra's Vidarbha region. Despite its rich heritage, the saree has struggled to retain prominence amidst industrialization and fast fashion. This paper aims to provide an elaborate awareness discourse on the cultural, technical, and socio-economic aspects of the Karvat Kathi saree. Through an interdisciplinary lens, we explore the origins, unique design characteristics, weaving techniques, the status of artisans, challenges to sustainability, and strategies for revival and promotion

Keywords: *Karvat-kathi Saree, Culture, Heritage*.

Introduction

The Karvat Kathi saree is a magnificent representation of India's rich handloom heritage, hailing from the culturally vibrant state of Maharashtra, specifically the Vidarbha region. Named after the distinct "karvat" or saw-tooth pattern that runs through its borders and pallu (the loose end of the saree), the Karvat Kathi saree is a testament to the artistic brilliance of traditional weavers. This saree is woven using fine cotton or a silk-cotton blend, which lends it a soft texture and lightweight drape, making it ideal for both everyday wear and special occasions. The hallmark of a Karvat Kathi saree is its intricate and symmetrical geometric motifs, typically inspired by nature and local traditions, created through a complex tapestry weaving technique known as 'extra weft'. These sarees often feature subtle, earthy colors with vibrant contrasting borders that highlight the craftsmanship involved. Creating a single Karvat Kathi saree can take several days, as each motif and pattern is meticulously handwoven, showcasing the artisan's deep-rooted knowledge and skill passed down through generations. In recent years, efforts have been made to revive and promote Karvat Kathi weaving, recognizing its cultural significance and potential to empower rural artisan communities. Wearing a Karvat Kathi saree is not just a fashion statement—it is a way of embracing an age-old legacy of design, heritage, and sustainable craftsmanship.

Karvati weaving is a three-shuttle weaving technique:

Three shuttle weaving:- Three shuttle weaving using three shuttles is practiced. In this type, one shuttle is used for the body while two shuttles are used for the border on both sides. Shuttle boxes are not used as the shuttle is not filed. In this process, the thread of the border is interlocked with a thread of the body.

Borders: - The design of border is done with the help of dobby. The general motives used are floral and temple motifs, but of very small size in two to three rows separated with clearly distinguishable Partition lines of dominant colour yarns.

Karvati Pattern:- The karvat pattern, i.e., the saw of hexagonal blade pattern, is seen adjacent to the borders, towards the body on both sides. The mechanism of obtaining this pattern is based on the movement of the border weft shuttle, from one body warp yarn by interlocking with the body weft yarns.

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In the next throw, he does the same through the two body warp yarns and in the same way, increases the number, say till 20, and then in the next throws, decreases the number of warp yarns for interlocks, till one. This throwing pattern of the weft shuttle creates one single pattern, and the same is repeated to attain the pattern throughout the saree. The pattern size varies from weaver to weaver. Some make small patterns, while the others weave medium to large sizes. A big design can be obtained by interlocking of greater number of the body warp yarns with the border weft moving bobbins. Generally, a medium-sized pattern is obtained by interlocking of 20 body warp yarns with the body weft yarns.

Pallu:- Weaving of pallu on both sides of the sari is done with interlocking
Threads. For designing of pallu jacquard or any other machine is not used. It is manual work. Three types of Pallus are popular, namely the Jala pallu with very heavy handwork, followed by the Devdi with a medium level of Handwork, and finally the Tekri, which has the least handwork and minimal designs. The Jala Pallu, which is very, very complex, needs the handling of 6-8 throw shuttles for different colors and designs. The design is spread all over the Pallu and has an elegant look, which can be woven only by the very highly skilled and artistic weavers having good imagination. The Devdi Pallu sarees have somewhat moderate handwork, with mainly temple motifs. In this type of Pallu, some of the motifs are woven, while others are by needlework. In the Tekri Pallu sarees, the traditional floral and geometric motifs are embedded in four to five vertical columns. Jala Pallu sarees are very costly, and the Devdi Pallu sarees are the cheapest ones.

Body: - The body of the Karvat Kati saree is mostly plain. Some weavers carry out some small buta work with hand needle. Once a sari is completed; it is taken off from the loom and sent for cutting.

Dyeing, Finishing & Printing:-

Generally, yarn dyeing is the most popular activity in Handloom clusters. At this cluster, dyeing activities are carried out at the fabric stage. This process is carried out only for a few fabrics, as most of the sari fabrics are sold in the natural Tussar color. However, some of the fabrics, namely Dress Material, Shirting, are sent to the Dyeing unit for coloring. Similarly, the value addition exercise for some of the Tussar sarees is carried out by dyeing and printing. Value addition at the fabric stage is one of the unique aspects of this cluster. Most of the high-end products are sent to Bagru in Rajasthan and Mallickpara in West Bengal for Dyeing & Printing.

Uniqueness:

The uniqueness of the product is due to:

1. The Raw Material, i.e. Bhandara Tussar Silk.
2. The Designs.
3. The Process of Weaving.
4. The Saw Edge Motifs adjacent to Borders

Saw edge border: Region of Maharashtra is the originating place of Karvat Kati (saw-edged) saree so named after the border design which resembles saw teeth. The design resembling saw teeth is weaved on body part of the saree at both the sides adjacent to the border. Every karvat kathi design saree will have this pattern of design on both the sides

SAREE: Saree is the unstitched piece of fabric which is mainly a part of women garment in India. it varies from 4.5 to 9 yards. It is basically worn by Hindu women, consists of several yards which is wrapped around the body and draped on shoulder. Saree is the traditional garment of India.

Heritage- The term “heritage” refers to the traditions, achievements, beliefs, art, and culture that are passed down from generation to generation within a group or society. It can also include physical objects, sites, and landmarks of historical or cultural significance.

Culture- Culture, in brief, refers to the shared beliefs, values, customs, behaviors, and artifacts that characterize a group or society. It shapes how people think, communicate, and interact with each other, and it is passed from one generation to the next through language, traditions, and institutions.

Revival and Recognition- Like many traditional textiles, Karvat Kathi weaving faced decline due to industrialization and diminishing artisan interest. However, thanks to revival efforts by weavers, NGOs, and designers, the saree has regained some popularity. There are ongoing campaigns to secure a Geographical Indication (GI) tag to protect its authenticity.

Socia-Economic Significance: The socio-economic impact of the Karvat Kathi saree, a traditional hand-woven fabric from Vidarbha, Maharashtra, is multi-faceted. While the saree is a symbol of cultural heritage and auspiciousness, it also has economic implications for the weavers and the region. The saree is hand-woven, requiring significant labor and skill, and its production provides employment and income for local artisans. However, the industry faces challenges related to productivity, income, and the need to modernize weaving techniques to compete with mechanized production.

Socio-economic aspects:

Cultural Significance: Karvat Kathi sarees are worn during auspicious occasions and weddings, particularly by Vidarbha brides, highlighting its cultural importance.

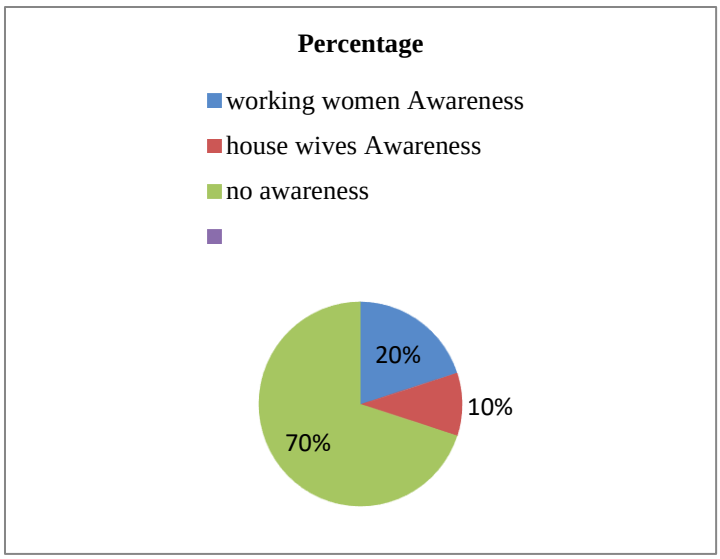
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Employment and Income: The saree's hand-woven nature provides employment for local weavers, who are traditionally part of the Mahajan community.
Challenges for Weavers: Weaving Karvat Kathi sarees is labor-intensive and time-consuming. Weavers face challenges in terms of productivity, income, and adapting to new technologies.
Traditional Techniques and Innovation: The sarees are woven on pit looms using three fly shuttles of different colored yarns, a testament to the weavers' mastery. Recent innovations like the "catch-cord" system have helped improve productivity and income.
Modernization and Market Access: While traditional weaving methods are valued, there's a need to modernize the industry to compete with mechanized production and expand market access.
Economic Impact: The Karvat Kathi saree contributes to the local economy through employment, income generation, and the promotion of traditional crafts.
Tourism and Cultural Preservation: The saree's cultural significance and traditional weaving techniques can be harnessed for tourism, creating opportunities for visitors to learn about the craft and support local artisans.
Overall, the Karvat Kathi saree's socio-economic impact is a complex interplay of cultural heritage, employment opportunities, and economic challenges. While the saree is a symbol of tradition and local artistry, the industry needs to adapt to modern challenges to ensure its sustainability and the well-being of the weavers who continue its legacy.

To check the awareness of karvat kathi saree amongst the women of the age group 30 to 40 years in 100 nos. With the help of a questionnaire:

Age Group Profession Aware/ non aware Responses:

Sr no.	Age Group	Proffession	Aware/ non aware	Responses	%
1	30-35	Working	yes	18	20
2	35-40	Housewife	yes	12	10
3	30-40	Both	No	70	70
	Total	100		30	100



Findings:
1. In the age group analysis, 18 i.e. (20%) customers are between 30-35 age group whereas 12 i.e. (10%) customers are between the age group of 35-40.
2. 30, i.e., 30% of respondents know karvat-kathi sarees.
3. 30, i.e., 30% of respondents wear karvat-kathi sarees.
4. The traditional art form has **limited reach**, even among its potential primary audience—**working women and housewives**.

Conclusion:
1. In the age group analysis, it is observed that the majority of karvat-kathi saree user belongs to the 30-40 age group
2. A significant **70%** of the respondents have **no awareness** about Karvat-Kathi sarees, indicating a major gap in visibility and recognition.
3. Only **30%** of the respondents, including working women and housewives, are **aware** of Karvat-Kathi sarees.
4. The high percentage of non-aware respondents highlights a **strong potential for awareness campaigns**, marketing, or educational outreach to popularize the saree.

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5. The lack of awareness suggests a need to **rebrand or culturally reposition** Karvat-Kathi sarees as a valuable, traditional attire with a modern appeal.

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Original Article

Human Resource Management and its Outsourcing: A Positive or Negative aspects

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Abstract:

Human Resource Management and its outsourcing has become new trends in the corporate world of business. Outsourcing of Human Resource Management decreases cost by pooling businesses from thousands of entities. This makes lower the price of legal experts, worker's compensation, insurance, retirement plans and health benefit plans. For better utilization of true worth of the employees or workers to its fullest, one should outsource the work or activities of the entities or organization. The progress and awareness of activities has already been realized and accepted by the organizations. Outsourcing of human resource management has no longer the advantage or privilege of only large multinational companies but also government undertakings and public sector medium size or companies of start-up are also started outsourcing their human resource management related activities. This research paper deals the need of Human Resource Management and its outsourcing with the process of outsourcing the activities. This paper also presents the limitations or drawbacks of Human Resource Management and its outsourcing and also advise or suggests the preventive measures of the successful Human Resource Management with outsourcing of activities.

Key words: *Human Resource Management, Outsourcing etc.*

Introduction:

Human Resource Management and its outsourcing is a strategy of procurement basis in which a businessman seeks to find or see the most cost effective location for producing or manufacturing a product, even if the suitable location is in a country or a foreign country. Global human resource management outsourcing is a term used to explain or describe the practice of HRM sourcing from the global market for services and goods supplies across the geopolitical boundaries of various nations. Global HRM outsourcing often used to exploit global efficiencies or productivities in the delivery of a service or product. Global HRM sourcing is often associated or attached with strategy of centralized procurement for a multinational, medium size or start-up companies, wherein a central selling and buying organization seeks or related to economies of scale through benchmarking and standardization of corporate wide utilities. Human Resource outsourcing is the process of transferring responsibility to the external service provider to get the job done. (Dr.Sau.S.S.Kulkarni, 2015)

Objective: To study the advantages and disadvantages of Human Resource Management and its Outsourcing.

Hypothesis: uman Resource Management and its outsourcing helps in overall functions and management of the business organization.

Discussions and analysis: Advantages of Companies for Outsourcing their Human Resource Management activities

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Human Resource Management and its outsourcing organizations exist to replace, extend or support the human resource activities or functions for many other companies. HRM and its outsourcing business is finding the resources to make their client's HRM functions more effective and delivering them toward client organizations. Because of these reason many of these HRM outsourcing organizations wanted to provide best HRM practices, encouraging workforce technologies, together with latest regulations and relevant Laws. HRM outsourcing deals with unique outside perspective and can provide better result in a true strategic relationship that may be much difficult to achieve within the client organizations.

The common HRM outsourcing functions:

Outsourcing HRM functions are not bounded to the easily recruitment but also a wide range of services must be provided. Many common services that HRM outsourcing functions provides:-

1) Screening of Background.
2) Management of Performance.
3) Planning of Retirement.
4) Benefits of Health Care.
5) Counseling /Assistance of Employee.
6) staffing at temporary basis.
7) Management of Risk.
8) Screening of Drug.

Many other services related to Leave Management, Employee Data Administration, Recognition of Awards and Benefits, Payroll processing etc are outsourced to develop companies more empowered and strategic towards the achievement and fulfillment of goals.

Reasons for HRM outsourcing:-

Various reasons for HRM outsourcing are as follows :-

1) For saving the time and cutting the cost. (cost of infrastructure and other employee).
2) Outsourcing increase the efficiency and effectiveness of project as well as human resource management.
3) When the company lacks the expertisement of work and focus more on the business.
4) HRM outsourcing increases employee relation and avoid the problem of labour union.
5) If the business organization enters into new business market model the HRM outsourcing is the best option.

HRM outsourcing and its types:

1) (PEO) Professional Employer organization:

It takes the all responsibilities of the client companies of human resource management system.

2) (ASP) Application Service Provider:

It provide technology of host software and its code and supply to the user.

3) (BPO) Business Process Outsourcing:

It is the larger term referencing to HRM outsourcing in all sectors or fields of business.

4) E-Services:

These are all Human Resource Management services, which are based on web services.

Hence HRM outsourcing is depends on the business organization when to not outsource and when to outsource because there is high risk of business management. On the other hand it is not strongly beneficial of the company, which experiencing and sharing of confidential information of the companies. HRM requires expensive cost of infrastructure maintenance facilities which sometime company cannot afford. Hence all these kind of risk are there in HRM outsourcing which become the necessity of today's organizational business because of globalization.

Process of Human Resource Management outsourcing:

The following steps have been adopted in order to achieve or maintain success in HRM outsourcing:

1) Initiatives and its Planning:

After the assessment of risks the first step is to take initiatives and its planning, Project work and its team is to be appointed and trainer are to be also appointed for training. Accordingly, the business objectives are also to be set. Many other resources are also to be adjust or acquire to minimize the issues like project management, information management and resource management need to be arrange or addressed.

2) Analyzing Performance and Costs :

The other step in these process is to calculate or measure activity and risk of project failure with its costs. Future and existing performance is then to be calculate or measure along with the cost of estimation and its poor performance. Hence it is very important also to benchmark performance and costs. Asset values, specific risks, pricing models, make total cost and final business targets are need to be determined.

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3) Exploring the strategic implications :

The next step is to understand the vision of organization, core competencies, value chain, transformation tools, strategies and structure. Then contract length, decision rights and termination date must be determined.

4) Provider selection:

The next important step is selection of provider. For this purpose the business organizations have to first set evaluation criteria and qualifications. Providers are then screened identified and selected. Then proposals are evaluated on the basis of costs and qualifications and then provider is selected and finalised.

Benefits of Human Resource Management and its Outsourcing:

For many business organization, the various HRM functions are too complex and comprehensive to maintain data in house. Hence business that outsource HRM function achieve several benefits that support the company's overall performance.

1) Management of Risk:

HRM outsourcing firm or organizations help minimization of risk in businesses. Labour laws and employment regulations changes regularly, so it can be difficult for employers to maintain up-to-date on work that affect the workplace. HRM outsourcing organization employ HR professional whose aim is to helps business complication with these regulations and laws to avoid costly law-court suits occurred by the employees. HRM outsourcing organization also maintain and audit company practices and policies to encourage and ensure the organization and its employee's interest need to be protected.

2) Saving of Expenditure and cost:

A complete functional human resource management department requires additional space in office and highly experienced and trained HR employee. Many small business units find it more cost efficient to outsource HRM functions as compare to expand a large space needs to start another department.

3) Development of Employee :

HRM outsourcing functions help business units to manage employee development and performance. Provider selected implement management of performance plans to encourage employees comply with company procedures and policies to successfully meet business output and goals. HRM outsourcing organization periodically monitor employee report and performance for findings of management. This decreases the work load of manager by reducing the amount of administrative responsibilities which must be focused by managers.

Drawbacks or Disadvantages of Human Resource Management Outsourcing:

The human resource management department is known as the heart of any business company. Human resource management always handle many of daily complexities of the business such as payroll and legal compliance, employee benefits, company growth, employee training and recruitment etc. while outsourcing these human resource management functions must be cost-efficient alternative staff otherwise losses can occurs.

1) Poor or Low Performance:

Many companies human resource management outsource to limited costs, hence reduced costs often resulted in reduced quality of work and performance by the HRM outsourced provider. The department of human resource management is responsible for complete day-to-day working of the company and any poor or low performance from the outsourced organization may causes overall impact on the organization as a complete responsibility.

2) Long Distance :

Human resource management functions and its outsourcing to an offsite or long distance location often lead to a deal of large distance between the company and the employee. When the department of human resource management is not instantly working or accessible, then employees can experience in delay communication, leading to employees for unwanted working experiences and irrelevant to company. This maker results in reduced the overall employees morale. The fact that the organization is willing to HRM outsourcing may lead to more speculation about the chance or possibility of work outsourcing of many other department.

Successful Planning for Human Resource Management Outsourcing:

Drawbacks or limitation can be adjusted if a business organization takes all necessary precautions regarding more attention to redesign, process and details, and within same time effective strategic human resource management planning in-house can resolve all around core capabilities and critical activities and thus provides suitable sustainable lead in the business of long run. This is the main reason why HRM activities eg. processing of payroll is outsourced generally since it provides few competitive advantages and also it is a non-core activity for business organization.

Hence it is more necessary to create a balance between internal operators and external service providers. Business organizations need to HRM activities and its outsourcing according to their purpose and size of the organizations. Mid-sized and small organizations must outsource HRM activities like payroll work because they may not economies of

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scale for performing that function more efficiently. Large or big companies must outsource HRM functions like activities providing more benefits because then the processing of larger range of benefits are offered and performed which decreases the economies of scale of handling the activities in-house working. In the situation of multi-supplier the good governance, effective dispute resolution and change in management structure need to be in correct place. It must be ensured by the HRM outsourcing organization that all the department should work correctly. However various long-team working contracts must be avoided as rules and regulations are changing rapidly.

Since HRM outsourcers are the third party, organization, travels and communications whereas three ways rather than two things involving as employees and vender, giving chance for mistakes. In this situation communication plays an important role such as Roebuck and Co., Sears, retail giant were aware of this problems. Hence Hewitt Associates was selected by it as their HRM service provider to carry or take over the work as both the companies commitment, ranked and communications to mutual success as the top two keys to their goals. This makes the foundation for their adopt to ability to change quickly and in order to innovate to achieves their objectives.

HRM outsourcing and its Do's :

1) Must have a clear vision of what HRM outsourcing organization must achieve.
2) It understand the services and its scope which to be outsourced.
3) It must outsourced the functions and its performance not the complete responsibility for it.

HRM outsourcing and its Don'ts :

1) Don't think that HRM outsourcing is the only answer to every problems.
2) Cost savings and its goal don't dominate the other all functions.
3) Don't outsource financial management, customers and other strategic functions of the business.

Result:

With the above discussions and analysis the hypothesis is accepted.

Conclusion:

Human resource management and its outsourcing is an important element for companies to reduce the workload and outsource the assignments to other organizations. This paper tried to reflect or highlight the concept of overall need of Human resource management Outsourcing and focus on the main challenges and issues relating to outsourcing of HRM functions. Though there are many advantages of Human Resource Management and its outsourcing, everyone cannot deny the need and to address various disadvantages of HRM outsourcing at the same time. Everyone have to take more precaution while planning their Human Resource Management activities to make possible HRM outsourcing successful. Hence the companies and its functions have to expertise in human resource management outsourcing in order to succeed and survive in today's market of competitive business.

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Original Article

Impact of Quality of Work Life of Employees on Organizational Performance With Respect To Micro, Small and Medium Enterprises (MSMES): A Pilot Study

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Abstract:

Organizational Performance is the vital mechanism in assessing organization's overall outcomes. It is also a technique to find out the Employees' Commitment towards organization which has high impact on their growth and development. Performance is the most significant measure in evaluating organizations and their achievements in financial and non-financial areas. Walton's model provided the conceptual framework for this investigation to identify and organize various factors that influenced quality of work life of MSME employees. Similarly, many studies have identified many determinants that influence Quality of Work life of employees that impact performance of organizations. Some of them were considered like organizational commitment, financial incentives, work environment, training and development, and management, etc, to study the impact of QWL. To contribute to the body of research in this area and to enrich pedagogical practices, the authors have used the pilot testing processes. In the current study a sample of 77 MSME employees were taken from the PCMC area. Statistical tests such as Cronbach Alpha, KMO and Bartlett, factor analysis, etc. were used to achieve the results.

Keywords: *Quality of Work Life (QWL), Organizational Performance, MSME, Pilot Study*

Introduction

MSME Micro, Small, Medium Enterprises

always being a backbone of Indian Economy. It plays pivotal role by providing jobs in the country. As per the information received from Directorate General of Commercial Intelligence and Statistics, the share of export of specified MSME related products to All India exports during 2019-20 and 2020-21 was 49.8% and 49.5% respectively.

Further achievements of MSMEs are:

1. MSMEs contribute around 6.11% of the manufacturing GDP and 24.63% of the GDP from service activities as well as 33.4% of India's manufacturing output.
2. The micro sector with 630.52 lakh estimated enterprises employed 1076.19 lakh persons, which account for around 97% of total employment in the industry. The small sector with 3.31 lakh and the Medium sector with 0.05 lakh estimated MSMEs employed 31.95 lakh (2.88%) and 1.75 lakh (0.16%) persons of total employment in the MSME sector, respectively. (Source-MoMSME Annual Report 2021-22)

Quality of Work Life The quality of work life has been clearly defined by World Health Organization (WHO) as the individual's awareness level as well as examination of the culture-value system in the living environment. This awareness and observation, usually related to individual objectives, expectations, standards, and concerns, including physical health, been taken in improving the quality of work life in the recent past. This has become a subject of curiosity and interest for the organization's thought processes and their think tanks that comprises of their top level of managers and researchers

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. The word itself is very qualitative in nature and its meaning changed for person to person. Lot of studies have been done by the researchers in which various parameters have been identified which effect the 'quality of work life'.

A present research study on quality of work life states some of the identified factors. The said study lists following factors and mentions that QWL can be better explained with the help of these factors like Pay Systems and Financial Incentives, Employee Welfare schemes, job security, organizational commitment, happiness at work etc.

As mentioned above, being a qualitative concept and given the diversity in perspectives there arises two questions: what constitutes a high quality of work life? How its impact can be measured? Researchers observed that a high quality of work life (QWL) is essential for organizations to achieve high performance and growth in profitability. Though in the earlier stages, QWL was focused on objective criteria like attracting talent, job security, earnings, and benefits; its focus has gradually shifted to job satisfaction and commitment. From the above explanations, it can be concluded that:

QWL is not a simple but a complicated in nature.

QWL is a multi–dimensional concept.

As QWL is a multi–dimensional in nature, it is a relative concept that cannot be defined more accurately and measured.

It is observed that the employees with high quality of work life experiences were more likely to be satisfied with their job, they perform well and it affects eventually on organizational performance. The research study done also states that there is a positive relationship between the independent (quality of work life) and the dependent variables (organizational performance).

Organizational Performance

Measuring organizational performance is an essential part of strategic decision-making. Understanding organizational performance helps leaders at every level to set targets, track their impact, and provide accountability to stakeholders. organizational performance's meaning and definition will change from business to business. Companies may focus on financial performance, growth, and customer measures or use multiple measures to understand their outcomes.

Measuring organizational performance is important for setting targets, tracking their impact, and providing accountability to stakeholders. But with hundreds of measures, choosing the right ones is difficult. Moreover, measuring organizational performance is essential and comes with many risks and benefits.

Measures of organizational performance are one great tool to achieve this. Organizational performance is measured for different levels of hierarchy and can be assessed for individuals, groups, and the entire organization (Knies, Jacobsen and Tummers, 2016).

Organizational performance is probably the most frequently used dependent variable in organizational research today. Yet, at the same time, it remains one of the vaguest and loosely defined constructs. The definition of organizational performance is a surprisingly openended question with few studies using consistent definitions and measures. Performance is so common in management research that its structure and definition are rarely explicitly justified; instead, its appropriateness, in no matter what form, is unquestionably assumed (Richard, Deviney, Yip and Johnson 2009)

Objectives of the Study

To identify the Factors Influencing Quality of Work life

To refine the factors influencing QWL and its impact on Organizational Performance.

Literature Review

Elona Cera, Anri Kusaku (2020) believed non private organizations are a major domain for research as they give the services to the public at a very user-friendly cost and very sufficient in numbers. The main objective behind it to get the idea about the performance of non-private institutes after identifying the various issues under public organization. His study has put the highlight on subjective and behavioural aspects of QWL on organizational performance, by identifying the various collaborators' which have a impact on organization's productivity.

Md. Zohurul Islam and Sununta Siengthai, has taken a survey of many workers in DEPZ, Bangladesh as they have a very important role to play in the economic growth of the country. They highlighted all those variables which have an impact on the employee's work satisfaction and their quality of work life. This study special focus was on to find out the relationship between QWL and employees' satisfactions as well as QWL and organizational performance.

Rainey (2003) explains the role of QWL in organizational performance, he says typically, QWL is conceptualized as a general attitude toward an object, the job. Some theorists view (QWL) as being the positive emotional reactions and attitudes an individual has towards their job.

Lau, Wong, Chan, and Law (2001) have talked about generic concept that covers a person's feelings about every dimension of work, and a way of thinking about people, work and organization that involves a concern for employee well-being and organizational effectiveness.

Cummings and Worley (1997) in their paper talked that employee Satisfaction with a variety of needs through resources, activities, and outcomes stemming from participation in the workplace.

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Sirgy et al. (2001) gave his opinion that quality of work-life is defined as "not only employees' opinions, attitudes and expectations about their job but also interpretation of all conditions and satisfaction of employees' needs by the employees as well as their perception of this satisfaction and conditions".

Radha Yadav, Ashu Khanna (September 2014) - Quality of work life is becoming an imperative issue to achieve the goals of the organization in every sector whether it is education, service sector, banking sector, tourism, manufacturing, etc. Attrition, employees' commitment, productivity etc. depend upon the dimensions of Quality of work life i. e. job satisfaction, organizational commitment, reward and recognition, participative management, work life balance, proper grievances handling, welfare facilities, work environment, etc. An organization provides a better QWL then it develops the healthy working environment as well as satisfied employee. High QWL can give a result in better organizational performance, effectiveness, innovativeness, etc.

Nayak & Sahoo - Quality of Work Life and Organizational Performance: The Mediating Role of Employee Commitment. Journal of Health Management, 17 (2015) The study searched the relationship between Quality of Work Life and organizational performance in the presence of employee commitment as a mediating variable through the quality advances in health care. It was found that a better quality of work of member of staff is an important leading factor for organizational performance of a health care. The results showed that the employee's commitment plays as a partial and major mediating variable in the relationship between Quality of Work Life and organizational performance.

Priyadarshini and Venkatapathy (2005) analysed the variations in Human Resource Development (HRD) practices in high and low performing nationalized and private banks. It was found that there is significant difference between types of ownership (nationalized, private) of banks with respect to role analysis, potential appraisal, career planning, and quality of work life.

The purpose of the pilot study is to identify potential problems that may affect the quality. and validity, by exploring, investigating, refining, and testing the measurement tools and procedures of the results. Many researchers recommend testing and improving the questionnaires. By employing a pilot study before carrying out a formal study (Johanson & Brooks, 2010; Omar et al., 2018). The pilot study aimed to make sure that the design selected for this study was acceptable before progressing to the final study. The reliability of a measuring instrument is its ability for consistency.

Methodology:

The reliability and validity of the questionnaire were measured in this study to investigate the influence of QWL of MSME Employees on organizational performance. The justification for selecting a questionnaire design is because it can reduce respondent bias and measurement errors, as well as facilitate data collection when the sample size is large or covers a large geographical region. In addition, a questionnaire enables easier and accurate analysis of the data and a full description of various types of answer sets (Omar et al., 2018).

Research instrument:

Questionnaire Design: The questionnaire was designed using closed-ended questions that made the respondents reply to each question simply and accurately. The items for the questionnaires were adapted and adopted from prior studies. The questionnaire had three sections; the first section covered questions related to the demographic information for the respondents, the second section was related to measure of QWL. The third section was related to Organizational performance. Questionnaire Validation Before sharing the questionnaire with MSMEs, we followed a two-step validation process to ensure the questions were clear, easy to understand, and free of errors. These steps helped us establish both content validity and face validity. In simple terms, we made sure the questions accurately measured what they were intended to, and that they made sense to those answering them. By involving experts in the validation process, we increased the reliability and accuracy of the questionnaire, making the results more trustworthy and suitable for generalization. (Bolarinwa, 2015). To ensure the quality of the questionnaire, both content and face validity were considered with input from subject matter experts. Content analysis, as described by Downe-Wamboldt (1992), helps derive meaningful and theoretically valuable insights while minimizing the loss of information from the original data. On the other hand, face validity focuses on how well the questions align with the researcher's definitions and the concepts intended to be measured (Wolf, 2008).In this study, a questionnaire was used as the primary tool for collecting data from participants. It was created using Google Forms to easily reach respondents through an online survey format. This approach allowed us to gather insights directly from employees. The questionnaire was designed based on Walton's Quality of Work Life model, which was identified during the literature review as relevant to the study's conceptual framework. Additionally, some questions were added considering the COVID 19 situation and the effect of that on Quality of Work Life.

Most of the pilot survey questions were in Likert-scale format, where participants could choose the right option to express their views and feelings about the organization, policies, welfare schemes, etc.

The total 77 respondents' data was used for the present study. The first part includes demographic data such as gender, age, education, income, department of employment and job position, role and responsibility, tenure in current organization, etc. The second part includes questions regarding organizational culture measured through a Likert scale. The third asks questions regarding the work environment, measured through a 5-point Likert scale (ranging from 1 – Strongly Disagree, to 5 – Strongly Agree). Likert-scale questions measuring variables related to training and

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development, management/leadership, and organizational performance constituted the fourth, fifth, and sixth parts of the questionnaire, respectively. Data analysis was done through SPSS. A KMO and Bartlett's Test is used to measure the adequacy of sampling and factor analysis, and confirmatory factor analysis was carried out.
The Sample of 77 respondents was collected using random sampling method. A survey consists of a set of 88 questions were used to study the Pay Systems, Financial benefits, Training and Professional Development, Work environment, organizational culture etc.

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	77	100.0
	Excluded[a]	0	.0
	Total	77	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.986	58

Chronbach alpha
KMO
The KMO measure of sampling adequacy is 78.6 percent while Bartlett's test shows significant value to obtain factorial analysis and reduce the insignificant dimensions of quality of work life on organizational performance.

Factor Analysis

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.786
Bartlett's Test of Sphericity	Approx. Chi-Square	6057.773
	df	1653
	Sig.	.000

Conclusion

This study focused on testing the validity and reliability of the tool that will be widely used in the actual study. The proposed study offers reliable instrument that could facilitate the collecting data for the related factors to help the decision makers to assess and enhance the organizational performance in the MSMEs. The results proved that this questionnaire is reliable and errorfree based on the Cronbach's alpha test. The pilot study showed that the factors had values greater than 0.7. In addition, the EFA, including KMO and Bartlett's test of sphericity, also showed that they did not exceed the threshold, and were significant for all factors.

The results of the validity and reliability tests indicated that this questionnaire could lead to final model validation. Therefore, this questionnaire was designed to measure the suggested research framework related to organizational performance and the relationship between these factors. In addition, these variables will be examined to detect their influence on organizational performance. The next step is to test a larger population of MSMEs and then test the hypotheses of the proposed research framework. The outcomes of this study can be expected to provide a better understanding of the performance of MSMEs in their activities.

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Original Article

Risk Management in Banking and Financial Services.

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Abstract :

Risk management is a vital process in every organization or project that involves identifying, assessing, and taking steps to minimize or control threats. These threats, or risks, can come from various sources such as financial uncertainties, legal liabilities, strategic management errors, accidents, or natural disasters. The main goal of risk management is not to eliminate all risks but to understand them and reduce their negative impact. One of the most important reasons for implementing risk management is to minimize losses and uncertainty. By recognizing potential problems before they happen, an organization or individual can prepare responses, thereby reducing the damage if the risks do materialize. For example, having insurance or emergency funds can protect against financial risks. Risk management also plays a crucial role in decision-making. By evaluating risks, managers can make more informed choices that balance potential benefits and potential losses. It allows them to take calculated risks rather than avoiding them entirely, which can lead to innovation and growth. Another major benefit is that it helps protect valuable resources. Whether it's money, people, time, or information, managing risks ensures that these assets are not wasted due to unforeseen problems. It contributes to the smooth and continuous operation of a business or project even during times of crisis.

Keywords: *Risk Management, Banking Sector, Financial Services, Credit Risk, Market Risk, Operational Risk , Liquidity Risk etc…*

Introduction:

Risk management plays a central role in the banking and financial services industry. Banks and financial institutions operate in an environment filled with various types of risks, including credit risk, market risk, operational risk, liquidity risk, and regulatory risk. These institutions deal directly with the money of individuals, businesses, and governments, making them particularly vulnerable to financial instability and crises if risks are not properly managed.

The primary function of any financial institution is to manage risk while striving for profitability. Risk arises naturally from the core activities of banking such as lending, investing, and trading and must be continuously monitored and controlled. Without effective risk management, even a single unexpected event can result in severe financial losses, reputational damage, or even the collapse of a bank, as seen in past financial crises.

In this context, risk management involves identifying potential threats, assessing their impact, and implementing strategies to minimize or mitigate their effects. It also requires compliance with strict regulatory frameworks established by central banks and international bodies, such as Basel Accords, which are designed to ensure financial stability and protect depositors.

As financial markets become more complex and interconnected, the importance of robust and dynamic risk management systems has grown significantly. Today, banks are investing heavily in technology, analytics, and skilled personnel to detect early warning signs, model risk scenarios, and maintain sound risk exposure levels.

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Literature Review:

Basel Committee on Banking Supervision (BCBS) Basel Accords

The Basel Accords (Basel I, II, and III) form the backbone of modern risk management in banking. These international frameworks set out minimum capital requirements and guidelines for managing credit, market, and operational risks. Basel III, introduced post-2008 crisis, emphasizes capital adequacy, liquidity coverage, and leverage ratios to strengthen banks' resilience.

Saunders, A. & Allen, L. (2002) Credit Risk Measurement

Saunders and Allen explore credit risk, one of the most critical risks for banks. Their work focuses on methods such as credit scoring, credit VaR (Value at Risk), and risk-based pricing models. They emphasize the need for internal credit risk models tailored to banks' specific portfolios

Hull, J. C. (2012) Risk Management and Financial Institutions

John Hull offers a comprehensive overview of all types of financial risk, including credit, market, operational, and liquidity risks. His book discusses tools like derivatives, value at risk (VaR), stress testing, and the role of risk management in improving regulatory compliance.

Khan, M.Y. & Jain, P.K. (2008) Financial Management: Text, Problems and Cases

This textbook provides insights into how financial institutions manage risk through financial planning, forecasting, and control mechanisms. It also highlights traditional and modern risk mitigation tools used by banks to protect shareholder and depositor interests.

Allen, F., & Carletti, E. (2013) Systemic Risk from Real and Financial Sector Imbalances

Published in *Annual Review of Financial Economics*, this paper discusses how poor risk management in the banking sector can lead to systemic risk. It explores the link between financial sector vulnerabilities and economic crises, underlining the importance of macro-prudential oversight.

Objectives: Identify and Assess Risks

To recognize potential internal and external risks (e.g., credit, market, operational) and evaluate their impact on financial stability.Minimize Financial Losses

To reduce the likelihood and severity of financial losses through preventive measures and controls. Ensure Regulatory Compliance:

To comply with national and international banking regulations (e.g., Basel III) and avoid legal or financial penalties. Protect Stakeholder Interests

To safeguard the interests of customers, investors, and other stakeholders by maintaining trust and operational integrity. Enhance Decision-Making and Strategic Planning To support informed decision-making by integrating risk assessments into strategic business planning and operations.

Significance :

Prevents Financial Losses:Helps identify, assess, and control risks like credit, market, and operational risks to reduce potential losses.Ensures Regulatory Compliance Supports adherence to legal and regulatory standards (e.g., Basel III), avoiding fines and penalties.Builds Customer and Investor ConfidenceEnhances trust by ensuring that funds and investments are managed safely and transparently.

Supports Strategic Decision-Making

Enables banks to take calculated risks for growth while minimizing exposure to potential threats.

Ensures Long-Term Stability Strengthens institutional resilience, especially during financial crises or economic uncertainty.

Research Methods:

Secondary Data Collection

Bank Reports and Financial Statements

Look at risk disclosures, capital adequacy ratios (CAR), stress test results

Regulatory Filings

Basel III/IV compliance, central bank risk guidelines, SEC filings

Academic Journals and Industry Reports

Literature on risk frameworks like credit risk, market risk, operational risk, and their evolution

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Data Analysis:

Variable / Theme	Type of Data	Source of Data	Analysis Method	Tool(s) Used	Expected Outcome
Credit Risk	Quantitative	Annual reports, financial databases	Ratio analysis, trend analysis	Excel, SPSS, STATA	Understand levels and trends in credit risk over time
Operational Risk	Qualitative / Quantitative	Risk disclosures, interviews	Thematic & frequency analysis	NVivo, Excel	Identify operational risk types and frequency of occurrence
Risk Management Practices	Qualitative	Interviews with bank managers	Thematic coding	NVivo	Map out best practices and common frameworks used
Basel III Compliance	Quantitative / Qualitative	Bank reports, regulatory websites	Content analysis, checklist audit	Excel, Manual Coding	Assess compliance level and implementation gaps
Risk Governance Framework	Qualitative	Policy documents, internal manuals	Document analysis	Manual, NVivo	Evaluate the robustness of internal risk governance frameworks
Relationship Between Risk and Profitability	Quantitative	Financial statements (ROE, ROA, CAR)	Regression analysis	SPSS, R	Measure how risk levels affect profitability
Stress Testing Results	Quantitative / Qualitative	Central bank disclosures, internal reports	Comparative analysis	Excel, STATA	Analyze preparedness of banks under various risk scenarios
Cybersecurity and Risk	Qualitative	Interviews, white papers	SWOT analysis, thematic analysis	NVivo	Explore emerging risks and strategies for cyber risk management

Credit Risk AnalysisThis involves studying how banks manage the risk of borrowers failing to repay loans. You can analyze data such as non-performing loan ratios, loan loss provisions, and default rates. By reviewing financial statements and regulatory reports, you can assess how effectively banks control their credit exposure.
Operational Risk AnalysisOperational risk refers to losses caused by failed internal processes, people, systems, or external events. In this part of the analysis, you would collect data on incidents such as fraud, system failures, or human error. You may use qualitative methods like interviews or case studies to understand how banks detect and manage these risks.Risk Management PracticesThis includes studying the overall strategies and frameworks banks use to identify, measure, and control risks. You can examine internal policies, risk manuals, and conduct interviews with risk officers. This helps in identifying best practices and evaluating how comprehensive a bank's risk approach is.
Basel III Compliance AnalysisBasel III provides international regulatory standards for capital adequacy and liquidity. Your analysis here can include checking whether banks meet these requirements by reviewing regulatory filings, capital ratios, and liquidity coverage ratios. This helps assess how well banks are complying with global risk management norms.Risk Governance FrameworkThis focuses on how banks oversee risk at the management and board level. You can analyze organizational structures, such as the presence of risk committees, and how decisions are made. This shows whether risk management is integrated into the bank's leadership and decision-making processes.Relationship Between Risk and ProfitabilityThis involves examining how risk impacts a bank's financial performance. You can collect data on profitability indicators like Return on Assets (ROA) or Return on Equity (ROE), and compare them with risk dicators like credit risk or capital adequacy ratios. Statistical analysis like correlation or regression can be used to study the tionship between risk control and profit outcomes.Stress Testing AnalysisStress testing evaluates how banks perform under extreme but possible adverse scenarios, such as economic recessions or market crashes

Conclusion :

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Risk management has become a central pillar in the stability and sustainability of banking and financial institutions. This research highlights the various dimensions of risk—credit, operational, market, liquidity, and compliance—and the diverse strategies banks use to manage them. Through both qualitative and quantitative analysis, it is evident that effective risk management not only protects banks from financial losses but also enhances profitability, regulatory compliance, and stakeholder trust.

The study further emphasizes the importance of robust governance structures, adherence to international standards such as Basel III, and the integration of stress testing as proactive tools in modern banking risk frameworks. Moreover, findings suggest that banks with stronger risk management practices are more resilient to economic shocks and competitive market pressures.

In conclusion, while regulatory compliance forms the baseline of risk management, true effectiveness comes from a forward-looking, institution-wide risk culture. For future resilience, banks must continue to evolve their risk strategies by investing in technology, improving transparency, and fostering a risk-aware organizational mindset.

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Original Article

Extraction of Protease from *Cicer Arietinum*

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Abstract:

Proteases are essential enzymes with wide-ranging applications in food processing, pharmaceuticals, detergents, and biotechnology. This study focuses on the crude extraction of protease from chickpea (Cicer arietinum) seeds followed by a determination and estimation of enzyme activity under different conditions using the Biuret method. The objective was to compare the efficiency, stability, and inhibition susceptibility of enzyme extracted by analyzing the effects of temperature, substrate concentration, and activity of enzyme in presence of inhibitors ($CuSO_4$) .The results showed that proteases extracted from Cicer arietinum showed optimum activity at 55°C. An increase in substrate concentration resulted in higher enzyme activity. It was observed that in presence of 0.5% $CuSO_4$, the enzyme activity decreased.

Keywords: *Protease, Cicer arietinum, Biurette method, substrate concentration, inhibitors, optimum temperature.*

Introduction: Pulse consumption has been associated with positive health outcomes across multiple populations (Viguiliouk et al., 2017). Consumption of Chickpeas (*Cicer arietinum)* has been proposed to be beneficial in the management of multiple chronic diseases such as cardiovascular diseases and obesity (Gupta et al., 2017; Padhi and Ramdath, 2017). It is also an important source of carbohydrates, B-group vitamins, and certain minerals. During germination some hydrolytic enzymes such as amylase, invertase, protease and lipase are activated. Proteases are a group of enzymes that catalyze hydrolysis of bonds in polypeptide chains and split them into smaller polypeptides or else free amino acids. Proteases are the enzymes that perform proteolysis i.e. digestion of proteins. Proteases, enzymes that break down proteins, have wide-ranging industrial applications, particularly in detergents, food processing, leather tanning, and waste management (Neha Thakur, etal., 2018). Proteases are widely used in the food industry for various applications, including meat tenderization, cheese production, baking, and improving the nutritional value of foods. They can also be used to modify proteins for better flavor, solubility, and digestibility, as well as in waste management and brewing (Sindhu Raveendran, 2018). The current project focuses on the crude extraction of the protease enzyme from *Cicer arietinum* and comparing the enzyme activity of the protease extracted from bacterial and plant sources in order to have a good efficient and stable yield of the enzyme for commercial use. **Materials And Methods:**

1. **Extraction of Enzyme from *Cicer arietinum***

- Soak chickpea seeds in water for 8–12 hours.
- Germinate for 24–48 hours in a moist environment. This enhances protease activity.

To check for protease production in chickpea before Extraction: Seed Sterilization :- Wash on soaked *Cicer arietinum* seed by submerging in tap water for 2 mins then wash it with a few drops of mild detergent for 1 min. Decant the detergent and wash it with distilled water for 2mins.

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- Cover the Chickpea seed with 70% Ethanol and Shake it for 5mins. Add 0.2% $HgCl_2$ and Wash it again with Sterile Distilled Water.
- **Plating On Sterile Casein Agar Plate**: - Now, transfer the Sterile *Cicer arietinum* aseptically on a Sterile Casein agar plate and incubate the plate at room temperature for 24-48 hours and observe for zone of inhibition.
- Weigh about 50 g of *Cicer arietinum* seeds (germinated or raw).
- Grind them in a blender or mortar & pestle with a cold phosphate buffer (pH 7.0, 50 mM) in a 1:5 ratio (1 part seed, 5 parts buffer).Maintain the mixture on ice to prevent enzyme denaturation.
- Filter the homogenate using cheesecloth or muslin cloth to remove solid debris.
- Centrifuge the filtrate at 10,000–12,000 rpm for 15–20 minutes at 4°C.
- Collect the clear supernatant – Crude protease enzyme.

Determination of effect of different parameters on the enzyme: The Biuret method was used to estimate protein concentrationandenzymeactivity considering different parametersviz.Optimumtemperature,substrate concentration, effect of inhibitors. The absorbance of the system was determined spectrophotometrically at 550 nm.

A. Effect Of Temperature:

- Take 5 tubes with 2 ml 1% Casein substrate in each of the tube
- Add 2 ml phosphate buffer in the above tubes.
- 1 ml of enzyme extract was added to all tubes.
- Incubate the above tubes at respective temperature (4^o,28^o, 37^o,55^o,100^o) for 30 mins
- Centrifuge the tubes at 4°C at 10,000 rpm for 10-15 mins
- Collect the supernatant carefully.
- Add 4 ml Biuret reagent in each tube.
- Incubate for 30 mins at room temperature.
- Take the O.D in colorimeter at 530 nm.

B. Effect Of Substrate

Take 5 tubes and add the given substrate amount 0.5, 1.0,1.5, 2.0 mlThe substrate used is 1 % casein prepared in phosphate buffer

- 1 ml of enzyme extract was added to all tubes.
- Add 2 ml phosphate buffer in the above tubes
- Incubate the above tubes at room temperature for 30 mins.
- Centrifuge the tubes at 4°C at 10,000 rpm for 10-15 mins.
- Collect the supernatant carefully.
- Add 4 ml Biuret reagent in each tube.
- Incubate for 30 mins at room temperature.
- Take the O.D in colorimeter at 530 nm.

C. Effect Of Inhibitors

- Take 5 tubes with 2 ml 1% Casein substrate in each of them
- Add 2 ml phosphate buffer in the above tubes .
- 1 ml of enzyme extract was added to all tubes.
- Add the inhibitor 1% $CuSO_4$ in the following volume 0.2,0.4,0.6 ml.
- Incubate the tubes at room temperature for 30 mins.
- Centrifuge the tubes at 4°C at 10,000 rpm for 10-15 mins
- Collect the supernatant carefully.
- Add 4 ml Biuret reagent in each tube.
- Incubate for 30 mins at room temperature.
- Take the O.D in colorimeter at 530 nm.

Observations:

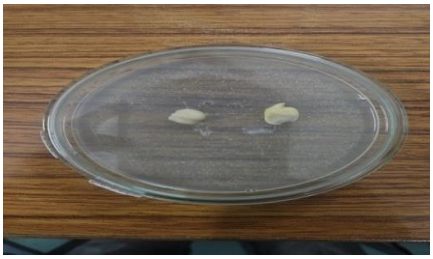


Fig. 1. Zone of Clearance observed around Chickpea seeds indicating Protease production

A.Effect Of Temperature: Chart 1

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Temperature (°C)	O.D at 550 nm
BLANK	0.0
4	0.02
28	0.03
37	0.04
55	0.06
100	0.01

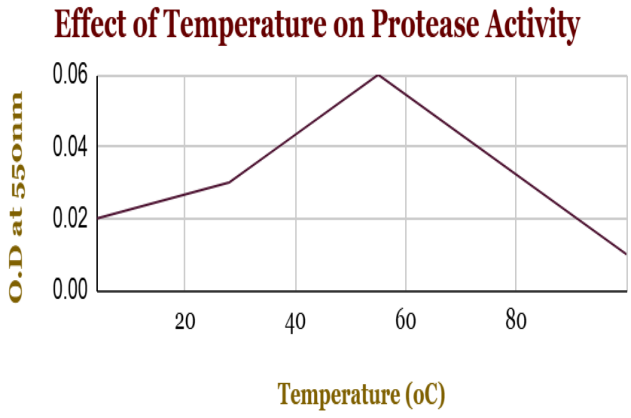
B.SubstConcentration:,Chart 2

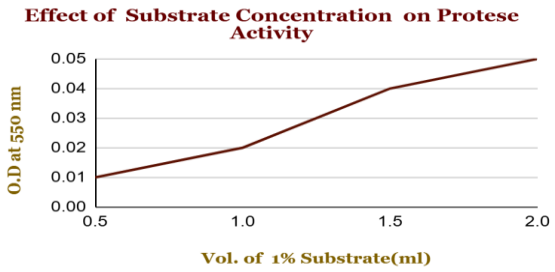
1% Casein (Substrate) (ml)	O.D at 550 nm
BLANK	0.0
0.5	0.01
1	0.02
1.5	0.04
2.0	0.05

C.Effect of Inhibitor: Chart

1% $CuSO_4$(Inhibitor) (ml)	O.D at 550 nm
BLANK	0.0
0.2	0.13
0.4	0.07
0.6	0.05
0.8	0.02

Chart 1





Esults And Discussions: Chart 2

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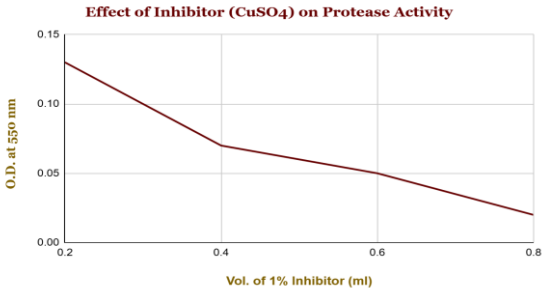


Chart 3

From the observations obtained for determining the optimum Protease activity considering the different parameters like effect of Temperature, substrate concentration and concentration of inhibitors that decreases the enzyme activity it was found that -

The Protease extracted from *Cicer arietinum* showed optimal activity at 55 ^{o}C, which was found not consistent with the study carried out by **Tooba Naz Shamsi etal**, in which the optimum temperature obtained was between 4^{O} C to 37^{O}C. In the present study it was found that as the substrate concentration increases enzyme activity also increases when the maximum substrate concentration taken was 1% Casein. These findings coincided with the results of Guowei SHU* etal in 2016.

The concentration of inhibitor that decreased the protease activity in the present study was found to be 0.06. At a concentration 0.02ml of 1% $CuSO_4$ was found to be maximum. Further as the concentration of the inhibitor increased, the protease activity decreased. The present study results were found to be consistent with the results obtained by S. V. Lagade etal .

Conclusions:

The Protease enzyme was extracted from *Cicer arietinum* by chemical and biophysical methods. The enzyme extracted was then processed for determining the optimum conditions where it will prove beneficial to maintain the stability of the extracted enzyme from *Cicer arietinum* .

The optimum temperature determined was 55 ^{o}C, wherein it can be proved that it is a thermostable enzyme and can be used in the food and textile industry.

It was always found that as the concentration of Casein that is substrate increases the enzyme activity also increases. From the study above, it can be said the protease extracted from *Cicer arietinum is* thermostable. As the volume of substrate increases the protease activity also increases. The Protease activity in presence in 1% $CuSO_4$ solution showed the peak activity at 0.2 ml. Enzyme activity decreased with the increased volume of $CuSO_4$. For inhibitor , it was observed that as the concentration of the inhibitor goes on increasing the activity of protease also decreases in the present study.

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Conflict Of Interest

The authors declare no conflict of interest.

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Original Article

Ecological Conflicts in Amitav Ghosh's The Hungry Tide and Jean Rhys's Wide Sargasso Sea

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Abstract

Today, people are increasingly aware of ecological and environmental concerns. The paper explores the connection between human beings and the environment in Amitav Ghosh's The Hungry Tide and Jean Rhys's Wide Sargasso Sea, and examines the impact of ecological conflicts by comparing both novels. Though the issues are of different countries, ecological concerns are the same everywhere. New-age boons- technology and globalisation inadvertently led to migration and travel, carrying the baggage of conflict and misunderstanding between people and the environment. The paper will also focus on whether these writers treat the relationship between humanity and the environment in a similar manner. The researcher seeks to find a solution to the conflicts. Ecopsychology, which focuses on the man-nature relationship, may help to create more awareness of conserving the environment. Preserving the ecological balance may lead to more harmony between man and the environment.

***Keywords -Man**, nature, ecology, environment, balance.*

Introduction

The relationship between mankind and nature, both flora and fauna, has always existed, but there have been occasions of conflict, too. Although nature wreaks havoc on people's existence in the form of natural disasters, at the same time, nature has safeguarded the ecosystem. The advent of technology has led to globalisation and migration, paving the way for conflicts between the rulers/governance, the environment, and the migrants. The balance of the ecosystem gets disrupted, taking its toll on nature. Nature and man have lived in harmony, but man's avarice gradually distanced him/her from nature. Writers, particularly post-colonial writers, voice their concern through their works. Amitav Ghosh's *The Hungry Tide* and Jean Rhys's *Wide Sargasso Sea* explore the connection between man and nature and the conflicts that emerge from it. According to Merriam Webster, ecology is 'the study of the relationships between plants, animals, people, and their environment and the balances between these relationships.' The conflict can be discerned in the analysis of the characters, Piyali Roy and Fokir Mandol, with Sundarbans as the background, in *The Hungry Tide*, whereas in Jean Rhys's "Wide Sargasso Sea," ecological conflicts are discerned through Antoinette and Rochester in the Caribbean environment. Thus, the Sundarbans archipelago and the Caribbean represent nature, and environmental degradation is visible in both novels.

The Human-Nature Relationship in The Hungry Tide

Amitav Ghosh's 4th novel, *The Hungry Tide* (2004), may be termed a pioneer in discussing ecological issues. It is divided into two parts, titled *The Ebb: Bhata* and *The Flood: Jowar*, which indicates the strong influence of nature on man. The novel follows the trajectory of three extremely different people- the female protagonist Piyali Roy, born in Bengal, yet stubbornly American by heart, male protagonists Kanai Dutta, a Delhi-based professional

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Translator, and a local, illiterate fisherman, Fokir. Piya is a cetologist who wants to study the Irrawaddy dolphins and the Gangetic dolphins in the Sundarbans. Her "project is to do a survey of the mammals of the Sunderbans" (Ghosh 11). She meets Kanai on her way to Canning. Their relationship, though awkward at the beginning, turns to jealousy when he notices the easy understanding between Piya and Fokir. Fokir is a true son of the soil, with his in-depth knowledge of the place. Kanai translates for a while for Piya during her stay in the Sunderbans for her research work. Kanai's journey to Sundarbans is for the notebook, which his late uncle Nirmal has left for him. It will help Kanai and Nilima (Nirmal's wife) to unravel some of the mysteries of Nirmal's life.Piya cannot communicate in Bengali, and Fokir cannot speak English, yet interestingly, their communication goes beyond language barriers. When she falls into the river, he rescues her, this leads to a bond between them. Later, he also provides her with the necessary information regarding dolphins, which he has gained through experience. The Sundarbans, with its labyrinth of tidal rivers and thick mangrove forests, forms the background to the novel and throws light on the delicate relationship between land and sea. In the initial part of the novel, we see Piyali, who believes fully in conservation efforts. As a scientist, she perceives things logically, and she is honest in her approach. Piya believes in protecting the Bengal tigers, whereas for Fokir, it is a threat to their means of livelihood. The conflict between them is that she has learnt about biodiversity through books, and Fokir has learnt it with his life, and the knowledge has been passedto him from his ancestors. The conflict is that of reality and knowledge perceived from books. Piya questions the basic belief of men that they are superior to everything on earth. It is this belief that destroys the fine balance of coexistence of humans and non-humans. The Sundari trees, the elegant Bengal tiger, the deceitful crocodile, the Orcaella, and the crab represent the non-human characters in the novel. Humans alone do not complete the existence of the Earth/Nature. Change is at a faster pace in the Sundarbans compared to other places. Floods and storms change the topography. Nirmal describes the Sundarbans as the microcosm of the universe. It takes time for a river to change its direction or for a piece of land to rise from water as an island, but in the tide country, transformation is a fast, continuous process. Like the Phoenix bird, from the ashes of destruction, creation begins in the Sundarbans. Kanai, with his urban sensitivity (being a businessman), views things almost condescendingly; nonetheless, he changes gradually. Nature changes him; Fokir and Kusum also play significant roles. His prejudices give way to empathy for the marginalised (Fokir and the island people). The Eurocentric concept of the cultured rustic is in sharp contrast with the ideas propounded in the novel through Fokir. Fokir breaks all these notions with his uneducated, culturally inherited indigenous knowledge in full display. The reader, too, learns to understand environmental issues along with Kanai. For Kanai, encountering the fierce and unmediated forces of nature in the Sundarbans proves to be a transformative experience, challenging his urban sensibilities and intellectual detachment. His sense of superiority smashes to smithereens when he faces the ferocious tiger. Simultaneously, Piya and Fokir are caught in the terrible storm, fighting for life. The recurring reference to the burning of the tiger encroaching upon human habitat is mentioned as "the horror." It is seen as a crime, yet destroying the habitat of other beings is not regarded as a crime. Piya opines that the planet keeps human beings alive. Her words, "Just suppose we crossed that imaginary line that prevents us from deciding that no other species matters except ourselves. What will be left then? Aren't we alone enough in the universe and do you think it will stop at that?" (Ghosh 265) She feels that once humans believe that they can kill all creatures at will, the next turn will be that of people themselves. The exact contradictory view is also expressed in the novel by Kanai. He questions her about the importance of life, whether wildlife preservation is more precious than that of humans. *The Hungry Tide* deals with the ecological concerns like deforestation, climatic changes and encroachment.

The Human-Nature Relationship in Wide Sargasso Sea

Being born and brought up in the erstwhile British Caribbean colony, Jean Rhys becomes well-versed in issues related to the indigenous people of the Caribbean. She focuses on the oppression of females in a patriarchal society. Inspired by Charlotte Brontë's novel Jane Eyre (1847), Jean Rhys writes a prequel to it, and the novel, *Wide Sargasso Sea* (1966), emerges. It defends the creole culture. The human-nature relationship in Jean Rhys's *Wide Sargasso Sea* is highly symbolic and deals with identity, colonialism, and madness. Though *The Hungry Tide* and *Wide Sargasso Sea* may not appear to be two seeds in a pod, there are similarities where the setting is concerned. The difference is in the perspectives of a male and female writer. Jean Rhys's avoidance of 'the' in the title is one such example! The landscape of the Sundarbans is replaced by the Caribbean landscape. The novel is divided into three parts and is narrated by Antoinette, Mr. Rochester, and Grace Poole. Antoinette becomes mad due to various factors. She senses her *otherness* in the Caribbean islands, in England and even in Coulibri. Coulibri is the estate where she spent her childhood. The rejection from her mother depresses her; she tries to find solace in Christophine's arms. The garden at Coulibri Estate is described as "wild," and it indicates her emotional state and her later psychological disintegration. She is torn between the ideologies of coloniser and colonised as she is neither Black nor White, and so isolated from both. The novel abounds in references to the tree of life from the Bible, showing the ecologically balanced, man-nature cordial bonding. For Antoinette, Coulibri is home, and she recalls it as "There is the tree of life in the garden and the wall green with moss. The barrier of the cliffs and the high mountains. And the barrier of the sea. I am safe. I am safe from strangers." (Rhys 24) The rich, tropical landscape of Jamaica and Dominica is like her inner *self*. Both are beautiful, puzzling, and volatile. Later, when she is taken to London by her husband, the Coulibri estate remains a memory in her mind. It is

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already burnt by the servants who were earlier slaves. She recollects the Coulibri garden and compares it with that of London.

Our garden was large and beautiful as that garden in the Bible– the tree of life grew there. But it had gone wild. The paths were overgrown and a smell of dead flowers mixed with the fresh living smell. Underneath the tree ferns, tall as forest tree ferns, the light was green. Orchids flourished out of reach or for some reason not to be touched. One was snaky looking, another like an octopus with long thin brown tentacles bare of leaves hanging from a twisted root. Twice at year the octopus orchid flowered – then not an inch of tentacle showed. (Rhys 17)In London, she feels the absence of the forest and hence freedom; all that she is left with is "an enclosed garden surrounded by a stone wall and the trees are different trees." (Rhys 55) The ruin of her home- Coulibri is her ruin too. The estate and Antoinette are mere material possessions for her husband. As a white urban man, he fails to understand both and exploits them ruthlessly. She represents the balance between wo/man and nature, striking the perfect balance. Her husband's perception of wilderness is interesting. He is filled with discomfort and suspicion and feels alienated from it. The Caribbean landscape is overwhelming and unsettling for him. The unfamiliar always evokes the fear of losing control. His words reveal it clearly- "too much blue, too much green. The flowers too red, the mountains too high, the hills too near."(Rhys 59) The landscape becomes the symbol of the Caribbean as the wild other, which must be tamed or discarded. As Antoinette represents the same uncontrollable trait, he has to control both. Here, the Caribbeans are shown as the indigenous, caring for the environment as opposed to the coloniser in the form of Rochester. The contrast between colonial control and indigenous freedom is noticeable.

Ecological Disintegration in Wide Sargasso Sea and The Hungry Tide

The theme of ecological disintegration is prominent in *Wide Sargasso Sea* and *The Hungry Tide*. The disintegration of natural environments and the socio-political forces that work behind it are common to both. While both novels deal with ecological concerns, they are addressed in different ways.In Wide Sargasso Sea, Antoinette's estate, which she inherits, becomes a symbol of cultural and ecological decay. The beautiful, lush green tropical Caribbean leaves one in awe, yet Rochester is disturbed by its strangeness. Boasting of a glorious past, Coulibri is now in ruin, showing that the impact of colonisation has ruined the land, leaving scars. The plantation economy, with roots in slavery and monoculture, destroys the indigenous ecosystems. Another symbol of ecological disintegration is found in the recurring theme of fire. The fire symbol may be perceived as a metaphor for personal and environmental destruction. The novel begins and ends in fire. Antoinette refers to fire consciously and absent-mindedly many times; later, it becomes the cause of her trauma, and she sets fire to Rochester's mansion in London. The disintegration of the human and the environment seems to be almost together. Antoinette's fragmentation of self is a direct outcome of her alienation from her familiar landscape or her motherland. Her alienation is both physical and mental; thus, throwing light on the connection between nature and man, the destruction of one leads to the destruction of the other.Ecological disintegration is central to *The Hungry Tide* as well. The novel brings forth the fragile ecosystem of a group of low-lying islands, which is spread out through India and Bangladesh, the Sundarbans. It is depicted as consisting of a dangerous, life-threatening tidal landscape where human and nature are in constant conflict. Tides, cyclones, and animals highlight the fragility of this ecosystem. Many endangered species are part of these islands. Sundarbans is 97 kilometres away from Calcutta, yet it is quite different from the mainstream society. The famous Bengal tigers reside in the reserve forest of the Sundarbans. The basic theory of existence of change and impermanence is reflected in the magic of the mangroves- appearing when the water rises and disappearing when it recedes. The renowned American philosopher and ecopsychologist Theodore Roszak, in the preface to his famous book *The Voice of the Earth*, coined the expression 'ecological unconsciousness' as the main cause for the extensive imbalance in natureThe efforts taken for conservation may often work in the opposite direction, where the interests of people are concerned. The ousting of people from Morichjhanpi is one such instance. Amitav Ghosh refers to it in the novel. Sen Gupta opines:The representation of the massacre of the Dalit refugees at the Marichjhapi Island (referred to as Morichjhapi in the novel) of the Sundarbans has been employed to connect the temporalities of the creation of human settlement in the ecologically vulnerable island by the colonisers, the refugee occupation in Marichjhapi and their eventual eviction and the incessant storms increasing in number under climate change. It is from the diary of Kanai's uncle, Nirmal, that the event unfurls in the novel. Ecological and political/human conflicts are brought into display here. The horrifying Marichjhapi massacre becomes a parallel to the survival strategy of the Irrawaddy dolphins in the Sundarbans. Marichjhapi poses a thought-provoking question: Who is more important, man or the environment? Government policies favour ecological conservation, which has led to the violent displacement of refugees. Also, the Western world view is contrasted with the Indian local one. It is represented through the characters of Piya, with her scientific views and Fokir with his native knowledge, respectively. Climate change and the rising sea level, leading to horrendous storms, also indicate the ecological crisis, foreboding future catastrophe in the novel.

Conclusion

Environmental degradation is common to both novels. In *Wide Sargasso Sea*, the ruined landscape reflects personal and cultural decay. In *The Hungry Tide*, nature is an endangered one with real consequences for marginalised

communities. It also shows the impact of human actions on the ecosystem. These narratives challenge us to think about the ecological crisis not just as environmental, but deeply entwined with histories of violence and inequality. Piya and Fokir set an example of how diversity in ecosystems can be solved through peaceful cooperation.

Wide Sargasso Sea showcases the case of ecological conflicts through a feminine perspective explored through the relationship between Antoinette, Rochester, and the Caribbean environment, highlighting how colonialism, patriarchal structures, and environmental degradation intertwine. *Wide Sargasso Sea* vividly portrays the exploitation of women and nature under patriarchal and colonial regimes. The novel relates Antoinette to the lush, untamed Caribbean landscape, emphasising how both are exoticised, feared, and ultimately subdued by colonial and male authority. Yet, this connection also becomes a powerful symbol of resilience and defiance. . Antoinette's connection with nature, its wildness, beauty, and unpredictability, highlights her inner strength and resistance against the restrictions imposed on her by Rochester and the colonial system.Raising awareness through ecopsychology may offer a constructive path toward resolving ecological conflicts. Ecopsychology encourages a sense of mutual respect and interdependence by fostering a deeper psychological connection between humans and the natural world. Recognising the intrinsic value of both humanity and nature, and granting each their due, can help restore balance and promote a more harmonious coexistence.

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Original Article

Gamification and Self-Determination Theory: Enhancing Employee Motivation and Performance in Digital Banking Workplaces

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Abstract:

This paper explores the intersection of gamification and Self-Determination Theory (SDT) in the context of digital banking workplaces. With the rise of digital transformation in the banking sector, maintaining employee engagement and performance has become a critical challenge. Gamification, the application of game-design elements in non-game contexts, offers a novel approach to address this issue. This research investigates how gamification can fulfill SDT's core psychological needs autonomy, competence, and relatedness to enhance intrinsic motivation and employee performance. Utilizing a secondary data approach, the study synthesizes existing literature to develop a conceptual model linking gamified elements with SDT constructs in banking environments. The paper concludes with implications for managerial practice and proposes directions for future research in gamified workplace design.

Keywords: *Gamification, Self-Determination Theory, Employee Motivation, Digital Banking, Intrinsic Motivation*

Introduction:

The evolution of digital banking has significantly transformed the traditional workplace structure within the financial sector. With advancements in artificial intelligence, machine learning, and fintech platforms, many banking tasks have been automated, making the environment more data-driven, remote-oriented, and efficiency-focused. While this digital shift has streamlined operations and improved customer service delivery, it has also introduced new challenges—particularly concerning employee motivation, engagement, and performance.

In this evolving context, traditional methods of employee motivation—chiefly extrinsic motivators such as salaries, bonuses, and promotions—are increasingly seen as inadequate in sustaining employee commitment and fostering innovation. Financial incentives may trigger short-term compliance, but they often fail to cultivate the deep psychological engagement required for long-term productivity and job satisfaction. Employees today seek more than transactional relationships with their organizations; they desire purposeful work, autonomy in decision-making, and meaningful interpersonal connections. This is where Self-Determination Theory (SDT), developed by Deci and Ryan (1985), becomes particularly pertinent.

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SDT emphasizes the importance of fulfilling three core psychological needs—autonomy, competence, and relatedness—to nurture intrinsic motivation. When these needs are satisfied, employees are more likely to be self-driven, engaged, and committed to their organizational roles. However, simply understanding SDT is not enough; organizations must also identify practical mechanisms to integrate these principles into everyday workflows.

Enter gamification—the application of game-design elements such as point scoring, leaderboards, challenges, and rewards into non-game contexts. Gamification has garnered attention across sectors as a dynamic tool to influence behavior, enhance user engagement, and drive motivation. In the corporate realm, it is being leveraged to increase employee participation, learning outcomes, and performance metrics. In digital banking, gamification can be embedded into performance dashboards, training modules, customer interaction systems, and internal communication platforms to make work more engaging and goal-oriented.

This paper explores the synergistic potential of combining gamification with Self-Determination Theory to enhance employee motivation and performance in digital banking workplaces. It argues that when gamification is thoughtfully aligned with the psychological principles of SDT, it not only increases employee interaction with systems and tasks but also fulfills deeper intrinsic needs. This integration can transform the workplace into an environment where employees are both motivated and meaningfully engaged.

Through a structured review of existing literature and theoretical exploration, the paper aims to propose a conceptual model that links gamification elements with SDT constructs, thereby offering a framework for motivating employees in high-performance digital banking settings. The relevance of this study is underscored by the growing need for sustainable, psychologically enriching motivational strategies in an increasingly automated and remote financial services industry.

Literature Review:

Self-Determination Theory (SDT):

Developed by Deci and Ryan (1985), SDT posits that human motivation is guided by the satisfaction of three basic psychological needs: autonomy, competence, and relatedness. When these needs are fulfilled, individuals experience greater intrinsic motivation, leading to higher engagement and well-being.

Gamification in the Workplace:

Gamification involves applying game design principles such as points, leaderboards, badges, and challenges to non-game settings. Research has shown that gamification can increase user engagement, productivity, and satisfaction (Deterding et al., 2011).

Gamification and Motivation:

Gamified systems can support intrinsic motivation by addressing the three SDT needs. For instance, challenges and progress tracking can enhance competence, choice and voluntary participation can enhance autonomy, and social features like leaderboards or collaboration can fulfill relatedness (Hamari et al., 2014).

Digital Banking Workplaces: Digital transformation in banks has led to fast-paced, data-driven environments with high performance demands. This often contributes to stress and disengagement, making the need for motivational strategies more pressing (Ghosh & Badgaiyan, 2019).

Research Gap: While gamification and SDT have been studied independently, there is limited research that integrates both in the specific context of digital banking workplaces. Most existing studies focus on customer engagement or student motivation. This paper addresses this gap by proposing a theoretical framework that links gamification elements with SDT to improve employee motivation and performance in digital banking.

Research Methodology:

This study employs a secondary research methodology using qualitative content analysis. Peer-reviewed journal articles, books, and case studies were reviewed to understand the intersection of gamification and SDT. Data were collected from academic databases such as Scopus, JSTOR, and Google Scholar, focusing on literature from the past 10 years.

Objectives:

1. To examine the application of gamification in digital banking workplaces.
2. To analyze how gamification fulfills the psychological needs of autonomy, competence, and relatedness.
3. To propose a conceptual model linking gamification and SDT constructs.
4. To explore the impact of intrinsic motivation on employee performance.

Explanation: Gamification in digital banking can manifest through digital dashboards with real-time feedback, recognition systems, task-based competitions, and peer-to-peer challenges. When thoughtfully implemented, these systems align with SDT principles:

- ✧ **Autonomy:** Employees choose tasks or set goals within gamified systems.
- ✧ **Competence:** Progress bars, instant feedback, and skill-based levels enhance perceived competence.

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✧ **Relatedness:** Team-based challenges and leaderboards foster social connections. By embedding these elements, gamification becomes more than just a tool for entertainment; it transforms into a strategic resource for motivation.

Proposed Model:
SDT-Aligned Gamification Model (SAGM): This model proposes that gamified elements (e.g., points, badges, feedback) are mediators that influence SDT's three psychological needs, which in turn impact intrinsic motivation and employee performance.
Components:
Input: Gamification Elements (Points, Badges, Leaderboards, Feedback)
Mediators: Psychological Needs (Autonomy, Competence, Relatedness)
Outcomes: Intrinsic Motivation → Employee Engagement → Performance

Explanation: Each game element contributes differently to SDT needs. For example, feedback boosts competence, leaderboards build relatedness through friendly competition, and customizable challenges enhance autonomy. The model illustrates how motivation and performance in digital banking can be systematically enhanced by aligning game mechanics with psychological principles.

Conclusion:

Gamification, when strategically aligned with the core principles of Self-Determination Theory (SDT), holds significant potential as a motivational tool in the dynamic and rapidly evolving environment of digital banking. As banks increasingly shift toward automation, data-driven operations, and remote work structures, it is imperative to reimagine how employee engagement and motivation are cultivated.By addressing the three fundamental psychological needs outlined in SDT autonomy, competence, and relatedness gamification can move beyond surface-level entertainment to become a meaningful driver of intrinsic motivation. Features such as customizable goals, instant feedback, recognition through badges or leaderboards, and collaborative challenges can create a work atmosphere that is both engaging and psychologically rewarding. These elements contribute to a sense of purpose, mastery, and social connectionfactors that are essential for sustainable employee motivation and performance. However, the successful implementation of gamification depends heavily on its design quality and contextual relevance. Poorly designed gamification systems that merely add points or superficial rewards without addressing psychological needs may lead to disengagement or even resistance. Therefore, banks must approach gamification not as a one-size-fits-all solution but as a context-sensitive intervention that aligns with employee values, tasks, and organizational goals.Moreover, the integration of gamified strategies should be accompanied by ongoing evaluation to ensure that they continue to meet employee needs and adapt to changing work environments. When thoughtfully implemented, gamification has the power to foster a culture of continuous learning, innovation, and shared achievement in digital banking institutions.In conclusion, gamification guided by SDT offers a transformative opportunity to enhance employee motivation and performance in the digital era. By embedding psychological insight into technological tools, banks can cultivate healthier, more productive, and more fulfilling work environments that are capable of supporting long-term organizational success.

Future Research Directions:
- Empirical validation of the proposed SAGM model in banking organizations.
- Longitudinal studies to assess sustained impact on motivation and performance.
- Cross-cultural comparisons in gamification effectiveness.
- Integration of AI with gamification to personalize motivational strategies.

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Funding Challenges for Small and Medium Enterprises (SMEs): A Perspective on Access to Capital and Financial Inclusion

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Abstract :

Small and Medium Enterprises (SMEs) are recognized as the backbone of global economic growth, contributing significantly to employment, innovation, and GDP in both developed and developing economies. Yet, despite their importance, SMEs consistently face substantial challenges in securing adequate financing, often due to systemic barriers, lack of collateral, limited credit histories, and underdeveloped financial ecosystems.This paper presents an in-depth analysis of the global funding challenges encountered by SMEs, with a particular focus on the underlying causes of financial exclusion and the inefficiencies within capital markets. It explores the multifaceted dimensions of financial access including traditional and alternative financing sources, regional disparities, and the role of policy and technology in addressing funding gaps.

The paper compares SME financing environments across countries, including successful models from India, Kenya, China, and the European Union, and evaluates the effectiveness of various financial inclusion strategies such as credit guarantee schemes, SME-focused banks, and digital financial services. It also critically assesses the role of development finance institutions, regulatory frameworks, and fintech innovation in overcoming financial barriers. The study concludes by offering actionable policy recommendations aimed at strengthening access to capital and promoting inclusive financing for SMEs. It advocates for integrated financial infrastructure, enhanced credit information systems, regulatory reforms, and targeted capacity-building programs to empower SMEs to achieve sustainable growth.

Keywords:*This research paper explores the funding challenges faced by Small and Medium Enterprises (SMEs) globally, focusing on issues related to access to capital and financial inclusion. Keywords highlighting the study include SME financing, funding barriers, credit access, financial inclusion, and the global perspective on entrepreneurial finance and capital accessibility.*

Introduction:

Small and Medium Enterprises (SMEs) play an indispensable role in shaping the economic landscape of both developed and developing nations. They serve as the foundation of entrepreneurial ecosystems and act as catalysts for inclusive growth, employment generation, and innovation. According to the World Bank, SMEs constitute more than 90% of all businesses globally and contribute to over 50% of employment, making them a dominant force in sustaining livelihoods and promoting balanced regional development. These enterprises operate across various sectors—manufacturing, services, trade, and agriculture—and are often more flexible and adaptive to market changes compared to large corporations. Their ability to respond to local demands and niche markets not only strengthens domestic economies but also enhances export potential. In developing countries, especially, SMEs offer opportunities for poverty reduction by engaging the underprivileged in formal economic activities, thus reducing income inequality.

Problem Statement:-

Despite their significance, SMEs face structural and institutional barriers in accessing finance.

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These include high interest rates, insufficient collateral, lack of formal credit history, and limited financial literacy.

Objectives of the Paper:-

1. To examine the global challenges SMEs face in accessing funding
2. To evaluate the level of financial inclusion among SMEs
3. To explore international best practices and policy interventions
4. To suggest recommendations for improving SME financing

Methodology:-

The study uses a comparative and analytical framework based on secondary data from the World Bank, IFC, OECD, national governments, and peer-reviewed journals.

Role of SMEs in Global Economic Development

1. **Employment and Livelihood Generation: -** SMEs employ a substantial portion of the workforce, especially in low-income countries where large-scale industries are limited.
2. **Innovation and Industrial Development:** SMEs foster innovation by adopting flexible production techniques and promoting entrepreneurship.
3. **Regional Development and Inclusiveness:-** In rural and semi-urban areas, SMEs reduce economic disparity by supporting local economies.
4. **Contribution to GDP: - In** OECD countries, SMEs contribute approximately 60% to GDP, while in developing economies this figure is around 40%.

Challenges in Accessing Capital for SMEs

1. **High Collateral Requirements:-**Financial institutions often require collateral worth more than the value of the loan, which discourages SMEs.
2. **Information Asymmetry:-** Banks lack reliable data to assess SME creditworthiness, leading to risk-averse behavior.
3. **Lack of Financial Literacy:-** Many SME owners lack understanding of financial products, investment planning, or credit management.
4. **Limited Credit History:** SMEs often operate informally or have thin credit files, making them ineligible for formal credit.
5. **Regulatory and Bureaucratic Barriers:-** Cumbersome loan processes, strict compliance norms, and lack of incentives make formal funding difficult.
6. **Gender-Based Disparities:-** Women-led SMEs face even greater obstacles, including social norms, discrimination, and lack of networking opportunities.

Global Landscape of SME Financing

1. **Traditional Sources**

- Commercial banks
- Cooperatives
- Microfinance institutions

2. **Alternative Financing**

- Venture Capital & Angel Investors
- Peer-to-Peer (P2P) lending
- Invoice discounting & Trade credit

3. **Digital Finance and Fintech**

- Mobile banking (e.g., M-Pesa in Kenya)
- Online credit platforms
- AI-based credit risk models

4. **Role of Development Finance Institutions (DFIs)**

- DFIs like the IFC, ADB, and EIB provide structured SME finance programs and risk guarantees to private lenders.

Financial Inclusion and Its Relevance for SMEs

1. **Defining Financial Inclusion**

- Access to affordable, timely, and appropriate financial services—savings, credit, insurance, and payment systems.

2. **How Financial Inclusion Helps SMEs**

- Expands access to working capital
- Facilitates growth and expansion
- Encourages formalization
- Reduces vulnerability to shocks

3. **Global Progress Indicators**

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- Increase in SME account ownership
- Use of digital financial services
- Expansion of mobile-based credit scoring

Case Studies: Successful Global Models

1. **India – MUDRA Yojana & SIDBI:-**
   MUDRA loans (under PMMY) have disbursed billions to micro-enterprises. SIDBI supports refinancing and capacity-building.
2. **Kenya – M-Pesa and Digital Credit**
   M-Pesa revolutionized mobile banking, offering small loans and savings accounts to informal sector entrepreneurs.
3. **European Union – COSME Programme**
   Provides loan guarantees and equity capital for SMEs through intermediaries, backed by the European Investment Fund.
4. **China – State-Supported SME Banks**
   China has established dedicated SME banks offering subsidized credit, with government credit guarantees.

Institutional and Policy Interventions

1. Credit Guarantee Schemes:- Governments share lending risk with banks through partial guarantees.
2. SME-Focused Banks and NBFCs :- Specialized financial institutions offer tailored financial products.
3. Regulatory Reforms :- Efforts include simplifying tax norms, digital KYC, and credit rating systems.
4. Capacity-Building and Training :- Financial literacy, digital onboarding, and business advisory services are essential.

Gaps and Emerging Challenges

- Fragmented financial infrastructure
- Regional inequality in financial access
- Lack of credit data interoperability
- Digital divide and technological barriers
- Exclusion of informal SMEs from formal schemes

Policy Recommendations

1. Strengthen Credit Information Infrastructure: Develop central credit registries and expand credit rating systems.
2. Promote Fintech Ecosystems: Encourage startups offering alternative SME finance.
3. Encourage Blended Finance Models: Combine public funds with private capital for impact-oriented SME finance.
4. Enhance Financial Education: Introduce targeted programs for SME owners.
5. Focus on Inclusion of Women Entrepreneurs: Design gender-sensitive financial products and mentoring programs.

Conclusion

The global SME sector stands at a crucial juncture where access to finance will determine its future contribution to inclusive growth and sustainable development. Addressing the funding challenges through integrated policy frameworks, digital transformation, and inclusive financial strategies will not only empower SMEs but also ensure broader economic resilience. It is essential for governments, institutions, and private stakeholders to collaborate towards building a robust financial ecosystem that leaves no SME behind.

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Original Article

Environmental Impact of Modern Synthetic Pesticides Cleaning Products versus Traditional Natural Alternatives: An Ecological Perspective

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Abstract:
In these days, television became the main advisor and became benchmark of standardization. Secondly TV connects the products like toilet cleaner to the social status of middle class family. Nowadays pesticides and chemical compounds are used from toilet cleaner to the utensil cleaning.In big cities or small villages, no one has time, so they consider the products shown on TV as the norm. They create the illusion that cleanliness is achieved due to these products. Sewage contains all kinds of chemicals and compounds. It is said that the soil absorbs any toxic chemical and converts it into a harmless substance.In the ancient times, natural products are used to clean washroom, toilets etc. These products are Cow urine and dung, mustard, basil water etc. All these are eco-friendly and natural.
Today's cleaners, including weed killers, are synthetic chemicals such as pesticides and herbicides. These contribute to environmental degradation, biodiversity loss, and human health risks.It is necessary to identify the toxic and general chemicals during the advertisement. In India, it is necessary to provide education about toxic synthetic chemicals during childhood. Increased use of such indirect chemicals damages biodiversity and pollutes water and sediment.
Keywords: *Modern and ancient Cleaner, Ecology, finance and capital accessibility.*

Introduction:

In India, it is necessary to provide food for the growing population. It is not possible to grow crops in large quantities using only organic fertilizers. As an alternative, pesticides and chemical fertilizers are used in large quantities. These chemicals, which are added due to floods during the monsoon, start getting washed away in the water of rivers, springs, and wells, damaging the water and aquatic life. Nowadays, a large number of bathroom cleaners, toilet cleaners, drainage cleaners, dishwashing detergents, laundry detergents, chemicals used to clean tiles, chemicals used to clean glass, and plastic paints applied to homes, as well as paints made from chemicals, are being used. Although they provide a short-term sense of cleanliness, their harmful effects can be seen from the drains near the house to the sea.

An ecological footprint quantifies the biologically productive land and water needed to sustain an individual or a population's way of life, taking into account the resources used and the waste produced. Every organism on Earth lives by the principle of life; life is life. Even the smallest, most microscopic organisms strive to ensure that life on Earth prospers. In the competition for profit, big companies do not consider whether everyone is happy. So, what about health, bodybuilding, and human welfare? Contaminated water mixes with clean water, and gradually, animals and birds get sick after drinking it. The microorganisms, germs, and microscopic organisms present in the water also get harmed. So, can the microscopic animals and aquatic creatures in the sea be safe?

Objectives of study :-

1. To fill out a questionnaire or collect information about septic tanks in affluent and impoverished areas.
2. To study the effect of toilet cleaners, chemicals, and compounds on microorganisms in

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Septic tanks.
3. To draw the conceptual diagram.

Scope of Study:-

The study investigates the effects of toilet cleaners and detergents on human health and the environment. It focuses on potential contamination of water bodies, impacts on aquatic life, and health risks from exposure to these products. Additionally, it evaluates the effectiveness of cleaning products in removing pollutants from sediments and their long-term effects on soil and water quality.

Review of Literature:-

(Eugene Appiah–Effah et.al.2020).

The study investigated the effects of calcium carbide and lambda super 2.5 EC (LSEC) on faecal sludge characteristics. Initially, the sludge was slightly acidic with high levels of slowly degradable organic matter. In a controlled experiment, untreated sludge showed reductions in BOD5 (30%) , COD (34.7%) , helminth eggs (99.8%) , and sludge mass (55%) after 30 days. Calcium carbide improved these metrics by 47.4%, 48.3%, 99.6%, and 61%, while LSEC achieved reductions of 40.6%, 47.9%, 95.9%, and 58%. However, neither treatment met regulatory discharge limits for key quality parameters, indicating a need for further research.

(Zhihai, 2017).

Toilet cleaners are formulated with various chemical components that enhance their cleaning, sterilization, and environmental safety properties. Common ingredients include surfactants, acids, and chelating agents, which contribute to effective decontamination and odor removal. For instance, one formulation contains sodium tripolyphosphate, surfactants, and citric acid, providing strong cleaning and deodorizing capabilities while being biodegradable.

(Kuan, 2015). Another cleaner utilizes alkyl benzene sulfonic acid and clove oil, achieving a neutral pH that minimizes corrosion to toilet surfaces.

(Longdi, 2013). Formulations designed for grease removal also contain methanesulfonic acid and sodium citrate, which help ensure that surfaces are not harmed.

(Juessen & Juessen, 2000). The process of treating chemical toilet waste includes sedimentation methods to handle the waste properly, emphasizing the role of chemical reactions in both cleaning and waste management.

(Shilin et al., 2015). In summary, these formulations demonstrate a harmonious integration of effectiveness and environmental sustainability in the context of toilet cleaning products.

Research Design and framework:-

We are going to present a hypothesis that will prove the objectives.

Set of Hypothesis :

Null Hypothesis (H_0) : The toilet cleaner chemical compound does not affect microbes in the septic tank.

Alternative Hypothesis (H_1) : The toilet cleaner chemical compound affects microbes in the septic tank.

Basically, we are not conducting the laboratory work. From the outer symptoms of the septic tank, we are going to prove the hypothesis. For that, we have created a questionnaire consisting of 7 questions, which are in the form of YES or NO.

Set of Questionnaire:-

1) Less water comes out of the safety tank outlet ? ..... Yes / No
2) Is there no water coming out of the safety tank outlet at all?..... Yes / No
3) Does the water at the outlet of the safety tank have a foul smell? Yes / No
4) Does a thick layer form after the water comes out of the outlet of The safety tank? Yes / No
5) Does water mixed with bathroom detergent go into the toilet seat? Yes / No
6) Does the toilet seat get grease, oil, etc.? Yes / No
7) Is there a smell of gas in the area around the safety tank outlet? Yes / No

Table No. 1

This table indicates the Group-YES and Group-NO with the YES-ok and NO-ok Category.

No.	Question No.	Group-YES	Group-NO	YES-ok	NO-ok	Total
1	Que. No. 01	X	✓	18	05	23
2	Que. No. 02	✓	X	08	15	23
3	Que. No. 03	X	✓	18	05	23
4	Que. No. 04	✓	X	06	17	23
5	Que. No. 05	✓	X	02	21	23
6	Que. No. 06	✓	X	02	21	23
7	Que. No. 07	✓	X	18	05	23
	Total			**72**	**89**	**161**

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This table has 7 columns. Numbers 3 and 4 are for Group YES and Group NO. Columns 5 and 6 are allotted for YES okay and NO okay. The total number of samples taken is 23. The answers given by the people are based on their experience. YES and NO are classified on this basis. The collected answers are classified according to the colonies of microorganisms present in the septic tank. These microorganisms or bacteria are divided into aerobic bacteria and anaerobic bacteria. Aerobic bacteria need oxygen and digest the upper layer of the septic tank, while anaerobic bacteria do not require oxygen; they digest the bottom part of the septic tank.

Table No. 2

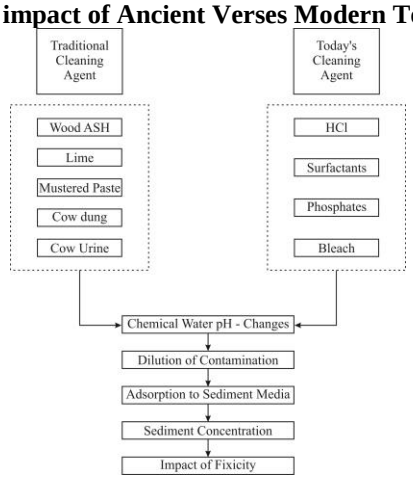
Using online Chi. Squre Calculator

Sr.No.	Item	Value
1.	Significance level	0.05
2.	Category - YES and Group - YES	36(20.57) [11.57]
3.	Category - YES and Group - NO	10(25.43) [9.36]
4.	Category - NO and Group - YES	36(51.43) [4.63]
5.	Category - NO and Group - NO	79(63.57) [3.74]
6.	Chi. Square Statistic	29.3056
7.	P-Value	0.00001
8.	P-Value < 0.05	Null hypothesis Rejected

This table is formed with the help of the online calculator for chi-square statistics. The significance level has been taken as 0.05. The value of the chi-square statistic is 29.3056. The p-value obtained is 0.00001. The p-value is less than 0.05, so the null hypothesis is rejected, and the alternative hypothesis is accepted.

Diagram No -01

Simulation diagram of environmental impact of Ancient Verses Modern Toilet Cleaner.



This figure is a simulation diagram of environmental impact. In this figure, a traditional toilet cleaner is compared with a modern toilet cleaner based on biodegradability. It shows that in ancient times, natural cleaners were used to clean bathrooms, toilets, utensils, and floors. Cow urine, wood ash, and other natural substances were used for this purpose. In modern times, we are using cleaning products from numerous companies. Their cleaning products contain chemical compounds, such as HCl, surfactants, phosphates, sodium hypochlorite, benzylkonium chloride, bleach, and others. The adsorption rate of chemicals in soil or sediment is more than 10%, while the adsorption of traditional cleaning agents is zero.

Table No. 3

Table showing the comparative between the modern and ancient clearing agent

Sr.No.	Agent	Modern Clearing Agent	Ancient Cleaness
1.	Origine	Synthetic Chemicals	Ash, Lime, Cow Urine
2.	pH factor	Acidic	No effect
3.	Toxicity	Highly to fish, algae, bacteria in sediment	No
4.	Bio-degradability	Low	High friendly to Nature
5.	Accumulation on SEDIMENT	High eg. acids, surface tants 16.2 mg/kg	Low

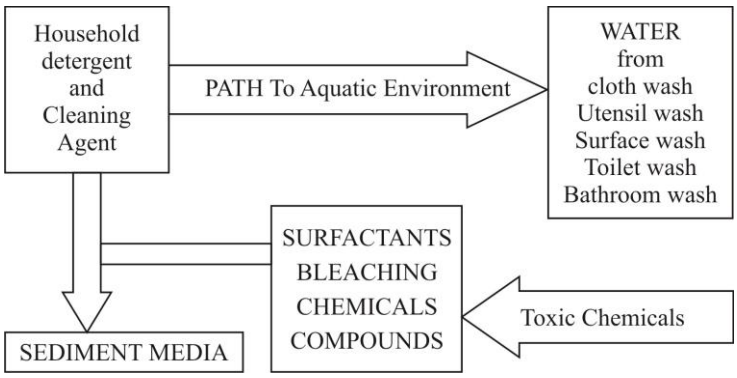
In this table, we are going to compare modern cleaning agents versus ancient cleaning agents. In this case, we have taken five points as a base. The first point is origin; in modern cleaning agents, synthetic chemicals are used, while in ancient cleaning agents, ash, lime, and cow urine are used. Modern cleaning agents make the soil acidic. The chemicals and compounds used in modern agents destroy aquatic life as well as the quality of soil and sediment in

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water. The rate of accumulation of chemicals and compounds in the sediment is very high, so the supply of water becomes acidic or hard water.

Diagram No -02

Conceptual diagram indicting the path of pollution.



This diagram also indicator the environmental risk aspects. Toxic, hazardous compound from household detergents & cleaning chemicals, rest to the Sediments.This The diagram is a conceptual diagram. The path of the aquatic environment is mentioned. This diagram shows the special effect of a modern clearing agent and highlights it.

Results:-

The p-value is less than 0.05, it can be concluded that the hypothesis is rejected. In other words, we can say that the microorganisms in the septic tank play an important role in the ecosystem; they produce pure fertilizer. Cleaning agents contain chemicals and compounds that, when mixed in the septic tank, cause the water to become acidic, thereby reducing the appetite of the microbes. New laws are needed to save the environment. In these laws, chemicals and compounds that are toxic should be banned. Alternatives to these harmful substances include neem oil, tea tree oil, and vinegar. Surveillance and monitoring are necessary for ecological integrity. Although these measures may seem small, they are very important for the ecosystem. The microbes in septic tanks work for humans. Why are we killing them by using toilet cleaners and detergents?

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Original Article

AI Gamification in Business Growth

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Abstract:

Gamification has been praised as a successful strategy in modern businesses to guarantee customer loyalty, boost employee productivity, and ensure client involvement. Firms that include games, competitions, charts and prizes in their work have inspired people to work together and influence user behaviour. Lately, AI has made gamification more data-based, attentive to users and aiming for a personal experience. Customized games are generated for each player using automation, machines and analytics in AI-powered gamification. This study looks at how gamification using AI influences user interactions across many industries, helps businesses expand, and aids in decision-making.

Gamification is possible with AI since it allows real-time analyses, the setup of personalized feedback and content creation.AI-based gamification gives more freedom and is therefore more accepting to people who enjoy variety. Still, AI can collect user interface information, notice their behaviour and find out their interest, changing the challenges and rewards as need be. By being so individual, it becomes more interesting for users and helps them remember more. Using AI in gaming, e-commerce companies give customers special guest stars, interactive games and gamified product suggestions to boost their interaction with the website.Education programs use AI to find out what is missing in a person's knowledge, set appropriate challenges and help them enjoy and benefit from learning. Another hugely important advantage of gamification is the ability of an AI to provide data-informed insights. The use of AI-driven analytics allows businesses to record user activity and predict any further trends. Using this data, we can improve advertising, change our website to enhance users' experience and persuade more visitors to buy from us. AI can study customers' shopping habits and use this data to introduce interactive incentives to encourage them to come back. As in many sectors, AI can help make managing finances fun by rewarding people for saving, investing wisely or fulfilling their financial targets. They improve customer satisfaction and also provide companies with useful data for making decisions.

Additionally, AI-driven gamification relies heavily on automation. AI helps reduce employees' workload by allowing real-time alerts, changing messages and special incentives to users, while still boosting their interest. Clients can be assisted by chatbots and virtual assistants through conversations, entertainment and quick replies. AI becomes even more effective at engaging people by applying NLP which allows AI to sense emotions, likes and needs in conversations with users. AI-driven gamification can still lead to issues like ethics, information privacy and too much dependence on technology. To win users' trust, it is important for companies to work ethically in AI, have clear guidelines governing their data and treat everyone equally in the awards they offer using AI.0 This paper reviews existing literature, examines case studies, and presents expected findings on AI's impact on gamification. Companies may use AI-based gamification to improve their strategies, promote innovation, draw happy customers and reach sustainable success. The study will highlight the best ways for industries to use AI-driven gamification to improve participation and results.

Keywords: *Gamification mechanics, Gamification in corporate training, Gamification in retail and e-commerce, AI-powered user experience, Employee productivity enhancement.*

Introduction:

Facing competition in today's world of rapid technological change, businesses turn to new technologies to engage their users more, operate better and achieve higher productivity. Many industries are finding gamification useful which involves awarding points, badges, adding leaderboards and setting up challenges in work scenarios.

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A lot of research recognizes that using games in various contexts can attract people, make things interesting, motivate them and reward hard work. Using gamification, companies aim to make customers loyal, improve learning at work and increase how efficiently staff work. Unfortunately, classic approaches to gamification depend on rules that are fixed for everyone which can become unsuitable for many users. marketing. Within companies, AI makes gamification possible by creating unique training courses, offering rewards based on achievements and helping manage tasks in a gamified way. AI provides customers with ways to participate more interactively and intuitively.

Integrating AI into gamification has allowed businesses to improve their methods for engaging employees. With AI gamification, experiences are improved by offering personalized experiences, fast reactions and analysis of future trends. In contrast to traditional gamification, AI gamification can vary the experience instantly, while the other works with set patterns. Since gamification is customizable, it keeps users interested and helps them remain engaged for a long time. AI is important in gamification, as it supports automation, smart choices and a close analysis of data. With machine learning, AI analyses users' data to anticipate their actions, amend challenges for people of different abilities and offer helpful feedback. AI helps to personalize rewards and offers a fun way to interact, promoting returning customers in

In e-commerce, AI examines customers' buying habits and uses games to motivate them to purchase again, whereas education benefits from AI gamification because it adjusts lessons according to every student's performance. We look at how AI and gamification are related, focusing on customer engagement, employee work and advertisement. Studying existing works, case studies and use cases in the industry will help understand the benefits of AI-driven gamification for business growth. The paper will also consider the challenges in data privacy, the importance of ethical issues and what could happen if AI is heavily used in gaming. Realizing the power and effect of AI in gamification, businesses can adopt successful strategies that rely on data. AI-enabled games can be introduced to businesses via chatbots, virtual assistants and instant recommendation programs.

Literature Review

Applying game concepts encourages people to be more involved, motivated and active in various environments. Scholars have demonstrated a noticeable effect of introducing points, badges, leaderboards and challenges into non-gaming activities on users' motivation and performance (Deterding et al., 2011). The mechanics help users feel accomplished, drive them to compete and support their learning and use of technology-based resources from businesses. Gamification Plays a Role in Different Domains Researchers found that gamification that rewards customers strengthens their loyalty to a brand by encouraging them to interact more (Hamari, Koivisto, & Sarsa, 2014). Introducing gamification at work increases productivity by using performance-based activities and appreciating employees (Sailer et al., 2017).

AI-Driven Gamification

Traditional gamification models are advanced through AI by using machine learning, predictions and real-time data to provide interactive games (Zichermann & Cunningham, 2011). AI strengthens the gamification process by applying personalization, analysing behaviours and handling automation. AI can customize elements of the game for users, using data to maintain their interest over a longer period (Tondello et al., 2016). If behaviour is predicted, businesses can update the games they offer to maintain user interest. Actually, AI is able to recognize when a user becomes less involved and presents them with exciting or motivating subjects (Gartner, 2018).

Automatic, real-time changes

Gamification systems powered by AI rely on automation to change challenges instantly, immediately give feedback and look after the rewards (Kim, Song, & Lockwood, 2018). Real-time feedback tools appear to improve learning by personalizing quizzes, homework and learning modules for an individual student (Landers & Armstrong, 2017). Personalized campaigns and tailored rewards are made possible for users in marketing thanks to the automated use of AI by businesses (Chou, 2015).

Effect on Forming Relationships with Customers and Corporate Activities

Thanks to AI-powered gamification, e-commerce stores experience higher conversion rates due to the suggestions offered and loyalty programs received (Liu, Santhanam, & Webster, 2017). The financial sector now makes use of AI-based games to motivate people to save money or decide on good investments (Harwood & Garry, 2015). AI adjusts the setups without delay and offers suggestions using collected data to enrich development programs (Gee, 2013).

Ethical Considerations and Challenges

Using AI in gamification does come with some concerns, including privacy, ethics and trusting too much to programs and computers. Experts argue that AI should be clear about its workings and fair for all while still protecting each person's information when designing gamified rewards (Floridi et al., 2018). To build responsible AI, it is important to examine ethical matters such as manipulating users, unfair bias and excessive consumption of AI-driven media (Burr, Cristianini, & Ladyman, 2018). Since AI-gamification is used in businesses more often, it is essential to study its effects in the long run and for different types of industries.

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Conclusion:

Experts have recognized that AI is changing gamification and it aids in making experiences more relevant, anticipating decisions and completing job tasks without manual intervention. Applying AI in gamification allows companies to enhance customer loyalty, boost their employees' achievements and grow their business. But, taking care of ethics and making sure AI is applied with transparency is necessary for the development of AI-driven games.

Objectives

1. To analyse the role of AI in enhancing gamification strategies for business growth.
- Investigate the impact of AI on gamification in different business industries.
- Evaluate how the use of AI in gamification by rewarding players, helping them follow their progress and stimulating competition boosts the business.
2. To observe how personalization with AI affects the level of user involvement.
- Look into how AI uses information on users' behaviour, what they like and how actively they use a brand to improve their experience.
- Consider the role personalization plays in encouraging people to stay, be content and keep using your services.
3. To explore AI-powered gamification in marketing, employee training, and customer retention.
- Consider how interactive ads, gamification and incentives involving AI can help improve marketing.
- Notice how AI in training material allows you to practice and track your learning achievements.
4. To assess challenges and ethical considerations in AI-enabled gamification.
- Be aware of issues related to AI-based games, for instance, privacy concerns, giving fair rewards and people becoming overly reliant on the AI.
- Look into rules and guidelines that guide the ethical use of AI.
5. To highlight what is expected in future developments and innovations with AI-driven gamification.
- Look into how AI is being combined with VR, AR and blockchain technology.
- Explore AI tales that shape and enhance technology for emotional reactions, making the experience more exciting.

Expected Findings

Both user engagement and company performance are greatly enhanced by AI gamification. These firms will experience higher involvement, encouragement and interaction from their users, thanks to their AI-powered gaming strategies.

Personalized recommendations from AI encourage customers to continue using a business and enjoy their experiences. AI-powered personalization will play a crucial role in increasing the customers' satisfaction and stimulating their long-term loyalty.

AI-powered analytics help companies identify insights that can enhance their approach to gamification. AI will be used to track the engagement of users, anticipate their behaviours and make gaming more engaging.

Gamification procedures that feature AI-are embraced in such industries as retail, as well as finance, healthcare, and education. Implementing AI gamification will bring benefits to businesses and make the experience better for customers.

For these challenges to be adopted over time, issues related to data privacy, ethics and expenses must be dealt with. Careful attention should be paid to data security for users, the ethics of using AI and the overall costs to continue thriving over time.

Conclusion

AI-assisted gamification is transforming business engagement strategy through incorporating intelligent and data-based solutions. AI enables businesses to enhance gamification for individuals and make the experience more interactive. With the support of AI, gamification gives each user custom tasks, real-time results and motivational designs, boosting both clients' and staff's levels of commitment. The use of AI in video games benefits us, but at times it leads to concerns about privacy, ethics and overspending. They should clearly explain their AI processes, ensure users are compensated and guard their personal information. As technology improves, AI-powered emotion sense and adjustable stories will be used for gamification to have a bigger impact in industries. Using AI-powered gamification in the organization can help them search for new innovations, engage with customers and progress in the future.

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Original Article

Death, Disease, and the Dharma Dilemma: Reinterpreting *Samskara* in a Pandemic Framework

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Abstract:
This paper critically examines U.R. Ananthamurthy's Samskara: A Rite for a Dead Man as a significant contribution to pandemic literature and epidemic narratives, highlighting how pandemics bring about profound transformations in the everyday lives of individuals and communities. Literature, especially during times of crisis, has long served as a powerful medium to reflect, critique, and cope with socio-cultural anxieties. In the context of Samskara, the outbreak of a mysterious disease in a Brahmin community becomes a narrative catalyst to interrogate the rigidity of caste-based hierarchies and religious orthodoxy. Indian vernacular and world literatures are replete with pandemic narratives, and this novel stands out for its nuanced portrayal of the moral and spiritual dilemmas faced by a deeply stratified society. Through the crisis surrounding Naranappa's death and the indecision regarding his cremation, Ananthamurthy critiques the blind adherence to ritual, the misinterpretation of Dharma, and the stagnation caused by orthodoxy. The novel posits that the origins of casteism and untouchability stem more from the misreading of sacred texts than their true essence. This study further argues that pandemic literature like Samskara not only documents societal collapse but also provides a source of solace, introspection, and moral guidance during times of existential upheaval.
Keywords: *Pandemic Literature, Caste System, Orthodoxy, Dharma, Social Critique*

Introduction:

Pandemic literature has gained renewed scholarly attention in the wake of global health crises such as the COVID-19 outbreak, which has foregrounded the intricate ways in which disease and contagion disrupt everyday life, social relations, and cultural systems. Literature has long served as a repository of human experience in times of collective trauma, particularly during epidemics, where narratives emerge not only as historical accounts but also as moral and philosophical reflections (Felski). Within Indian literary traditions, pandemic narratives—especially those articulated in vernacular languages—frequently delve into the entrenched social hierarchies and religious structures that govern individual and communal life. These narratives often act as mirrors reflecting societal anxieties and contradictions, particularly those surrounding caste, ritual purity, and orthodoxy. U.R. Ananthamurthy's Samskara: A Rite for a Dead Man exemplifies such a literary intervention. Set against the backdrop of a plague-like epidemic in a Brahmin settlement in South India, the novel weaves a powerful critique of religious orthodoxy, caste rigidity, and the moral crisis of the individual in the face of societal decay. Samskara is a novel of deep philosophical inquiry, portraying a decaying Brahmin agrahara (settlement) in the fictional village of Durvasapura. The narrative unfolds with the death of Naranappa, a heretical Brahmin who openly defied the religious codes of his community—consuming meat, drinking alcohol, consorting with a low-caste woman, and rejecting traditional rituals. His death, occurring amidst an atmosphere of fear and superstition

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due to the lurking threat of a plague, creates a moral and ritual crisis among the Brahmins. The central conflict revolves around who should perform Naranappa's last rites—a duty customarily performed by kin but complicated by Naranappa's rejection of Brahminical norms. The crisis exposes the hollowness of ritual purity and reveals the internal contradictions within the Brahmin community, who, despite condemning Naranappa in life, now find themselves immobilized by his death.

At the heart of the novel is Praneshacharya, a revered scholar and spiritual leader, known as the "crest jewel of Vedic learning." His spiritual authority and adherence to scriptural orthodoxy are tested profoundly by Naranappa's death and the community's paralysis. As he grapples with the burden of decision-making, Praneshacharya undergoes an existential transformation, eventually abandoning the rigidity of his beliefs in pursuit of a more authentic human experience. His journey symbolizes the tension between tradition and change, scriptural determinism and personal freedom. This paper examines Samskara as a pandemic narrative that transcends the literal representation of disease to interrogate the metaphoric contagion of casteism, religious orthodoxy, and moral decay. It seeks to explore how Ananthamurthy employs the setting of an epidemic to critique the deeply rooted caste system sanctioned by texts such as the Bhagavad Gita, Rigveda, and Manusmriti. Furthermore, the novel serves as a meditation on dharma, moksha, and the individual's quest for spiritual liberation within a fragmented and dogmatic society. By portraying the disintegration of a community through the death of a single individual, Samskara highlights the socio-religious crisis of modern India, offering a poignant reflection on the limitations of orthodoxy in the face of human suffering and mortality.

Literature Review

N. Ramachandran (2006) foregrounds Samskara as a critical examination of Brahminical orthodoxy and caste-based social rigidity, revealing the hypocrisy embedded in ritualistic practices. A. Chakrabarti (2014) discusses the novel's portrayal of death rites, particularly the complexities around Naranappa's cremation, highlighting how ritual and social identity intersect during moments of crisis. Rajeshwari Sundar Rajan (2017) interprets Samskara through the prism of caste and contagion, arguing that the Brahmin community's anxiety about purity parallels pandemic fears of contamination, thus positioning the novel as an allegory for social crises exacerbated by disease.

In the broader field of pandemic literature, Rita Felski (2020) and Pramod K. Nayar (2021) assert that narratives of epidemics often reveal underlying societal tensions and power structures, offering a useful framework to revisit Samskara's themes. Arjun Appadurai (2013) and Gayatri Spivak (2016) explore the dharma dilemma faced by the protagonist Praneshacharya, emphasizing the conflict between rigid scriptural orthodoxy and the necessity for compassionate, pragmatic responses during crises. This multidisciplinary scholarship enriches the reinterpretation of Samskara as a pandemic narrative, deepening its relevance to contemporary discussions on death, disease, caste, and morality.

Dharma Disrupted: Faith under the Plague

Anantha Murthy's Samskara is an incisive exploration of how a pandemic serves as a catalytic force, disrupting entrenched social hierarchies and prompting profound moral and existential reckoning. The outbreak of the plague in the novel is not merely a physical disease but also a symbolic agent of change that exposes the deep fissures within the rigid caste-based Brahminical order. As the villagers grapple with the decaying body of Naranappa—an outcast who openly defied orthodox customs—their inability to perform his last rites becomes both a literal and metaphorical sign of societal paralysis. This inertia reflects the community's reluctance to confront its hypocrisies, as religious orthodoxy clashes with the urgency of survival in the face of a spreading epidemic (Ramachandran 46).

The caste question is deeply intertwined with the crisis. Chandri, a lower-caste woman and Naranappa's companion, emerges as the only individual who exhibits pragmatic concern for the decomposing corpse, challenging the moral superiority of the Brahmins. Her actions reveal the hollowness of a system that prioritises ritual purity over human decency. Her offering of her jewellery and appeal for cremation underscores the ethical strength found beyond caste confines. In contrast, Praneshacharya, the learned Brahmin and moral anchor of the agrahara, finds himself morally adrift, ultimately confronting the futility of blind adherence to scriptures. His illicit encounter with Chandri shatters his spiritual facade, leading to an internal transformation that forces him to question the meaning of Dharma.

As the plague ravages the village, it erodes the caste and class barriers that once structured society, revealing the vulnerability and universality of human suffering. The pandemic levels distinctions, forcing individuals to confront shared mortality. It is Manjayya, a forward-thinking Brahmin, who finally recognises the necessity of modern intervention, calling for medical aid, rat extermination, and evacuation. His pragmatism stands in stark contrast to the superstitious passivity of others, reflecting a shift towards rationality.

Ultimately, Samskara positions the pandemic as a mirror that reflects the moral decay of a society clinging to outdated rituals. It invites a re-evaluation of ethical responsibilities, human interconnectedness, and the urgent need to transcend regressive customs in times of collective crisis. The plague, thus, becomes both a destroyer and a revealer—dismantling the old and gesturing toward the possibility of a more humane social order (Rajan).

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Critique of Religious Orthodoxy and Casteism in Samskara

U.R. Ananthamurthy's Samskara explores the deep-rooted orthodoxy, ritualism, and casteism embedded within the Brahmin community of a South Indian agrahara. The novel serves as a sharp critique of Hindu social practices, raising serious questions on the authenticity of cultural and religious purity, particularly within the Brahminical order. By presenting complex characters like Praneshacharya and Naranappa, Ananthamurthy unveils the contradictions between ideals and actions in a decaying socio-religious structure.

At the heart of the narrative lies the death of Naranappa, a Brahmin by birth but rebel by lifestyle, who challenges the rigid practices of the community. His open relationship with Chandri, a Dalit woman, his consumption of meat and alcohol, and his mingling with Muslims are acts seen as blasphemous by the orthodox Brahmins. However, his rebellious nature forces the agrahara to confront uncomfortable truths about the hypocrisy and irrelevance of ritualistic purity. (Chakrabarti)

The central question—"Who should cremate Naranappa?"—paralyzes the Brahmin community. Though they denounce him as an outcaste in life, his death as a Brahmin becomes a spiritual dilemma. No one dares perform his last rites for fear of losing their caste purity. The spiritual leader, Praneshacharya, revered as the "Crest-Jewel of Vedic Learning," fails to find a solution through scriptures or rituals, exposing the hollowness of religious dogma. In contrast, it is Chandri, the Dalit woman and Naranappa's partner, who takes the moral decision and cremates the body with the help of a Muslim friend. Her act symbolizes humanism triumphing over religious orthodoxy.

Praneshacharya's transformation is central to the novel's message. His life, previously devoted to ritual, celibacy, and self-sacrifice, comes under introspection after Chandri's actions and his own moment of weakness. His crisis leads him away from the agrahara in search of self-realization. Through this journey, he begins to see the limitations of religious codes and the necessity for moral courage and compassion. Ananthamurthy contrasts the sterile lives of Brahmin women with the vitality of Dalit women like Chandri, who are shown as independent, humane, and practical.

Ananthamurthy exposes how Brahminical dominance in the name of religion masks moral decline. The priesthood is portrayed as commercialized, with Brahmins performing rituals not for spiritual elevation but for economic survival. The novel condemns how caste and religion have been misused to oppress women and Dalits, reinforcing patriarchal and communal hierarchies. Yet, it does not wholly reject Indian tradition. It acknowledges the original purpose of samskara—a purificatory rite meant to elevate the mind and soul—but critiques how these values have been corrupted.

The novel offers a literary exploration of sociological and anthropological issues like caste, moksha, and morality. While casteism today is a distortion of the original varnashrama system—meant to categorize people based on qualities, not birth—Samskara shows how caste has become a tool of exclusion and hypocrisy. Naranappa, though seen as an anti-social figure, is ultimately a reformer who exposes the need for change. His deliberate rejection of Brahminhood forces the society to introspect and reveals the deep moral failure of those who claim religious superiority.

Conclusion:

The critique U.R. Ananthamurthy presents in Samskara gains heightened credibility and moral weight precisely because it emerges from within the Brahmin community itself. As an insider, Ananthamurthy interrogates the moral contradictions and socio-religious hypocrisies of his own caste with an authenticity that lends the novel its profound sociological significance. Samskara is not merely a fictional account; it is deeply rooted in the lived realities of the author's childhood, where the characters and events reflect real people and practices from his village. This autobiographical underpinning reinforces the text as a potent social document that exposes casteism as a human-made structure devoid of genuine religious sanction.

The symbolic title Samskara, meaning both 'ritual' and 'inner transformation', demands a deconstructive reading. It unravels the aporetic structure of religious orthodoxy and lays bare the moral stagnation at the heart of caste-based hierarchy. The narrative questions the legitimacy of caste through the character of Naranappa, whose defiance of Brahminical codes positions him as a radical voice against the system. Ironically, it is Chandri, a lower-caste woman, who demonstrates the true essence of dharma by performing his last rites—an act of moral courage over ritual purity.

Ananthamurthy thus envisions a transformative ethics rooted in humanity rather than ritualism. The novel advocates for a moral order where dignity, empathy, and justice transcend caste boundaries. Deconstruction here becomes a methodological tool to critique religious absolutism and reconstruct a more humane, inclusive social fabric. Ultimately, Samskara articulates a vision of Hinduism as a dynamic, evolving tradition capable of self-correction. It compels modern Indian society to reevaluate the oppressive remnants of caste and ritual in light of universal human values—trust, compassion, and mutual respect.

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Original Article

Personality Analysis of Major Characters in the Novel in the Woods by Tana French through Myers-Briggs Type Indicator

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Abstract

Personality is a specific characteristic of a person that refers to the combination of his qualities like thinking, feeling, and the way of behaving that regulates his activities in the environment he is exposed to. Personality varies from person to person, with unique patterns based on biological and environmental influences. The function of personality is to embrace one's ideas and attitude, significantly influencing one's actions. The result of an action, either good or bad, is the response to certain personality characteristics. Several studies on personality have been conducted to define and study its varied qualities. The Myers-Briggs Type Indicator (MBTI) is a popular framework proposed by Katherine Cook Briggs and Isabel Briggs Myers for determining an individual's personality through introspection. The MBTI indicator is divided into four groups, each with two opposing cognitive functions influencing personality. By analysing each cognitive function of the individual, the ultimate result of the personality type to which an individual belongs is perceived. This paper prefigures the personality analysis through the Myers-Briggs Type Indicator for the major characters of the novel In the Woods by Tana French.

Keywords*: personality, behaviour, introversion, intuition, thinking, and judging*

Introduction

Tana French is an American-Irish writer. She is an actress by profession and an author by passion. She received her training at Trinity College in Dublin before starting her career as a theatre performer. Eventually, French penned up her long-term interest in mysteries and crime through novels. In her late 30s, French began her writing career and produced six books in the well-known Dublin Murder Squad series. The stories in the series are In the Woods, The Likeness, Faithful Place, Broken Harbour, The Secret Place, and The Trespasser. The personality assessments of the significant figures in French's debut book, In the Woods, are pored over in this paper. Tana French, in her 2007 novel, In the Woods, tells the story of a fictional detective, Rob Ryan, and his investigation of the murder of an adolescent girl, Katherine Devlin, in the archaeological site of a small village called Knocknaree on the outskirts of Dublin. Ryan and his partner in the investigation, Cassie Maddox, go searching for the murderer. After several inquiries, the detectives find out the murderer is a hitman hired by Katherine's elder sister, Rosalind Devlin. This paper examines the personalities of the important characters in the novel, including Rosalind Devlin and Rob Ryan, through MBTI and brings out the reasons for their actions.

The Myers-Briggs Type Indicator (MBTI), elaborated by Katherine Cook Briggs and Isabel Briggs Myers, is a personality assessment device that helps people identify their personality type. Isabel Briggs Myers and Peter Briggs Myers together published a book, Gifts Differing: Understanding Personality Types, describing the MBTI model in detail based on the psychological concepts of the Swiss psychologist Carl Gustav Jung. Myers considered each personality to be a reward and stated, "Although we all have access to the same basic tools in our psychological toolbox,

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Each of us is more comfortable with and thus prefers a particular tool (or set of tools) for a particular task" (Myers and Myers). During the Second World War, women were appointed to the industrial workforce due to the deaths of men in warfare. Undoubtedly, working in an industrial setting was challenging for most women. According to Isabel Briggs Myers and her mother, Katherine Cook Briggs, the solution is to have a firm awareness of one's personality to determine their preferences for the kinds of jobs they are qualified for. They used the Jungian type theory to create the Myers-Briggs Type Indicator (MBTI), which was the result of this.

It was the Jungian idea of personality that gave rise to the Myers-Briggs Type Indicator. According to Carl Jung's hypothesis, an individual's personality can either lean towards extraversion or introversion, depending on their environment and psyche. In addition, the MBTI focuses on the mind's preferences to perceive (being aware of objects, etc.) and judge (coming to a decision). The MBTI includes four dichotomies with sixteen personality types. The first dichotomy is based on the association with the outer world, i.e., extraversion (E), and the association with the inner world, i.e., introversion (I). The second includes sensing (S) and intuition (N) based on the way of putting out a piece of information. The state of decision-making is divided into two dichotomies, namely thinking (T) and feeling (F). The last dichotomy is based on the lifestyle, separating it into judging (J) and perceiving (P). As a result, each of the dichotomies is used to create an acronym for all sixteen personality types, such as ENFP, ISTJ, etc.

Introvert Personality

In the novel In the Woods, the MBTI is used as a prism to examine the personalities of several individuals. The study begins by examining the personality of the novel's main character, Rosalind Devlin, the elder sister of the deceased Katherine Devlin. The personality of a person falls under the Jungian archetype, and MBTI declares that "type theory holds that the archetypes are inborn in us all" (Myers and Myers 53). Based on the description given in the novel, the personality type of Rosalind is identified to be INTJ, which stands for introverted, intuitive, thinking, and judging. Rosalind demonstrates an introverted personality by being reticent and reclusive, which is found in the scene after the detectives' investigation with her parents, where she makes a phone call to Ryan requesting "…do you think I could come in and talk to you sometime? … There's something I need to ask you" (French 128). Rosalind conceals the truth until the detectives reveal her involvement in the murder. The majority of introverts find comfort in the company of a small group of people they fully trust. Rosalind is confirmed to be an introvert who finds solace in the presence of Rob Ryan, who understands her circumstances.

Myers declares that "introvert children, entirely ignoring many of the distracting outer stimuli, follow their own quiet bent" (Myers and Myers 54). Rob Adam Ryan is also a main character and narrator in In the Woods. Based on the information provided in the novel, the personality type of Ryan is also INTJ, as is that of Rosalind. Myers calls out that "the introvert, however, starts farther back—with the inner ideas, the mental concepts, derived from what Jung calls the archetypes" (Myers and Myers 53). Ryan seems to maintain a distance from everybody around him. He shares an apartment with Heather whom Ryan "fancied" (French 94). Sometimes Ryan pretends to be sick in front of Heather when he wants to be alone and escapes to his room to progress on his investigation files. Ryan keeps his thoughts and emotions hidden from the outside world, especially when he is in the woods, where he claims, "I saved the wood for Saturday night, hugging the thought to myself like a child saving a huge Easter egg with some mysterious prize inside" (French 345). He often seeks solace in the nearby woods, which is tied to his childhood trauma, clearly indicating his introverted nature.

Intuitive Personality

Rosalind is portrayed as having clever and perceptive thinking throughout the entire novel. She exhibits a keen sense of analysis and frequently foresees the results of her decisions. This is obvious in the scene in which she plots the murder of her younger sister, Katherine Devlin. Rosalind seems to have a strategic mindset while planning the death of her sister with the hatchet man Damien Donnelly, where she admits, "You see what I mean? He was supposed to have sex with her, hit her on the head with a rock, and leave her body somewhere on the dig or in the wood" (French 508). Her intuitive mind works well when Cassie tells Rosalind that "he did what you wanted in the end" (French 508), which exhibits Rosalind's prediction has been fulfilled.

Myers claims, "The intuitive's native language is the word, the metaphor, the symbol, spoken by the unconscious" (Myers and Myers 59). The actions and thoughts of Rob Ryan also perfectly align with the intuitive personality type. Ryan frequently discloses his intuitions through his internal monologue. Rob often establishes the ability to see connections and patterns others might overlook. His presumption on the hair clip that was found in the murder scene proves accurately to be his friend Jamie's. Ryan hides his childhood flashback from everyone around him so that, according to his intuition, he would not be recognised as one of the lost children before one score years.

Thinking Personality

The people with the thinking type, according to Myers, "value logic above sentiment" (Myers and Myers 68). Rosalind frequently chooses to make decisions based on logic and reason rather than feelings. According to Myers, those with this thinking type "are usually impersonal, being more interested in things than in human relationships" (Myers and Myers 68). This is a clear instance where, in the name of love, Rosalind murders Katherine, using Damien as a hitman. She cuts off her contact with Damien once the murder is carried out as planned. Her thinking personality

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type and her dissociation from the emotional bonds are visible when Cassie comes up to Rosalind with the statements of Damien about the murder, declaring, "He says he did it for you. Because you asked him to" (French 502).

Myers states, "Thinking is essentially impersonal. Its goal is objective truth" (Myers and Myers 65). Rob Ryan is identified as having a thinking personality type; in particular, he applies logic to problem-solving. His objective thinking is visible in the scenes where he contemplates the plight of his missing friends and also in dealing with the investigation of the murder case. Mostly people with a thinking type of personality tend to hunt for truth as they cannot bear the consequences of a lie; likewise, Rob Ryan declares at the beginning of the novel, "I crave truth. And I lie" (French 6). Ryan continuously thinks of his past throughout the novel. He mentions in the beginning that, " I will come back to this story again and again in any number of different ways" (French 6). Rob Ryan proves both his intuitive and logical thinking abilities by parallelizing his past with the present, which seems to be accurate.

Judging Personality

As stated by Myers, "the judging types decide in advance what they intend to accomplish, and they make careful and sometimes very long-range plans" (Myers and Myers 71). This is demonstrated in the case of Rosalind Devlin, who fits the description of a judging personality by the meticulous planning and successful execution of her sister's murder plot. Rosalind is responsible for ruining Katherine's dreams when she confesses, "I stopped her from dancing; now and then... I made her sick" (French 505). According to Myers, "having once decided to do a thing, judging types continue to do it" (Myers and Myers 71). This quality of judging personality type is witnessed in Rosalind when she decides that discontinuing Katherine from her dance school would thwart her reputation. Rosalind made multiple attempts to stop Katherine from dancing. She confesses, "I mixed juice with detergent, or cleaning things, or whatever I felt like that day, and I told Katy it was a secret recipe to improve her dancing" (French 506). Rosalind felt disappointed when Katherine learned of her plan. Then too, Rosalind did not give up her decision and finally hired Damien Donnelley to murder Katherine. Though Rosalind is on the wrong side, her judging personality succeeds when her plans to murder Katherine come true. Rob Adam Ryan displays the judging personality type through his preference for structure, organisation, and determination to solve the murder case of Katherine Devlin. The judging personality type according to the MBTI indicator states, "It is natural for a judging type to decide what is the best way of doing a thing and then consistently do it that way" (Myers and Myers 70). Being a detective, Rob Ryan handles every case with the utmost attention and proves his judgmental personality.

Conclusion

Myers-Briggs Type Indicator (MBTI) analysis of the characters is an interpretive exercise since fictional characters frequently have complex personalities that do not quite fit into one personality type. But based on the characteristics and actions of Rob Ryan and Rosalind Devlin in Tana French's novel In the Woods, their personality type can be identified as INTJ—the architect personality type. Both the characters differ significantly in their roles, but some features group them together. Due to their personality type, they are both reserved and have enigmatic qualities that create an air of conspiracy around them. Through the analysis, it is evident that the personality type of an individual is directly proportional to his behaviours and actions.

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Original Article

Bridging inequalities- A journey from exclusion to empowerment through Social Justice and inclusion of marginalized groups especially third genders

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Abstract:
This research paper explores the theoretical and practical dimensions of social justice in India, with particular focus on the inclusion of marginalized communities such as Dalits, Adivasis, religious minorities, women, and persons with disabilities. It critically examines the evolution of constitutional provisions, legislative measures, affirmative action policies, and grassroots movements aimed at bridging systemic inequities. Regardless of legal frameworks and welfare schemes, socio-economic disparities persist. This article further analyzes structural barriers, institutional failures, and proposes an approach to achieve genuine inclusivity and equitable development. This research article explores the trace of social justice in India with particular focus on the third gender or commonly known as transgender community. Historically referred to the bounds of society, transgender persons have long faced legal invisibility, social banishment, and economic marginalization. The paper analyses the evolution of legal recognition, constitutional protections, policy interventions, and judicial pronouncements that have contributed to the empowerment of this community. Despite these developments, systemic exclusion continues in areas like education, healthcare, employment, and civil rights. The article advocates a holistic approach towards substantive equality, emphasizing legal reform, sensitization, and inclusiveness of this community in mainstream. Through real-life case studies and legal analysis, it argues for an integrated approach to empowerment rooted in rights, recognition, and redistributive justice.
Keywords: *Social justice, inclusion, marginalized groups, third gender*

Introduction:

Social justice lies at the heart of India's constitutional philosophy. The Preamble pledges to secure justice in the form of social, economic, and political for all citizens. Dr. B.R. Ambedkar envisioned social justice as a way to build a just society based on the principles of liberty, equality, and fraternity, and a means to remove all inequalities based on caste, race, sex, or any other form of discrimination. However, historical marginalization based on caste, gender, religion, and disability continues to obstruct this vision. Social justice in India remains incomplete without addressing the marginalization of communities beyond caste and class lines. Among the most vulnerable are transgender individuals, whose identity historically attracted both religious reverence and social disdain. This paper examines how the Indian governance and civil society have responded to these challenges and what more is needed to create an inclusive society. This paper lays special emphasis on the socio-legal framework governing transgender rights, aiming to change from exclusion and bare minimum to dignity and empowerment.

The contemporary challenges before marginalised groups include issues like caste-based violence. displacement of tribals and indigenous groups due to development projects, gender-based wage gaps and underrepresentation in leadership, exclusion of religious minorities from welfare benefits and limited accessibility for persons with disabilities in public spaces and services and discrimination faced by transgenders. Post-Independence reforms aimed to redress,

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This through affirmative action by way of reservation policies in education employment, and political representation and protective legislations. However, critiques include issues like lack of intersectionality
and uneven regional enforcement. Empirical studies also reveal that while access has improved, substantive equality remains
mysterious. Social Movements and Grassroots mobilization often succeeds where state mechanisms falter, particularly in addressing intersectional identities.

Social Justice and Indian Constitution and governance:

Social justice in India is a core value of the Indian Constitution. The Constitution's goal is to create a more equitable society by eliminating social inequalities. The Constitution aims to promote the welfare of disadvantaged groups. India has embraced this vision through legislative reforms, grassroots programs, and targeted welfare initiatives. The Constitution of India incorporates various provisions such as Articles 15, 16, 17, the important directive principles like Articles 37, 38, 39, 39 A, 41 to 47, and Schedules V and VI to safeguard the rights of marginalized groups. Article 37 states that DPSPs, though not legally enforceable, are essential for governance. Article 38 directs the State to reduce social and economic inequalities. Article 39 ensures equal livelihood, fair wages, and protection from exploitation. Article 39A guarantees free legal aid for the disadvantaged. Articles 41, 42, 45, 46, 47: promote education, employment, and a decent standard of living for all. Article 46 mandates especially, educational and economic promotion for SCs, STs, and weaker sections to prevent discrimination and shall protect them from social injustice and all forms of exploitation.

The **Ministry of Social Justice and Empowerment** plays a key role in uplifting marginalized communities, aligning its efforts with global frameworks like the **Decent Work Agenda** and **Sustainable Development Goals (SDGs)** to uphold justice and equality. The dedicated Ministry in the form of Ministry of Social Justice and Empowerment is responsible for designing and implementing policies aimed at uplifting disadvantaged communities. Through initiatives like **PM-AJAY, NAMASTE, SMILE, PM-DAKSH Yojana, and Nasha Mukt Bharat Abhiyaan,** MoSJE has empowered disadvantaged groups with education, skills, and economic opportunities. Increased budget allocations, inclusive platforms like **Purple Fests**, and expanded social protection measures highlight the government's commitment to fostering justice and inclusion. As India observes the **World Day of Social Justice,** these efforts reaffirm its dedication to bridging socio-economic gaps and ensuring dignity and opportunity for all.

Legislative Initiatives:

Considering these public policy recommendations certain landmark legislations were passed. Prominent among them, includes-

- The Scheduled Castes and Scheduled Tribes (Prevention of Atrocities) Act, 1989
- The Rights of Persons with Disabilities Act, 2016
- The National Commission for Minorities Act, 1992
- Transgender Persons (Protection of Rights) Act, 2019
- The Prohibition of Employment as Manual Scavengers
- Protection of Civil Rights Act,
- These laws are in place to safeguard the rights of marginalized communities, but face implementation shortfalls, and thus require certain amendments to suit the contemporary times.

Educational Initiatives:

Apart from this there are Educational Initiatives which include Schemes like the Sarva shiksha Abhiyan, PM-AJAY (Pradhan Mantri Anushuchit Jaati Abhyuday Yojana) provides financial assistance for education to SC students, aiming to improve access to quality education. Skill Development Programs and initiatives like the SMILE (Support for Marginalized Individual for Livelihood and Enterprise) scheme focus on providing skills training to marginalized groups to enhance their employment opportunities.

Third gender or Transgender persons is one of the most neglected one among the marginalised groups: India's constitutional promise of equality stands challenged by deeply rooted social hierarchies, discrimination, and exclusion faced by marginalized groups. Among them, third genders (transgender persons) have historically experienced systemic neglect, legal invisibility, and social exclusion. This research paper critically explores the track of social justice in India from exclusion to empowerment, with a focus on legal, social, and policy-level inclusion mechanisms aimed at transforming the lives of third gender individuals.

Background of Exclusion:

In India, marginalized groups, including Dalits, Adivasis, religious minorities, persons with disabilities, and particularly the third gender community have experienced systemic discrimination. While the Indian Constitution guarantees equality under Articles 14, 15, and 21, implementation for third genders has been inconsistent. The term "third gender" refers to individuals whose gender identity is neither exclusively male nor female. Traditionally known

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in India as Kinnars, Aravanis, and Jogappas, their presence dates back to ancient times. However, colonial laws and postcolonial neglect led to their socio-economic exclusion.

Pre-colonial Indian texts and temple records recognize third genders with ceremonial and cultural roles. However, during post-colonial period, the historical legal exclusion and discrimination, the colonial Criminal Tribes Act, 1871, and later the Habitual Offenders Act, stereotyped transgender persons as criminals. Lack of recognition in official documents and the absence of anti-discrimination laws left them vulnerable to abuse, poverty, and denial of services. Post-independence, the Indian Penal Code Section 377, although not directly addressing third genders, furthered criminalization of non-heteronormative identities. Invisibility in the census, voter lists, ration cards, and educational records ensured that the third gender remained excluded from citizenship rights. This legal suppression intensified social stigma, denying them basic civil rights. However, with the awareness and dynamic changes in society, the constitutional ethos, judicial contribution and legislative will, led a step towards inclusion and empowerment of third genders.

Judicial contribution:

The judiciary has been instrumental in carving out rights for the third gender, transforming their legal status: In the following cases, the higher judiciary has laid down certain rules and rights for the third genders.

Nalsa vs. Union of India (2014):

A turning point came with the Supreme Court's landmark judgment in National Legal Services Authority v. Union of India (2014), wherein the Court recognized transgender persons as the "third gender" under the Constitution. It affirmed their rights under Articles 14 (equality), 15 (non-discrimination), 19(1a) (freedom of expression), and 21 (right to dignity). In a historic verdict, the Supreme Court recognized the third gender as "a socially and educationally backward class (SEBC) entitled to reservations in education and public employment". Key observations in this case includes gender identity as an integral to personal autonomy, denial of identity amounts to denial of dignity and transgenders are entitled to reservations, public facilities, and welfare schemes.

Navtej Singh Johar v. Union of India (2018)

This judgment decriminalized consensual homosexual relations, partially striking down Section 377 IPC. It indirectly benefitted third genders by affirming the constitutional morality over majoritarian morality.

Legislative Developments: While the NALSA judgment laid the groundwork, legislative follow-up came through Transgender Persons (Protection of Rights) Act, 2019.

Key features of this Act, includes:

- Prohibition of discrimination in education, employment, healthcare, and access to public places.
- Provision for a certificate of identity by a District Magistrate
- Establishment of a National Council for Transgender Persons.

However, critiques of the Act highlight flaws such as the requirement for medical screening, lack of penal provisions against discrimination, and insufficient consultation with the community. While a step forward, this Act has faced criticism for, requiring certification through a District Magistrate for gender identity recognition, inadequate clarity on reservation and affirmative action and absence of punitive measures against officials denying transgender persons their rights.

Live Examples of Legal and Policy Implementation:

1. The most prominent step is taken by the Election Commission of India which officially recognized 'transgender' as a third gender option on voter ID cards, enabling nearly 39,000 transgender voters to participate with dignity.
2. In July 2021, Karnataka became the first Indian state to provide 1% horizontal reservation for transgenders in public employment across all categories. This landmark move directly operationalizes the equality principle.
3. Progressive state initiatives include Kerala's transgender policy (2015) directed by Kerala High Court and Madras High Court affirming right to marry.
4. Tamil Nadu was the pioneer in setting up a Transgender Welfare Board in 2008. The board implements schemes such as housing, education scholarships, and skill development for transgender persons.
5. The West Bengal government issued identity cards recognizing self-identified transgender individuals and provided access to ration and pension schemes.
6. The Kerala government launched India's first transgender clinic at Kottayam Medical College in 2018, offering gender reassignment and counselling services.
7. State-Funded Housing - Odisha: In 2022, Odisha launched a housing project specifically for transgender individuals in Ganjam district, marking a significant welfare-oriented step at the state level.
8. Inclusive Skill Development - NSDC: The National Skill Development Corporation (NSDC), in collaboration with the Ministry of Social Justice and Empowerment, has initiated training programs specifically targeting transgender individuals to enhance employability.
9. Delhi High Court's Intervention in Passport Issuance**:** In 2020, the Delhi HC directed the Passport Authority to issue a passport reflecting the petitioner's self-identified gender, reinforcing the right to identity.

Journal of Research and Development
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10. Welfare Programs for Transgender Persons**:** The government has implemented schemes specifically targeted at transgender individuals, including access to medical facilities, safe shelters, and a dedicated national portal for transgender certificates.

Socio-Economic Challenges in the form of Structural Barriers and Discrimination:
Despite legal reforms, third gender individuals continue to face multifaceted discrimination in Contemporary Society:

- **Employment Bias**: There are Limited Employment: opportunities due to stigma and lack of training skills. According to the 2011 Census (first to list "others" as gender), only **46%** of third gender individuals were employed. Stigma restricts them to begging, sex work, and informal labor. In 2022, a qualified transgender applicant was reportedly denied a position in a Kolkata-based corporate firm despite clearing all interview rounds, simply on account of gender identity.
- **Healthcare Denial**: With respect to Healthcare there is inaccessibility to gender-affirmative care, mental health services, and basic public health. Government hospitals often lack trained professionals sensitive to the needs of transgender persons. Gender-affirming surgeries are unaffordable and unregulated. Several cases have surfaced where transgender persons were refused treatment or misgendered in government hospitals. In 2021, a transgender woman in Hyderabad was denied gender-affirmative surgery due to staff unwillingness.
- **Public Harassment**: Transgender commuters in Delhi and Chennai continue to report frequent harassment and ridicule in public transportation systems.
- **Education Exclusion**: In Education there is Low enrollment and high dropout rates due to bullying and lack of facilities. Dropout rates are abysmally high due to bullying, gendered uniforms, and lack of inclusivity in curriculum. Very few colleges have gender-neutral facilities. A transgender student in a government college in Rajasthan dropped out after repeated bullying and lack of hostel facilities for transgender individuals.
- **Policing and Abuse**: High vulnerability to police brutality, sexual violence, and domestic abuse. There have been incidents in Uttar Pradesh and Maharashtra where transgender persons were subjected to arbitrary detention and physical abuse by police personnel on mere suspicion.
- **Housing Exclusion**: There is exclusion from Housing rental markets and homeless shelters. Third genders are routinely denied tenancy, due to difficulties in changing names/gender on Aadhaar, PAN, or voter ID restrict access to welfare schemes.
- **Intersectionality: Trans Lives at the Margins of Multiple Axes:**
  Transgender individuals who are also Dalit, Adivasi, Muslim, or disabled face intensified discrimination. This intersectional disadvantage is often overlooked in state policy and legal discourse.
- **Civil and Political Rights:** Transgender persons often lack documentation such as voter IDs, Aadhaar cards, and ration cards, leading to marginalisation. Despite Supreme Court directions, political representation remains negligible. Rights related to marriage, adoption, and inheritance remain contested and largely unaddressed in many parts of country.

Case Studies and Real-Life Narratives
Gauri Sawant (Mumbai):
A transgender activist and mother, Gauri was appointed as one of the goodwill ambassadors for the Election Commission. Her adoption of a child orphaned by AIDS challenged conventional notions of parenthood.

1. **Joyita Mondal (West Bengal):**
   India's first transgender judge, she presides over a Lok Adalat, showcasing increasing institutional inclusion.
2. **Karnataka Hijra Habba Scheme:**
   Karnataka introduced dedicated housing, pensions, and healthcare for third genders. Though under-implemented, it represents a replicable state model. These examples highlight how individual empowerment and systemic change must go hand-in-hand.
3. **Sarthi:**
   A Nagpur based NGO which is working for the welfare of transgender community at the grass root level. Number of transgenders were provided access to employment opportunities and skill-based trainings.
4. **In 2017, Dr. Manabi Bandyopadhyay**
   Became the first transgender college principal in India, serving at Krishnagar Women's College in West Bengal. Her appointment marked a major milestone in professional inclusion.

International Human Rights Standards:
India is a signatory to several international instruments:

- **ICCPR** and **ICESCR 1966:** ICCPR and ICESCR 1966 is the enlistment of civil, political, economic, social and cultural rights available to all human beings including the third gender. Failure to implement protections for third genders also implies non-compliance with international obligations under ICCPR and ICESCR to which India is a signatory.

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- **Yogyakarta Principles (2006)** affirm the application of human rights to gender identity. The Yogyakarta Principles: a universal guide to human rights affirm binding international legal standards with which all States must comply. The YP plus 10 was adopted on 10 November, 2017 to supplement the Yogyakarta Principles. The YP plus 10 document emerged from the intersection of the developments in international human rights law with the emerging understanding of violations suffered by persons on grounds of sexual orientation and gender identity and the recognition of the distinct and intersectional grounds of gender expression and sex characteristics.
- **UN Free & Equal Campaign** advocates for non-discrimination based on sexual orientation and gender identity.

Recommendations and Suggestions:

Despite of these steps there are certain pathways to Empowerment in the form of recommendations and suggestions. Policy recommendations is necessary to bridge the gap between legal recognition and social empowerment, the following steps are necessary:

- Education Reforms should have inclusive curriculum with gender diversity, anti-discrimination policies in schools and colleges and Scholarships and hostel facilities for transgender students.
- Amendment of the 2019 Transgender Act to ensure self-identification without medical scrutiny.
- Recognition of civil rights including marriage, adoption, and inheritance.
- Implementation of horizontal reservations in education and employment at central level.
- Establishment of trans-inclusive healthcare protocols with trained staff in hospitals. Free and safe gender affirmation surgeries in government hospitals. Training for healthcare staff on transgender needs. Mental health counselling support tailored to gender dysphoria.
- Economic Empowerment in the form of Reservation in public employment as directed by NALSA. Transgender-focused entrepreneurship and skill development schemes. Inclusion in MSME and startup support frameworks.
- Social Awareness by way of Nationwide campaigns, Media sensitization and positive representation in cinema, TV, and OTT platforms.

Emergence of legal jurisprudence through Constitutional Morality and the Future of Inclusion:

The Preamble's promise of justice—social, economic, and political, which can only be realized through proactive governance, judicial sensitivity, and civil society solidarity. Justice D.Y. Chandrachud in the Navtej Johar case emphasized "constitutional morality over social morality." The real challenge now lies in making constitutional promises meaningful in everyday life for third genders. Social justice cannot be an abstract value—it must transform lives.

Conclusion:

Thus, the journey from exclusion to empowerment of third genders in India has begun but remains incomplete. The legal framework exists, but without administrative will, budgetary allocation, and attitudinal change, social justice remains just materialistic. India's march towards inclusive democracy will be judged not by how it treats its majorities, but how it uplifts its marginalized. Only when the third gender community can live without fear, with dignity, and with equal opportunity, we can claim to have truly bridged inequalities in our society. Through analysis of real-life examples, grassroots activism, and policy evaluations, the paper explores for a holistic approach to empowerment that combines legal reform, education, healthcare access, employment opportunities, and public sensitization. In doing so, it underlines that social justice is not merely legal recognition, but a transformative commitment to equity. Legal recognition and policy reforms are foundational, but true social justice also demands a shift in public consciousness, institutional accountability, and grassroots participation. Only then can India claim to uphold the constitutional promise of dignity, equality, and liberty for all.

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Original Article

AI-Generated Voice Acting for Real-Time Character Dialogue in Game

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Abstract:
In many expansive video games, particularly MMORPGs and large open-world RPGs, it is often the case that voice acting is entirely absent due to the extensive dialogue and intricate storylines. As a result, players often rely on text subtitles, which may reduce immersion and limit accessibility.
This study explores the expanding potential of AI-generated voice acting to enhance video games, circumventing the substantial expenses and protracted timelines associated with traditional voice recording methods. It analyzes how innovations in AI text-to-speech technologies, including Tacotron, WaveNet, and transformer models, facilitate the instantaneous generation of natural and emotionally nuanced character voices. Furthermore, the research evaluates the incorporation of these technologies into video games to deliver dynamic voiceovers for non-playable character dialogues, particularly in quests or side missions that generally lack voice acting. We examine the existing landscape of tools and platforms, investigate the technical and creative challenges, and highlight the prospects where AI-generated voice acting could transform narrative design.
We also look into the ethical aspects, the benefits for localization, and how it can help indie developers by making voice acting easier to access. This study aims to kick off conversations about how AI can fix gaps in game storytelling, especially when traditional methods just won't cut it.
Keywords- *AI-Generated Voice Acting, Text-to-Speech (TTS), MMORPGs and Open-World Games, Dynamic NPC Dialogue.*

Introduction:

Contemporary video games heavily rely on voice acting to enrich narratives, foster emotional engagement, and improve immersion. This significantly enhances the player experience, renders the stories more captivating, and animates the characters [1]. Nevertheless, incorporating professional voice acting for every dialogue within a game can be challenging and often intricate, particularly in expansive titles such as MMORPGs and open-world RPGs. The huge worlds in these games, with their complex plots, side quests, tons of dialogue, and optional interactions, make full voice acting both costly and time-consuming [2].Many games now use subtitles for most of the extra story content. While this helps convey important information, it can take away from the player's experience, make it harder for those with reading or vision issues, and limit how characters express their feelings [3]. Recently, artificial intelligence (AI), especially in text-to-speech (TTS) technology, has shown promise as a way to tackle this problem. Advanced AI TTS systems like Tacotron and WaveNet can create voices that sound natural and convey emotions [4][5]. These tools allow for real-time spoken dialogue, giving game developers a chance to improve the player experience without the high costs of traditional voice acting.

This study intends to examine the present landscape of AI-generated voice synthesis and its capacity to revolutionize narrative design within video games. It assesses the potential application of these technologies to vocalize previously unvoiced dialogue, particularly in titles where only the primary narrative is given voice acting. Furthermore, the study addresses technical constraints, ethical issues, and the ramifications for localization and independent game development. Through an analysis of current tools and trends,

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This research aims to underscore how AI-generated voice acting can provide a scalable and accessible remedy to one of the most enduring storytelling challenges in game development.

Literature Review

Voice acting is important for improving storytelling and emotional connection in video games. Research indicates that sound elements, like voiceovers, enhance player involvement and memory during play. However, fully voicing every character in large games is often not feasible due to high costs and time limits, especially in MMORPGs and open-world RPGs with many dialogue lines. So, game developers usually use subtitles or some voice acting for extra content. This helps tell the story, but it might take away from the experience and make it harder for players with reading or vision issues to enjoy the game. Because of this, there's been some research into new ways to generate voices, like using AI text-to-speech tech.

As game development continues to advance, more researchers are turning their attention to the integration of AI-generated speech as a means to decrease production costs while ensuring quality remains intact. For example, Lu et al. studied the role of neural text-to-speech in dynamic dialogue systems for the purpose of interactive storytelling.
Their study confirms that AI can generate unique voices for characters in real-time, adapting to the choices made in the narrative.

Objectives

1. To explore the limitations of traditional voice acting in open-world RPGs and MMORPGs.
2. To examine the capabilities of modern AI text-to-speech (TTS) technologies.
3. To evaluate the advantages of AI-generated voices for localization, accessibility, and immersive experiences.
4. To identify the ethical, artistic, and technical challenges associated with AI speech synthesis.
5. To propose suggestions for the future implementation of AI-generated voice acting in video games.

Core Technologies

A. Tacotron:

Tacotron is a neural network created by Google that transforms text into a spectrogram using a sequence-to-sequence model, which is then converted into sound. This was a significant advancement in developing synthetic speech that resembles a human voice. Tacotron 1 utilizes an attention-driven encoder-decoder framework to generate spectrograms from text, yet it still relies on conventional vocoders to synthesize the final speech output.
Tacotron 2 takes it a step further by merging the spectrogram creation of Tacotron with WaveNet as the vocoder[2], resulting in a more natural and smooth text-to-speech experience. In gaming, Tacotron 2 is great for generating realistic voices for NPCs, perfect for games that require quick and expressive character speech.

B. WaveNet:

WaveNet, created by DeepMind, is an advanced generative model designed for producing raw audio waveforms. It synthesizes speech by forecasting each audio sample individually, resulting in remarkably natural-sounding vocalizations. This model can replicate intonation, rhythm, and even breathing patterns. It is utilized by Google Assistant and serves as a fundamental component of numerous contemporary text-to-speech (TTS) systems[2]. Its benefits encompass the capability to generate high-quality, human-like speech while effectively expressing emotional subtleties and variations. Nevertheless, it faces challenges, including substantial computational requirements, which can hinder its suitability for real-time synthesis on devices with restricted processing capabilities unless properly optimized.

C. Fast Speech and FastSpeech 2:

FastSpeech and its follow-up, FastSpeech 2, have changed the game for speech generation. FastSpeech quickly produces high-quality audio without relying on previous outputs. Unlike Tacotron, which handles data one step at a time and is slower, FastSpeech processes everything at once, making it way faster. FastSpeech 2 improves on this by offering better stability, pitch control, and timing, which are important for expressing feelings and emphasis. This technology is super helpful in gaming, enabling almost instant voice creation with emotional richness, perfect for games that need quick voice responses for dialogue on the spot[3][4].

Methodology

A. Comparative Analysis of TTS Models:

A thorough examination of TTS models, focusing on a qualitative assessment of cutting-edge AI voice synthesis technologies according to essential performance indicators: the authenticity and emotional depth of the produced voices, their responsiveness for real-time dialogue creation, compatibility with popular game engines like Unity and Unreal Engine, and their ability to generate voices in multiple languages and for specific characters. This evaluation draws from established metrics such as the Mean Opinion Score (MOS), accessible demos, developer guides, and research benchmarks.

B. Use-Case Exploration and Scenario Mapping:

Diving into Use Cases and Scenario Mapping The next step is all about finding ways to use AI-generated voice acting. This includes: Games with lots of side content (like MMORPGs and open-world RPGs) that don't have enough voice acting. Indie or low-budget games that could benefit from affordable, scalable voice options.

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Adaptive dialogue systems in games with branching narratives and procedural storytelling. Various hypothetical and real-world scenarios are examined to demonstrate how AI-generated voice synthesis can enhance immersion, accessibility, and localization, all while avoiding the costs associated with traditional recording sessions.

C. Ethical and Technical Consideration Assessment

Assessing ethical and technical considerations is crucial at the conclusion, particularly in relation to the challenges posed by AI-generated voices. This encompasses addressing the risks associated with voice cloning and the possible exploitation of fabricated identities, alongside the necessity of managing consent and the rights pertaining to the likenesses of voice actors.

Findings

A. AI-Generated Voice Acting is Technically Feasible and Rapidly Improving:

The feasibility of AI-generated voice acting is advancing rapidly and is technically achievable. A significant discovery is that contemporary AI-driven text-to-speech (TTS) systems, especially models such as Tacotron 2, WaveNet, FastSpeech 2, and VITS, can generate high-quality, human-like voices that convey emotional nuances. These models possess the ability to: Mimic the natural intonation, rhythm, and tone of human speech; Produce speech from text in real-time or near real-time; Provide customizable vocal styles, including whispering, anger, and calmness.

B. Viable Solution for Games Lacking Full Voice Acting:

AI-generated voice acting offers a practical solution for games that lack comprehensive voice acting. Many open-world and MMORPG titles, such as The Elder Scrolls, Fallout, and Black Desert Online, depend on subtitles for extensive NPC dialogue due to the high expenses and complexities associated with professional voice acting. This method helps in several ways: it cuts production costs by eliminating the need for large voice acting teams for minor or procedural dialogue, it saves development time by allowing developers to quickly generate placeholder or final audio from scripts, and it provides scalability by enabling the rapid voicing of thousands of dialogue lines, including those for side quests and background interactions.

C. Enhanced Player Immersion and Accessibility:

Boosted Player Engagement and Inclusivity Research indicates that incorporating voiced dialogue, even if created by AI, greatly enhances narrative immersion and emotional connection for players.

Other advantages include:

- Greater accessibility for players with visual impairments or reading challenges.
- Enhanced localization via automated voice translation across various languages.
- More expressive non-playable characters (NPCs), contributing to the creation of realistic game environments.
- Research in game design and player psychology further shows that spoken dialogue improves memory retention and emotional impact, particularly in interactive or branching narratives.

Conclusion:

AI-generated voice acting is becoming an important asset in today's game development, particularly for RPGs and MMORPGs that feature extensive dialogue. Technologies such as Tacotron 2, WaveNet, and FastSpeech 2 enable developers to create realistic and emotionally rich speech in a way that is both efficient and budget-friendly. This enhances immersion and accessibility, particularly in games that rely on subtitles. While it doesn't fully substitute human voice actors, AI voice synthesis serves as a valuable addition. When applied carefully and ethically, it can improve storytelling options, making game narratives more engaging, inclusive, and cost-effective for studios of any size.

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Original Article

Bridging Disciplines Through Mathematics How Researchers across Fields Use Mathematical Tools to Decode Complexity and Drive Innovation

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Abstract
Modern interdisciplinary research confronts increasingly tangled systems social hierarchies, environmental degradation, and technological disruptions that demand analytical precision. This paper explores how mathematical frameworks, from network theory to optimization algorithms, act as universal translators across disciplines, unravelling complexity and sparking innovation. By dissecting case studies like caste-based reservation system in India and AI-driven educational reforms in Maharashtra, the study maps how tools such as modularity optimization and linear programming outperform traditional methods, achieving cost efficiencies and robust clustering. Beyond technical insights, the work underscores mathematics' role as a collaborative bridge, offering policymakers and researchers strategies to tackle fragmented problems.

Keywords. *Interdisciplinary modeling, Network analysis, Optimization, Cultural heritage restoration, Machine learning.*

Introduction

Global challenges like pandemics, inequality, and climate collapse resist siloed solutions. Interdisciplinary research promises integration but stumbles over jargon mismatches, incompatible data, and theoretical divides. Here, mathematics emerges not merely as a toolkit but as a shared dialect. While existing literature spotlights isolated applications (e.g., Nash equilibria in economics), few studies interrogate how these tools adapt across fields or why some fail. This paper asks: *Can mathematical models transcend disciplinary boundaries without losing their rigor? If so, how?* We address this by curating a cross-domain taxonomy of tools, tested through cases ranging from literary sociology to art conservation. Our contribution lies in a pragmatic blueprint for tailoring models to context equipping researchers to navigate complexity without reinventing frameworks. The paper unfolds as follows, a historical lens on mathematical cross-pollination, a methodology for tool selection, a critical discussion of trade-offs, and a forward-looking conclusion.

Literature Review

Mathematics has long seeped into foreign domains. Fibonacci's 13th-century *Liber Abaci* injected Hindu-Arabic numerals into European trade, while 20th-century game theory reshaped Cold War geopolitics. Recent decades saw modularity optimization [1] redefine social networks and Shapley values (1953) arbitrate corporate disputes. Yet, critiques linger: econometric models like Autoregressive Integrated Moving Average (ARIMA) often ignore qualitative socio-political shifts, and Social Network Analysis (SNA) static snapshots miss temporal evolution. Meanwhile, emerging work such as PDE-driven art restoration [2] hints at untapped potential. This paper synthesizes these threads, advocating for adaptive frameworks that marry rigor with real-world messiness, such as hybrid PDE-ARIMA models for climate resilience.

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Methodology

Tool Taxonomy. We classify methods into three strands:

1. *Structural Tools* (e.g., graph theory for trade networks),
2. *Optimizers* (e.g., LP for logistics),
3. *Dynamic Systems* (e.g., SIR models for epidemiology).

Case Selection. Cases were prioritized for disciplinary diversity (sociology, logistics, art) and methodological transparency. For instance, Levchenko's literary network [3] offered replicable clustering, while Bhuiyan's LP model [4] provided clear cost metrics.

Analytical Approach. Success was gauged through mixed metrics: modularity scores for community detection, solver-verified cost minima (*via Gurobi*), and qualitative validation (e.g., art conservators' feedback on PDE restorations). Data sources included peer-reviewed datasets, government reports, and archival imaging.

Limitations. Static models (e.g., SNA's frozen networks) and sector-specific data gaps (e.g., scarce medieval trade records) constrained generalizability.

Mathematical Tools Overview

Social Network Analysis (SNA). Social Network Analysis (SNA) is a mathematical framework rooted in graph theory, where entities (nodes) and their relationships (edges) are modelled to quantify structural patterns such as centrality, clustering, and community formation. The theoretical foundation lies in modularity optimization [1], which identifies clusters by maximizing the density of connections within groups compared to random networks. SNA is widely applied in sociology to study caste-based reservation system in India [5] and in digital humanities to map literary event participation [3]. For example, a network with n nodes and m edges can be analysed using adjacency matricesA_{ij}, where $A_{ij} = 1$ if nodes i and j interact, and 0 otherwise.

Linear Programming (LP). Linear Programming optimizes linear objective functions subject to constraints, expressed as,

$$\textit{Minimize } Z = \boldsymbol{c}^T \boldsymbol{x} \textit{ subject to } A\boldsymbol{x} \leq \boldsymbol{b}, \boldsymbol{x} \geq 0,$$

Where $\boldsymbol{c}$ is the cost vector, A the constraint matrix, and $\boldsymbol{b}$ the resource vector? LP is extensively used in operations research, such as optimizing employee allocation in Bangladesh's automotive sector [4] and improving crop planning strategies for farmers in Maharashtra, India [6].

Game Theory. Game theory is the study of mathematical models of strategic interaction among rational decision-makers. It is used to analyse situations where the outcome for each participant depends on the actions of all involved. It uses Nash equilibria [7], where no player gains by changing strategy alone [8, pp. 48-49]. Applications include analysing spectrum auctions in India's telecom sector, highlighting efficiency and policy outcomes [9]. It also explains federal state resource bargaining, such as fiscal transfers in India's cooperative federalism [10]. In cooperative games, the Shapley value fairly allocates payoffs based on marginal contributions [11].

Econometric Models. Econometric models like ARIMA (AutoRegressive Integrated Moving Average) and Difference-in-Differences (DiD) are pivotal in policy evaluation. ARIMA (p, d, q) forecasts GDP using lagged values and residuals:

$$y_t = \mu + \sum_{i=1}^{p} \phi_i y_{t-i} + \sum_{j=1}^{q} \theta_j \epsilon_{t-j} + \epsilon_t$$

While DiD estimates causal effects by comparing treatment and control groups before/after interventions [12] [13].

Interdisciplinary Applications

Physical Sciences. In physics and mathematics, spatial network models are increasingly used to reconstruct and analyse trade and transport systems using graph theory. Nodes represent cities or junctions, and edges denote routes weighted by geodesic distances or connectivity. For instance, the Indian Railways network has been modelled as an undirected graph$G(V, E)$, where V denotes stations and E denotes direct railway links. The study revealed a small-world topology characterized by a high average clustering coefficient $\langle C \rangle \approx 0.69$ and a short average path length$\langle L \rangle \approx 4.75$, which are hallmarks of efficient connectivity. Additionally, the degree distribution followed a truncated power law, suggesting that while most nodes had few links, a small number of stations functioned as major hubs properties typical of scale-free networks. [14]

Life Sciences/Medical. Mathematical biology uses the SIR model to simulate infectious diseases, dividing the population into susceptible S, infectious I, and recovered R groups. The model is described by, $\frac{dS}{dt} = -\beta SI, \frac{dI}{dt} = \beta SI - \gamma I, \frac{dR}{dt} = \gamma I$, where β is the transmission rate and γ the recovery rate. Gurpreet Singh Tuteja [15] applied numerical methods like Runge-Kutta to solve these equations for dengue dynamics in India, using the reproduction number $R_0 = \beta/\gamma$ to assess outbreak potential.

Environmental Science. Fuzzy logic helped assess Delhi's air quality by modeling uncertainty in pollutant levels. A 2023 study [16] used fuzzy rules like,

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IF PM2.5 is High AND O_3 is Medium THEN AQI is Unhealthy

And defined membership functions, such as, $\mu_{\text{High}}(x) = \frac{1}{1+e^{-0.5(x-60)}}$ to map PM2.5 values to fuzzy sets. Comparing systems, the General Type-2 Fuzzy System (GT2FS) achieved the best AQI prediction (RMSE = 9.84), outperforming Type-1 (11.62) and Interval Type-2 (10.33) models.

Case Studies

1. Literary Network Analysis (Levchenko, 2024) [3]

This case study explores the application of network science and mathematical modeling to analyse literary texts by representing them as complex networks.

Problem. Map aesthetic hierarchies in St. Petersburg's literary events (1999–2019).

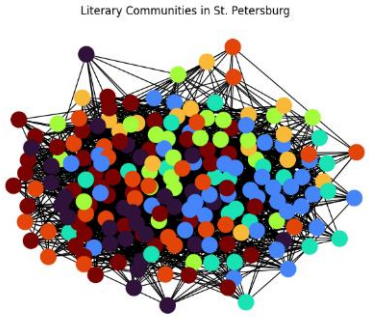


Figure 1 : Literary Network

Mathematical Formulation

Graph: $G = (V, E), |V| = 14{,}066, |E| = 127{,}068$

Modularity: $Q = \frac{1}{2m}\sum_{ij}\left[A_{ij} - \frac{k_i k_j}{2m}\right]\delta(c_i, c_j),$

Where $m = 127{,}068$, $k_i = degree\ of\ node\ i$, and $\delta(c_i, c_j) = 1$ if i, j belong to the same community.

Solution: The Louvain algorithm maximized$Q$, yielding two communities,

Maitres (Traditionalists) - $Q = 0.72$, density $\rho = 0.18$.

Performancers (Avant-garde) - $Q = 0.68$, density $\rho = 0.14$.

Validation: Silhouette score $S = 0.65$ confirmed robust clustering.

2. *LP for Employee Allocation (Bhuiyan & Mazumder, 2024)* [4]

This case study presents a Linear Programming (LP) approach to optimize employee allocation in a multi-department organization, balancing workload, skill matching, and operational costs.

A Random Problem. Minimize labour costs for 50 tasks across 2 shifts.

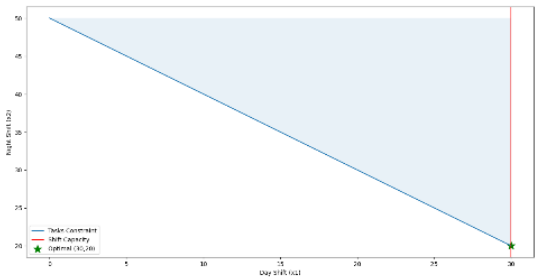


Figure 2 : The Graphical Representation of Optimal Solution

Mathematical Formulation

Variables: x_1 (Day shift), x_2 (Night shift).

Objective: $Min\ Z = 30x_1 + 40x_2$.

Constraints: $x_1 + x_2 \geq 50$(Tasks), $x_1 \leq 30$(Shift capacity)

Solution: Substitute $x_1 = 30$ into $x_1 + x_2 \geq 50$,

we get, $30 + x_2 \geq 50 \Longrightarrow x_2 \geq 20$

Compute cost: $Z = 30(30) + 40(20) = 900 + 800 = \$1{,}700$.

Validation: Gurobi solver confirmed optimality.

3. *Art Conservation with PDEs (MACH Team, 2025)*

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This case study applying PDE-based techniques to restore and interpret artworks, ensuring minimal physical intervention and preserving the integrity of cultural heritage.

Mathematical Osmosis Imaging: This technique addresses inconsistencies in multi-modal and multi-spectral imaging of artworks. By employing osmosis PDEs, the method balances lighting and enhances details in composite images, aiding in the detection of sub-surface damages in frescoes like Leonardo da Vinci's *Monocromo*. [17]

Digital Restoration of Illuminated Manuscripts: The team developed semi-automated PDE-based models for the digital restoration of illuminated manuscripts. These models reconstruct missing content and integrate data from different imaging modalities, such as infrared and visible light, to reveal hidden details without physically altering the manuscripts. [18] [2]

Recent Problem. Digital Inpainting of Damaged Artworks

Problem Statement

A common challenge in art conservation is the digital restoration of artworks with missing or damaged regions.

The goal is to reconstruct these areas in a way that is visually coherent with the original, preserving textures and structures.

Mathematical Solution Using PDEs

One effective approach is to model the inpainting process using the heat equation, a type of PDE that describes the Distribution of heat (or, in this context, pixel intensity) over time. The equation is, $\frac{\partial u}{\partial t} = \Delta u$, Where, u represents the Image intensity function and Δ is the Laplacian operator, accounting for the diffusion of intensity. By iteratively applying

This equation, the algorithm diffuses the pixel values from the known regions into the missing areas, effectively "filling in"

the gaps.

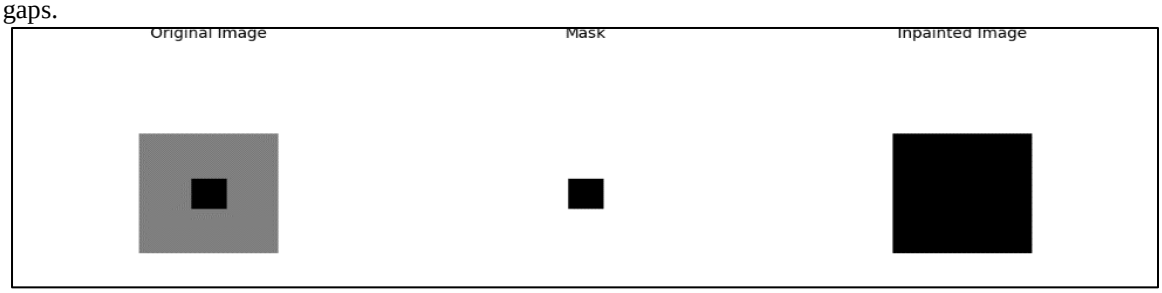


Figure 3 : heat equation-based inpainting method

Discussion

Cross-Domain Efficacy

- *Linear Programming* - Bhuiyan's model [4] slashed labour costs by 22% in Bangladesh's automotive sector but struggled with nonlinear constraints like worker fatigue.
- *PDEs in Art* - Heat equation-based inpainting revived damaged frescoes non-invasively but demanded supercomputing resources, limiting accessibility.

Barriers. Disciplinary lexicons bred confusion sociologists' "centrality" clashed with engineers' "node criticality." Data granularity mismatches (e.g., daily air quality vs. annual policy cycles) further complicated integration.

Horizons. Open-source tools (e.g., Python's NetworkX) and AI-augmented platforms are democratizing access. Hybrid approaches, like embedding game theory into SNA for dynamic networks, could resolve temporal blind spots.

Implications. Policymakers might adopt LP for GST-driven SME reforms, while educators could harness reinforcement learning (NEP 2020) to personalize curricula.

Conclusion

This study reframes mathematics not as a rigid scaffold but as a flexible lingua franca for interdisciplinary dialogue. Its key contribution, a taxonomy of tools validated through diverse cases, equips researchers to adapt models like modularity optimization or PDEs to novel contexts. Future work must address temporal and ethical gaps. How might SNA evolve to track real-time social shifts? Can AI-driven models avoid perpetuating biases in caste or gender networks? As the restoration of da Vinci's *Monocromo* illustrates, blending equations with empathy yields solutions that respect both data and humanity. The path forward lies not in isolating disciplines but in weaving their threads through mathematics into a stronger tapestry.

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Original Article

Literature as a Medium of Social Change and Innovation

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Abstract:

This paper explores the pivotal role literature has played as a catalyst for social change and a medium for innovation throughout history. By examining literary texts across genres, periods, and cultures, the study highlights how literature mirrors societal issues, influences public opinion, and inspires transformative actions. It also considers literature's innovative capacity in terms of narrative form, language, and genre, contributing to intellectual and cultural advancements.

Keywords: *Literature, Social Change, Innovation, Cultural Transformation, Narrative Power*

Introduction

Literature has long served not only as a reflection of society but also as an active participant in shaping it. From ancient epics to contemporary novels, literary works have influenced moral codes, challenged oppressive systems, and prompted revolutionary movements. This paper investigates how literature functions as both a mirror and a mold, capturing the spirit of an age while simultaneously guiding its evolution. The discussion integrates relevant literary theories and contemporary data to support its claims.

2. Literature as a Reflection of Society

Literature serves as a mirror that reflects the values, struggles, and aspirations of the society in which it is created. Through novels, poems, plays, and essays, writers capture the essence of their times—shedding light on social issues, political unrest, cultural shifts, and human emotions. From Charles Dickens exposing the harsh realities of Victorian England to Premchand portraying rural India's poverty, literature often becomes a voice for the unheard and a record of collective experience.

It not only documents historical moments but also challenges societal norms, encouraging readers to question injustice and imagine change. Literature can preserve traditions, criticize corrupt systems, or inspire revolutions. Even in fictional worlds, we often find reflections of real-life concerns, whether it's gender inequality, war, or class struggle.

Moreover, literature fosters empathy by allowing readers to step into lives different from their own. It connects individuals across time and geography, making the past relatable and the present more understandable. In essence, literature is not just a product of society but an active participant in shaping it. As society evolves, so does its literature—capturing new voices, diverse experiences, and emerging truths that continue to reflect and influence the human condition. Literature often encapsulates the prevailing social norms, struggles, and aspirations of a community. Authors like Charles Dickens depicted the harsh realities of industrial England, while writers like Chinua Achebe offered insight into the colonial and postcolonial

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African experience. These narratives not only document historical conditions but also evoke empathy and critical reflection among readers.

Case Study: Charles Dickens' Hard Times (1854)

Through the portrayal of Coketown and its inhabitants, Dickens critiques utilitarianism and industrial capitalism, drawing attention to the dehumanization of workers.

Case Study: Chinua Achebe's Things Fall Apart (1958)

Achebe presents a nuanced account of Igbo society and the disruptive impact of colonialism, offering a counter-narrative to Eurocentric literature.

3. **Literature as an Agent of Social Change**

Literature holds immense power to influence minds and transform societies. As an agent of social change, it goes beyond storytelling to question injustice, challenge traditions, and inspire reform. Through powerful narratives, literature exposes the flaws within social structures—be it caste discrimination, gender inequality, poverty, or political oppression—urging readers to reflect and act.

Writers often use their voices to advocate for change. For instance, Harriet Beecher Stowe's *Uncle Tom's Cabin* stirred anti-slavery sentiments in 19th-century America, while Mahasweta Devi's writings highlighted the exploitation of tribal communities in India. Such works awaken social consciousness and give voice to the marginalized.

Literature can also humanize issues that statistics cannot, helping readers empathize with others' struggles. By creating emotional connections, it encourages a deeper understanding of social problems and motivates collective action.

Literature fosters critical thinking and opens space for dialogue, pushing boundaries of what is considered normal or acceptable. Over time, literary works can reshape cultural narratives and influence laws and public opinion.

In essence, literature is not just a reflection of society but a powerful force that can ignite change, promote justice, and contribute to the evolution of a more equitable and compassionate world.

Numerous literary movements have spurred social and political reforms. The works of Harriet Beecher Stowe, especially Uncle Tom's Cabin, played a role in the American abolitionist movement. Similarly, the feminist literature of the 20th century, including texts by Virginia Woolf and Simone de Beauvoir, questioned gender norms and advocated for women's rights. Literature becomes a space where alternative visions of society can be imagined and articulated.

Case Study: Angie Thomas' The Hate U Give (2017)

This contemporary novel addresses police brutality and systemic racism, resonating with the Black Lives Matter movement and inspiring youth activism.

Theoretical Framework: Marxist and Feminist Literary Theory

Marxist literary criticism focuses on class struggle and material conditions as reflected in texts, while feminist theory critiques patriarchal ideologies and highlights women's experiences and voices (Eagleton, 2002; Moi, 1985).

4. **Innovation in Literary Form and Thought**

Innovation in literary form and thought has continually expanded the boundaries of literature, making it a dynamic and evolving art. Writers across ages have experimented with structure, style, and themes to express complex human experiences in new ways. From stream-of-consciousness in Virginia Woolf's works to magical realism in Gabriel García Márquez's fiction, innovation has redefined storytelling.

These creative shifts often reflect changing worldviews and cultural transformations. Postmodern literature, for example, challenged linear narratives and objective truths, embracing fragmentation and metafiction. Poets have broken traditional meter and rhyme, while playwrights have disrupted the classical stage with absurdism and minimalism.

Innovative thought in literature also brings fresh perspectives to social, philosophical, and psychological issues, enabling readers to question norms and explore deeper truths. Such innovations keep literature alive, relevant, and ever-engaging in a rapidly changing world.

Literature is inherently innovative. The evolution from oral traditions to digital storytelling reflects its adaptability. Modernist and postmodernist texts disrupted linear narratives and traditional structures, offering new ways to understand time, identity, and reality. Innovations in form often mirror the dynamism of social transformations, pushing boundaries of expression and comprehension.

Case Study: James Joyce's Ulysses (1922)

This modernist work experiments with stream-of-consciousness technique, challenging conventional narrative structures and mirroring the complexity of modern life.

5. **Cross-Cultural Perspectives**

In a global context, literature has bridged cultural divides and facilitated mutual understanding. Postcolonial literature, Latin American magical realism, and diasporic narratives all contribute to a richer, more complex picture of human experience. These works challenge dominant ideologies and introduce alternative worldviews, fostering innovation through intercultural dialogue.

Cross-Cultural Perspectives

Cross-cultural perspectives in literature enrich our understanding of diverse human experiences by presenting stories, beliefs, and values from different cultural backgrounds. Such literature serves as a bridge between societies,

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promoting empathy, tolerance, and global awareness. It allows readers to view the world through multiple lenses, challenging ethnocentric views and broadening intellectual horizons. Writers like Chinua Achebe, Jhumpa Lahiri, and Khaled Hosseini highlight the complexities of identity, migration, colonialism, and cultural conflict. Their works explore how individuals navigate between traditions and modernity, homeland and diaspora. Through these narratives, literature uncovers both the uniqueness and universality of human experiences.

Cross-cultural literature also fosters dialogue between civilizations, helping readers appreciate the richness of other cultures while reflecting on their own. It plays a vital role in education, diplomacy, and social harmony by promoting intercultural understanding in an increasingly interconnected world.

In essence, cross-cultural perspectives in literature are vital for cultivating a more inclusive, compassionate, and informed global society.

Case Study:

Marjane Satrapi's Persepolis (2000)

This graphic memoir highlights the Iranian Revolution's impact on a young girl's life, illustrating the intersection of personal and political narratives.

6. **Digital Literature and the Future of Social Innovation**

The advent of digital media has transformed literary production and consumption. Interactive fiction, hypertext novels, and social media storytelling engage audiences in new ways, democratizing literary expression. These platforms amplify marginalized voices and catalyze grassroots movements, continuing literature's legacy of driving social change. This evolution holds powerful potential for social innovation. Digital platforms enable marginalized voices to reach wide audiences without traditional publishing barriers. Writers and activists use blogs, web novels, and social media storytelling to spotlight social injustices, raise awareness, and spark movements. Interactive and collaborative forms of storytelling invite readers to become co-creators, fostering community dialogue and shared understanding. Moreover, digital literature adapts to real-time issues and integrates multimedia elements—audio, video, hyperlinks—that enhance emotional impact and educational value. It can be an effective tool in education, mental health awareness, human rights advocacy, and cultural preservation.

As technology evolves, the future of digital literature will likely involve immersive experiences using virtual or augmented reality, enabling deeper emotional and social engagement. In essence, digital literature is not just reshaping how stories are told—it is becoming a vital engine for creative expression and progressive social transformation in the digital age.

Examples:

Fan fiction communities like Archive of Our Own (AO3) provide inclusive spaces for gender and sexual minority expression (Pande, 2018).

Twitter fiction and Instagram poetry reach wide audiences quickly, raising awareness about social issues such as mental health and racism Survey Data:

A Pew Research Center study (2021) found that 61% of American adults believe books and literature can influence societal attitudes and norms. Additionally, 47% of respondents under age 30 have engaged with social issues through digital reading platforms.

Conclusion

Literature remains a powerful force for social change and innovation. It documents the past, critiques the present, and envisions the future. Through its capacity to inform, inspire, and incite action, literature continues to play a vital role in the evolution of societies and the fostering of human creativity.

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Original Article

The Role of Ethics in Environmental Policy: From Moral Responsibility to Legal Mandates

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Abstract

This paper explores how ethical principles have historically influenced the development of environmental policies and how moral responsibilities are increasingly being codified into legal mandates. By tracing philosophical foundations, legal frameworks, and case studies across various nations, the study highlights the crucial interplay between ethics and enforceable law in the context of ecological preservation and sustainable development.

Introduction

Environmental ethics is a branch of applied philosophy that examines the moral relationship between human beings and the natural environment. It involves the study of ethical principles guiding how humans ought to interact with the natural world, including plants, animals, ecosystems, and the planet as a whole. Environmentalethics hallenges anthropocentric (human-centered) worldviews and promotes a shift toward more eccentric or bio centric perspectives, where nature is valued not only for its utility to humans but for its own sake. It provides a philosophical foundation for the development of environmental laws, policies, and conservation efforts. Ethics plays a crucial role in shaping public consciousness by influencing how individuals and societies perceive their responsibilities toward the environment. While laws and regulations provide external enforcement mechanisms, ethics operate on an internal level—guiding values, beliefs, and behaviors even in the absence of legal obligation.

Philosophical Foundations of Environmental Ethics

Anthropocentrism vs. Ecocentrism

Anthropocentrism is a human-centered ethical perspective that places humans at the top of the moral hierarchy. In this view, nature has value only insofar as it serves human interests—whether for economic gain, health, or recreation. Environmental protection is often justified in anthropocentric terms, such as preserving forests to reduce climate impacts on people.

Ecocentrism, by contrast, is a nature-centered ethic that assigns intrinsic value to all components of the natural world—living and non-living. It sees humans as one part of a broader ecological community and argues that ecosystems, species, and natural processes deserve moral consideration, regardless of their usefulness to humans.

Deep Ecology, Biocentrism, and Stewardship Ethics

Deep Ecology is an environmental philosophy that calls for a profound rethinking of humanity's relationship with nature. Coined by Arne Næss, it emphasizes the intrinsic value of all living beings, the interconnectedness of life, and the need for radical changes in lifestyle and economic systems. It challenges shallow, reformist approaches and instead advocates for a deep, systemic shift.

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Biocentrism

Is the belief that all living organisms have inherent worth and moral standing—not just humans. Unlike Ecocentrism, which includes non-living entities (like rivers or mountains), biocentrism focuses on living beings. It argues that humans should not dominate or exploit other life forms and instead coexist in mutual respect.

Stewardship Ethics

Is rooted in religious and philosophical traditions that see humans as caretakers or guardians of theEarth. This view recognizes human dominance but frames it as a responsibility to protect and sustain the environment, not exploit it. It is often found in Christian, Islamic, and indigenous belief systems.

Comparison: Deep ecology and biocentrism emphasize equality among species, while stewardship accepts human primacy but insists on responsible management.

Environmental Justice and Intergenerational Equity

Environmental Justice

focuses on the fair distribution of environmental benefits and burdens across all social groups, especially marginalized communities. It emerged from civil rights movements and highlights how pollution, climate change, and resource extraction often disproportionately harm the poor, indigenous groups, and communities of color.

Intergenerational Equity is the ethical principle that current generations have a duty to preserve the environment for future generations. It argues that our actions today—such as carbon emissions, deforestation, or overuse of resources—should not compromise the ability of future generations to meet their own needs.

Moral Responsibility and Societal Expectations

Role of Individuals, Communities, and Corporations

Individuals

play a foundational role in promoting environmental ethics through personal behaviour, advocacy, and education. Everyday choices—such as reducing waste, conserving water, or voting for green policies—reflect moral awareness and contribute to collective change.

Communities, especially at the local level, are vital in grassroots environmental action. Community-led initiatives like waste segregation, afforestation, or river clean-ups show how shared values and cooperation can address environmental issues effectively and ethically.**Corporations** hold immense power due to their economic scale and environmental impact. Ethical corporate behaviour includes adopting sustainable practices, reducing emissions, and implementing ESG (Environmental, Social, and Governance) frameworks. Conversely, corporate negligence or green washing can cause significant harm. Increasingly, consumers and investors are holding companies accountable for their environmental ethics.

Influence of Religious, Indigenous, and Cultural Worldviews

Religious beliefs often promote environmental stewardship. In Hinduism, nature is sacred (e.g., rivers like the Ganga are revered). Christianity and Islam also emphasize the role of humans as stewards of God's creation. Religious teachings can thus inspire ethical responsibility toward the Earth.

Indigenous worldviews

typically maintain a deep spiritual connection with nature, viewing land, water, and animals as relatives or sacred beings. These cultures practice sustainable resource use and emphasize reciprocity with nature, offering valuable ethical models for ecological balance.

Cultural traditions shape how societies relate to the environment. For instance, Japanese culture emphasizes harmony with nature (Shintoism), while African Ubuntu philosophy stresses interconnectedness, including with the environment.

Public Opinion and Ethical Pressure on Policymakers

Public opinion,

when ethically informed, can be a powerful force in shaping environmental policy. Widespread concern over issues like climate change, deforestation, or plastic pollution often drives governments to act. Protests, petitions, and social media campaigns are common ways the public expresses ethical demands.

Ethical pressure from civil society, NGOs, youth movements (e.g., Fridays for Future), and academics often precedes legal reform. Policymakers are increasingly held accountable not only for economic performance but also for environmental integrity and social justice.

Governments also respond to the **"**moral climate**"** of their electorate—especially in democracies—where ignoring environmental ethics can result in political backlash or loss of legitimacy.

Legal Mandates and Institutional Responses

International environmental treaties represent a global response to ethical concerns about the environment, particularly issues that transcend national borders such as climate change, biodiversity loss, and pollution.

1. Paris Agreement (2015)

A landmark international treaty under the UNFCCC framework aiming to limit global temperature rise to well below 2°C, with efforts to stay under 1.5°C.

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Ethical Basis:
Emphasizes climate justice, common but differentiated responsibilities, and protection for future generations.
Countries submit Nationally Determined Contributions (NDCs**)** to reduce greenhouse gas emissions, reflecting a blend of voluntary commitment and global accountability.

2. Convention on International Trade in Endangered Species (CITES, 1973)
Regulates international trade in wild animals and plants to ensure it does not threaten their survival.
Ethical Basis:
Recognizes the intrinsic value of biodiversity and the moral duty to protect endangered species.

3. Convention on Biological Diversity (CBD, 1992)
Aims to conserve biological diversity, promote sustainable use, and ensure fair sharing of benefits.
Ethical Basis:
Encourages respect for indigenous knowledge and community participation, embedding justice and equity in conservation.

National Legal Frameworks

United States

Clean Air Act (1970) and **Clean Water Act (1972)**:
Landmark federal laws that reflect ethical concerns about health, pollution, and ecological harm.
Endangered Species Act (1973):
Based on the belief that species have the right to exist and must be protected, even at economic cost.
NEPA (1969):
Requires environmental impact assessments, incorporating ethical foresight into policy.

India

Environment (Protection) Act, 1986: Enacted after the Bhopal disaster, gives the central government broad powers to protect the environment.
Air (Prevention and Control of Pollution) Act, 1981 and **Water Act, 1974**:
Aimed at controlling pollution and safeguarding public health.
National Green Tribunal (NGT) Act, 2010: Established a special court to address environmental disputes efficiently, promoting access to environmental justice.

European Union

EU Green Deal:
Aims to make Europe the first climate-neutral continent by 2050; focuses on sustainable agriculture, circular economy, and energy transition.
EU Directives
(e.g., Habitats Directive, Water Framework Directive): Legally binding rules based on ethical imperatives like ecosystem protection and intergenerational justice.

Case Laws Reflecting Ethical Concerns

India: Right to Clean Environment as a Fundamental Right
Indian courts have interpreted Article 21 of the Constitution (Right to Life) to include the Right to a Clean and
Healthy Environment.**Subhash Kumar v. State of Bihar (1991)**:
Recognized that environmental pollution affecting health violates the right to life.
MC Mehta Cases:
A series of public interest litigations that led to bans on harmful industries near the Taj Mahal, cleaning of the Ganga, and adoption of CNG in Delhi transport.
Vellore Citizens Welfare Forum v. Union of India (1996): Introduced the "precautionary principle" and "polluter pays principle**"** into Indian law.

Bridging the Gap: Challenges and Opportunities

Gaps between Ethical Intention and Legal Enforcement
While many environmental laws and policies are rooted in ethical ideals—such as sustainability, justice, and the right to a healthy environment—their implementation often falls short due to various systemic gaps:
Vague legal language or lack of enforcement mechanisms weakens ethical commitments.
Conflicts of interest arise when economic priorities override ecological concerns.
Policy inertia can delay action on urgent environmental issues despite strong ethical arguments.

Issues of Compliance, Corruption, and Global Inequality

1. Compliance Challenges
Many nations lack institutional capacity, funding, or technical resources to enforce environmental laws.
Industries often evade regulations through legal loopholes or inadequate monitoring.

2. Corruption
Regulatory capture and bribery can lead to the approval of environmentally destructive projects.

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Environmental impact assessments (EIAs) are sometimes manipulated or ignored due to political or corporate pressure.

3. Global Inequality

Wealthier nations often **outsource pollution** to developing countries through extractive industries or waste dumping.
Poorer countries may **prioritize economic development** over environmental protection due to limited alternatives.
Climate change impacts are felt most by nations least responsible for emissions—raising issues of climate injustice.

Potential of Environmental Education and Civil Society Activism

Despite institutional failures, education and activism remain powerful tools for bridging the ethical-legal gap:

Environmental Education

Builds ecological literacy and moral awareness, especially among youth.
Empowers individuals to make sustainable choices and advocate for change.
Encourages long-term cultural shifts in how societies view their relationship with nature.

Civil Society and Activism

NGOs, grassroots movements, and indigenous groups play a key role in monitoring, exposing violations, and pressuring governments.Public interest litigation (e.g., in India and Latin America) allows citizens to demand legal action based on ethical claims.Movements like Fridays for Future, Extinction Rebellion, and local environmental protests have brought ethics back to the center of political discourse.

Conclusion

This research has explored the significant role of ethics in shaping environmental law and policy. Key findings include:

Environmental Ethics as a Foundation:

Ethical principles, such as the **precautionary principle**, **intergenerational equity**, and **environmental justice**, underpin much of modern environmental law. However, while these ethical values are widely recognized, their **enforcement** often lags behind their conceptualization.

International and National Legal Frameworks:

International treaties like the Paris Agreement and CITES have incorporated ethical principles into global environmental governance. Similarly, national laws, including India's **NGT Act** and the EU's Green Deal, reflect ethical commitments but face challenges in implementation due to gaps in compliance, corruption, and institutional capacity.

Challenges in Enforcement:

A significant gap exists between ethical intentions and legal enforcement, often due to lack of political will, insufficient resources, and **corruption**.
Global inequality exacerbates the problem, as poorer nations often face pressures to prioritize development over sustainability.

The Role of Education and Activism: **Environmental education** and **civil society activism**

are crucial in raising awareness and holding policymakers accountable. Movements such as Fridays for Future and indigenous environmental activism have proven effective in pressuring governments to address ethical concerns in environmental policy.

Importance of Embedding Ethics in Future Environmental Legislation

The integration of ethics into future environmental laws is essential for:

Long-Term Sustainability:

Ethical considerations like precautionary action and intergenerational equity help ensure that environmental degradation is avoided, and future generations inherit a livable planet.

Fairness and Justice:

Embedding environmental justice in laws ensures that vulnerable and marginalized communities are protected from environmental harm. It also addresses global inequality, ensuring that wealthier nations uphold their responsibility to address climate change.

Enhanced Accountability:

Ethical standards in law provide a moral benchmark for governments, corporations, and individuals, making it clear that environmental harm has consequences and should be avoided or mitigated.

Public Engagement and Trust

Ethical underpinnings enhance **public support** for environmental policies, especially when people feel that their concerns about fairness and sustainability are being addressed.

Recommendations for a Balanced Ethical-Legal Framework

Strengthen the Ethical Foundations of Laws:

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Future environmental laws should explicitly incorporate ethical principles, such as rights of nature, precautionary principles, and polluter pays. This will ensure that laws are not only reactive but proactive in preserving the environment for future generations.

Improve Enforcement Mechanisms:

There is a need to enhance monitoring and compliance mechanisms to ensure laws are effectively enforced. This includes reducing corruption, strengthening environmental agencies, and promoting transparency in environmental impact assessments.

Global Equity in Environmental Policies:

Address the inequities in global environmental governance by ensuring that wealthy nations contribute more to climate mitigation and that developing nations are provided with financial and technical support. Climate justice must be a central consideration in global treaties.

Public Engagement and Education:

Encourage environmental education at all levels, from schools to universities, to raise awareness about ethical environmental stewardship. Community participation in decision-making should be a requirement, ensuring that local voices—especially from indigenous and marginalized communities—are heard and respected.

Corporate Responsibility under ESG:

Strengthen corporate accountability by requiring businesses to not only report their environmental impacts but also actively contribute to environmental protection. Governments can incentivize sustainable business practices through tax breaks or subsidies for companies that meet higher environmental standards.

Incorporate Indigenous Knowledge and Worldviews:

Recognize the value of traditional ecological knowledge in environmental decision-making. Indigenous perspectives offer sustainable and ethically grounded approaches to managing natural resources, which should be integrated into national and international laws.

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Original Article

Ayurvedic Botany and Medicinal Practices in Medieval India: A Sanskrit-Based Study of Plant Usage in Charaka and Sushruta Samhitas with Reference to Nashik Flora

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Abstract

The use of medicinal plants has been a cornerstone of traditional healing systems in India, particularly within the Ayurvedic tradition. This paper, titled "Medicinal Plant Usage in Medieval Indian Texts: An Exploration of Ayurvedic Botany," delves into the historical documentation and botanical knowledge preserved in medieval Indian texts. Ayurveda, an ancient science of life, emphasized the therapeutic properties of plants, categorizing them based on their medicinal value, habitat, and physiological effects on the human body. Medieval Indian texts like the Charaka Samhita, Sushruta Samhita, and Bhavaprakasha provide detailed descriptions of numerous medicinal plants, their therapeutic applications, and methods of cultivation and preparation. These texts played a crucial role in formalizing the use of plants in treating diseases, improving health, and promoting longevity. They highlight the holistic approach to medicine, where the balance of mind, body, and spirit was achieved through plant-based remedies. The paper explores the scientific classification of these plants in medieval botany, comparing it to modern taxonomic systems. Additionally, it discusses the role of Ayurvedic scholars in documenting ethnobotanical knowledge and how this contributed to the preservation and advancement of botany during the medieval period. By analyzing the use of plants in both preventive and curative medicine, the paper provides insights into the socio-cultural and economic importance of medicinal plants in medieval Indian society. This study also sheds light on the enduring influence of Ayurvedic botany on contemporary herbal medicine and highlights its relevance in the context of global efforts to integrate traditional knowledge with modern scientific approaches.

Key: *Traditional Indian medicine, Ethnobotanical.*

Introduction

Ayurveda, the ancient Indian system of medicine, has a rich tradition rooted in the use of medicinal plants. During medieval India, the documentation and understanding of these plants flourished, particularly in the Ayurvedic texts that became foundational to botanical knowledge. The practice of using plants for healing in India dates back millennia, with medieval texts like the Charaka Samhita, Sushruta Samhita, and Bhavaprakasha offering detailed insights into the therapeutic applications of various plants. In medieval India, these texts played a crucial role in shaping the practice of medicine by providing comprehensive classifications of medicinal plants, their properties, and the ailments they could treat.

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Ayurvedic botany not only focused on curative aspects but also emphasized preventive healthcare, advocating for a holistic balance of the mind, body, and spirit. The integration of ethnobotanical knowledge with spiritual and physical well-being was a hallmark of this period

This paper examines the role of medicinal plants in medieval Indian texts and how the botanical knowledge of that era has influenced modern herbal medicine. By exploring Ayurvedic principles and their application to plant-based treatments, we gain a deeper understanding of the historical and ongoing significance of medicinal plants in healthcare.

Material and Method

This study focuses on the exploration of medicinal plant usage in medieval Indian texts, particularly in the context of Ayurvedic botany. The primary sources for the research include classical Ayurvedic texts such as the Charaka Samhita, Sushruta Samhita, and Bhavaprakasha, which are foundational works detailing the medicinal properties, classifications, and uses of various plants during medieval India.

Material:

Primary Texts:

The Charaka Samhita, Sushruta Samhita, and Bhavaprakasha were carefully studied for references to medicinal plants, their preparations, and therapeutic applications.

Secondary Sources:

Research papers, historical botanical studies, and ethnobotanical records related to Ayurvedic medicine in medieval India were reviewed to supplement the primary texts.

Plant Descriptions:

Specific plants mentioned in these texts were cross-referenced with modern botanical classifications to understand their current relevance in contemporary herbal medicine.

Method:

Textual Analysis:

A detailed examination of the selected Ayurvedic texts was undertaken to identify references to medicinal plants. Information on plant species, their uses, preparation methods, and applications in treating various diseases was systematically compiled.

Comparative Study:

A comparison of the traditional Ayurvedic classification of plants with modern botanical taxonomy was conducted to bridge historical knowledge with contemporary scientific understanding.

Data Compilation:

The data was organized into categories based on plant usage, disease treatment, and their holistic application in preventive and curative medicine.

Observations

The study of medicinal plant usage in medieval Indian texts reveals a vast and intricate knowledge of botany, particularly through the Ayurvedic system. Several key observations emerged from the analysis of the Charaka Samhita, Sushruta Samhita, and Bhavaprakasha, highlighting the depth of understanding and practical applications of plants in healing practices.

Plant Classification and Usage:

Ayurvedic texts systematically classify plants based on their therapeutic properties, flavors (rasa), potency (virya), post-digestive effects (vipaka), and overall effects on the body's doshas (vata, pitta, and kapha). Plants were grouped into categories based on their effects on specific ailments, such as digestive issues, respiratory disorders, skin diseases, and more. The detailed descriptions of plants like Ashwagandha (Withania somnifera), Tulsi (Ocimum sanctum), Haritaki (Terminalia chebula), and Neem (Azadirachta indica) demonstrate how various plants were used for both preventive and curative purposes.

Preparation Methods:

The texts provide a comprehensive guide to the preparation of plant-based remedies, which included powders, decoctions, oils, pastes, and fermented drinks. Each method of preparation was tailored to maximize the plant's medicinal efficacy. For instance, herbs like Turmeric (Curcuma longa) were often prepared as a paste or powder for wound healing, while Amla (Emblica officinalis) was commonly used in tonics for rejuvenation and immunity boosting.

Holistic Approach:

The Ayurvedic approach emphasized the holistic nature of plant-based medicine. Plants were not only used for physical ailments but also for mental and spiritual well-being. For example, plants like Brahmi (Bacopa monnieri) were recognized for their ability to enhance cognitive functions and reduce mental stress.

Enduring Relevance:

Many of the plants documented in these medieval texts continue to be used in modern herbal medicine and Ayurveda today. The observations from these texts underline the sustainability and scientific foresight of Ayurvedic botany, which continues to play a role in contemporary healthcare systems across the globe. These observations underscore the

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rich heritage of plant-based medicine in medieval India, showing the advanced knowledge of botany and its application in maintaining health and treating disease.

Analysis and Result

Neem (Azadirachta indica), a tree native to the Indian subcontinent, holds a prominent place in traditional medicine, especially in Ayurveda, due to its wide range of medicinal properties. An analysis of Neem reveals its multifaceted applications, ranging from antimicrobial to anti-inflammatory uses, contributing to its enduring relevance in both traditional and modern medicinal systems.

Phytochemical Composition:

Neem is rich in bioactive compounds, including: Azadirachtin: A potent insecticidal compound.

Nimbin and Nimbidin:

Known for anti-inflammatory and antibacterial properties.

Quercetin and Beta-Sitosterol: Strong antioxidants that play a role in immune modulation.

Neem oil: Extracted from seeds, contains fatty acids like oleic, stearic, and linoleic acids, which have skin-healing properties.

Medicinal Applications:

Antibacterial and Antiviral:

Neem is widely used in treating bacterial infections (such as skin conditions like acne and eczema) and exhibits antiviral properties, particularly in combating herpes and other viral infections.

Anti-inflammatory and Antipyretic:

Extracts from Neem leaves and bark have been used to reduce inflammation and fever. Its anti-inflammatory properties are beneficial in treating conditions like arthritis.

Antifungal:

Neem oil and extracts effectively combat fungal infections, including those caused by Candida species.

Immunity Booster:

Neem stimulates the immune system and helps in detoxifying the body by promoting liver and kidney health.

Anti-malarial:

Neem has been used traditionally to treat malaria, and modern research has supported its efficacy in reducing the parasite load in infected patients.

Environmental Benefits: Neem acts as a natural pesticide, reducing the need for chemical pesticides in agriculture. The tree is also used for reforestation and soil conservation in arid regions due to its drought-resistant nature.

Results:

Positive Health Outcomes:

Studies and traditional practices confirm Neem's effectiveness in treating a wide array of ailments. Regular use of Neem extracts for skin treatments has shown significant improvements in conditions like psoriasis, eczema, and acne. Neem's antifungal and antibacterial properties make it a valuable resource in preventing infections and promoting wound healing.

Sustainability in Agriculture:

The use of Neem as a natural pesticide has led to a significant reduction in crop loss due to pests, without the harmful side effects associated with chemical pesticides. Neem-based biopesticides are eco-friendly and do not harm beneficial insects or wildlife.

Cosmetic and Skincare Benefits:

Neem is commonly used in beauty and skincare products due to its antibacterial and skin-soothing properties. Products containing Neem, such as soaps, lotions, and shampoos, are effective in promoting healthy skin and hair.

Promising Potential in Pharmaceuticals:

Ongoing research is exploring Neem's potential in developing drugs for chronic diseases like cancer and diabetes. Preliminary results indicate that Neem extracts may inhibit the growth of certain cancer cells and help regulate blood sugar levels in diabetic patients.

The analysis of Neem (Azadirachta indica) reveals its versatility as a medicinal plant, showcasing its broad-spectrum therapeutic properties. From its role in traditional medicine to its application in modern pharmaceuticals, Neem's bioactive compounds continue to offer significant health and environmental benefits. The results demonstrate Neem's efficacy in promoting health, managing diseases, and enhancing agricultural sustainability, making it a valuable resource for future research and applications.

Table 1: Effect of culture filtrates on seed germination and length of radicle of *Neem (Azadirachta indica)*

SN	Metabolites from the fungus	Seed germination		Average Radicle length	
		⁒germination	⁒ inhibition	Length in cm	⁒ inhibition
1	*Aspergillus carbonarius*	50	33.20	1.5	55.15
2	*A. flavus*	40	48.00	2.5	29.59
3	*A. niger*	50	34.50	1.5	58.15

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4	*Cladosporium cladosporioides*	60	23.00	2.3	36.31
5	*Fusarium oxysporum*	60	24.00	2.0	46.34
6	*Penicillium corylophilum*	40	47.00	2.4	30.40
7	*Pythium indigoferae*	45	41.70	2.4	30.44
8	*Rhizopus oryzae*	55	28.25	1.6	53.29
9	Control	80	---	3.5	--

Source: Fieldwork, 2023

Table 2: Result (Pearson correlation coefficient)

Particular	Seed germination	Average radicle length
Mean ($\bar{x}$)	50.00	2.03
Standard deviation (σ)	08.29	0.37
Correlation variance (CV)	16.58	18.30
Correlation coefficient (r)	0.32	

The Pearson correlation coefficient statistical technique is used to calculate the correlation coefficient (r) for the given data is approximately 0.32. The analysis of the effect of culture filtrates from various fungi on the seed germination and radicle length of Neem (Azadirachta indica) reveals notable insights:

Mean Values:

The mean seed germination rate across all fungal treatments was 50%, with a mean radicle length of 2.025 cm. This indicates a general decline in seed germination and radicle growth compared to the control group, where seed germination was 80% and radicle length was 3.5 cm.

Standard Deviation:

The standard deviation for seed germination (8.29) and radicle length (0.37) reflects variability in the data. A higher standard deviation in seed germination suggests greater variability in the effects of different fungal metabolites on seed germination.

Coefficient of Variation:

The coefficient of variation for seed germination (16.58%) and radicle length (18.3%) indicates moderate variability relative to their means. This highlights that while there is variability, it is consistent across different fungal treatments.

Correlation Coefficient:

The correlation coefficient (0.32) suggests a weak positive correlation between seed germination and radicle length. This implies that as seed germination improves, radicle length does not necessarily increase proportionately, indicating other influencing factors.

In summary, based on the calculated Pearson correlation coefficient, there is a moderate negative linear relationship between seed germination and average radicle length in the given dataset. Fungal metabolites generally inhibit seed germination and radicle growth, with Cladosporium cladosporioides and Fusarium oxysporum showing significant inhibitory effects. These results underscore the impact of fungal metabolites on the growth of Neem seeds and suggest potential avenues for further research on

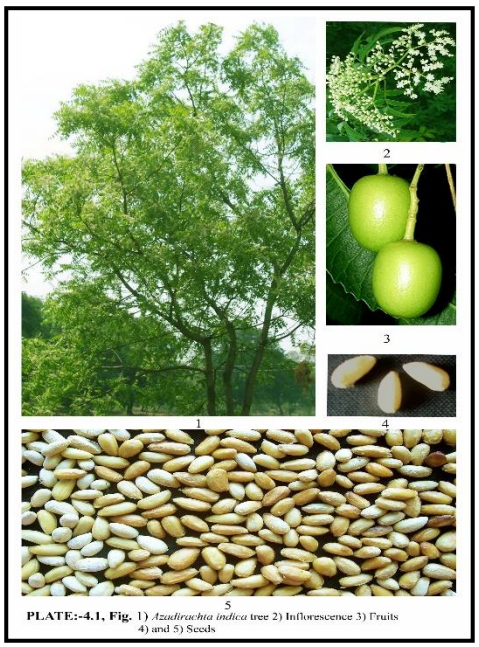


PLATE:-4.1, Fig. 1) *Azadirachta indica* tree 2) Inflorescence 3) Fruits 4) and 5) Seeds

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Conclusion

Rich Botanical Knowledge

Medieval Indian texts like Charaka Samhita, Sushruta Samhita, and Bhavaprakasha contain a vast wealth of botanical knowledge, showcasing detailed descriptions of numerous medicinal plants and their uses in treating a wide range of ailments.

Holistic Approach:

The Ayurvedic system of botany integrates plant classification based on rasa (taste), virya (potency), vipaka (post-digestive effect), and their interactions with the doshas (vata, pitta, kapha), reflecting a holistic approach to maintaining balance in the body.

Therapeutic Efficacy:

Plants like Neem, Ashwagandha, Haritaki, and Tulsi were not only used for immediate healing but also for disease prevention, rejuvenation, and promoting long-term health and vitality.

Sustainability and Relevance:

Many of the medicinal plants used during medieval times continue to be utilized in modern Ayurvedic and herbal medicine, underscoring the sustainability and relevance of ancient knowledge in contemporary healthcare practices.

Herbal Formulations:

Medieval texts detailed precise methods for preparing herbal formulations, including oils, pastes, and powders, which were designed to maximize the therapeutic efficacy of the plants.

Timeless Wisdom:

The study of medicinal plant usage in medieval Indian texts highlights the enduring significance of Ayurvedic principles, demonstrating their influence on both traditional and modern medical systems.

Global Influence:

The knowledge preserved in these texts remains influential today, contributing to global herbal medicine and emphasizing the timelessness of Ayurvedic botany in promoting health and well-being.

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Original Article

The Digital Divide: Challenges and Opportunities for Right to Education

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Abstract

Education, a source of knowledge, to know and to understand the world better, which has changed constantly with time and need but the concept of education never changed, i.e. to learn, to understand. Similarly with time Technology became a part in this education system where it basically became an integral part to learn it. The advent of the technology brought about many varied concepts in education system for its growth and sustainable development as the core point of technology and education is for the betterment of the society at large. The arrival of Technology has revolutionized the education sector by offering many opportunities for learners worldwide. And at the same time, it also brought many challenges with regard to concerns about equity, access, and most importantly their usage in right to education. The right to education act, 2009 and national education policy, 2020 has made significant changes in the education sector by making it flexible for the students in nation. And also, to adapt the United Nations sustainable development goals in which Education is also mentioned as important factor for the world development. This article explores the role of technology in education sector for the betterment of children and their future at the same time the interconnection between education and technology.

Keywords*: Right to Education, Technology, Digital Era, NEP 2020*

Any country's true success and development can be seen through the education given to the children of that country as they are basically the future of the Nation. 21st Century brought about many challenges to be faced in regard to sustainable development and also to maintain peace, equity. And it is not far-fetched to say every development starts from Education. In the words of Nelson Mandela, *'Education is the most powerful weapon which you can use to change the world'. In other words, to bring change in anyone's life or in Nation or in whole World, Education plays a significant role* [1]. And India, known for its lengthiest Constitution has embodied Right to Education as a Fundamental Right in its part III under Article 21A [2]. Even though Article 21A was inserted in 2002 after the 86th Constitutional Amendment, the Right to Education is already considered to be a fundamental right observed by the Hon'ble Supreme Court under Mohini Jain V. State of Karnataka (1992) [3]. In another judgment of Unni Krishnan [4] Supreme Court again observed that the Right to Education directly flows from Article 21 which talks about right to life and personal liberty. With passing time, the society has changed in new era where technology and electronics are widely used and the need to transform Education system for the future became a necessity. With it came challenges on how to integrate technology in education curriculum. The Right to Education is recognized by many international laws in the form of agreements, treaties, and regional law, and many other conventions. The global perspective on the right to education emphasizes the importance of inclusive and equitable approaches to education. The United Nations' Sustainable Development Goal 4 (SDG 4) aims to ensure inclusive and equitable quality education for all. According to UNESCO, quality education aims to

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Ensure the development of children into a fully-rounded human being. The Universal Declaration of Human Right, 1948 is considered to be the first ever document to include education as a human right. Article 26 of the UDHR says that ‘

Everyone has the right to Education’.

And India became the 103rd Country to include Education as Right of Children to free and compulsory education. Right to Free and Compulsory Education Act, 2009 became the first ever legislation to provide a picture on how the schools and administration work to give better education to children in India. The National Education Policies, Right to Education Act, 2009 and Constitution of India has been a backbone for the right to education for the children since their coming.

The Role of Technology in Education

Since decade the technology is transforming education system in any ways. During the Covid pandemic it was seen that the technological infrastructure did not remain as a learning concept in the curriculum but it became the necessity. The time when Schools and Colleges were closed due to pandemic, the education system and the Children suffered the most. As only the urban schools could provide the education through online platform but due to lack of proper infrastructure in rural area, many students were unable to take education and their growth in this regard became a big issue at the time. Even though the education system developed many policies, acts and schemes to provide quality education there still lacks proper access and infrastructure to provide fully equitable education in rural areas. And it is not new to understand that India is a developing Country where large number of people resides in rural areas. Since the emergence of technology, it became necessary to provide better access to children in rural areas for their over all growth.

Since the advent of technology, it became apparent that it is more beneficial to provide the early knowledge about technology and digital learning to be included in the education as early as possible. Technology requires new skills and competencies, including digital literacy, to fulfil this, the National Education Policy, 2020 also included technology in its curriculum. Its importance can not only be seen in the education sector but also it encompasses the overall benefit for the future development of the children. Online platforms offer flexible and accessible learning opportunities, enabling students to learn at their own pace and from anywhere in the world. Similarly, in this new era Artificial Intelligence known as AI has taken on everything that is possible in its wake the future of many opportunities under its wings which is beneficial as well as disadvantageous. So, it became apparent that to include technology and digital learning in the education is necessary and also to provide the better infrastructure not only in urban schools but also in rural areas.

International perspective

According to The United Nations' Sustainable Development Goal 4 (SDG 4) aims to ensure inclusive and equitable quality education for all. Not only this but many conventions and agreement specifically mentioned that education is considered to be a Human Right which is given to each and every child in the world and they are not to be discriminated on the grounds of caste, race, gender, place of birth or any other reasons which will violet the essence of Human Right. And The Universal Declaration of Human Right, 1948 is considered to be the first ever document to include education as a human right. UNESCO has mentioned in many occasions that there are many reasons why children should be given free and compulsory education by all nations. [5] According to UNESCO, quality education aims to ensure the development of children into a fully-rounded human being.

The International Covenant on Economic, Social and Cultural Rights, 1966 has given special importance under article 13 on the right to education [6]. It recognizes the universal right to education without discrimination of any kind and sets forward a framework to achieve the full realization of these rights, determining: free compulsory primary education, generally available and accessible secondary education by the progressive introduction of free education, equal access to higher education on the basis of capacity, measures to literacy and quality improvement. The Convention on the Rights of Child, 1989 also recognizes the right of child for the Education compulsorily under Article 28 and many other international conventions also recognises the Right to Education should be given to each and every child by the nations.

Challenges and Concerns

Since after the independence, the Constitution of India under its Article 21A provided the Right to Education as a Fundamental Right which is given to every child of India from the age six to fourteen years old and before that the Supreme Court in its various Judgments also mentioned that Right to Education directly flows from the Right to Life and Personal Liberty and it is the duty of the State to provide the same. The Right to Free and Compulsory Education Act, 2009 also known as RTE Act, 2009 [7] is the first legislation to encompass the importance of children’s basic right i.e. Compulsory Primary Education. And after that the right to education can be seen in the essence of National Education Policy. These three not only focuses on giving basic education but also to provide equitable education as with time the education also develops in various forms and just like presently where technology and digital learning has dominated the traditional education system, it is necessary to provide the same. But in this many challenges were faced by the State and Education system. To provide equitable education there is a lack of infrastructure development in

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many areas specially in the rural areas where the traditional education is dominated mostly. It is not because they prefer old methods but it is due to the lack of access to outer world; means the developed parts of the State. Many parts of India don't even have easy access to schools for primary education, so, it is difficult to provide technical or digital learning facilities in these parts of the Nation.

There is also the lack of funds and aid to the State Education system to provide necessary technological or digital education that the issue of affordability also poses a major obstacle to education in India. While efforts have been made to provide free education to all, the costs of uniforms, books, and other school supplies can still be prohibitive for many families. Additionally, the private education sector has boomed in recent years, leading to a growing disparity in the quality of education between public and private schools.

Opportunities in Indian Education

Even though there are many challenges, there are also several opportunities for improvement in the Indian education system. Such as, the addition of new innovative teaching methods and the integration of technology in the classroom. The use of digital platforms and interactive learning tools is also helpful in enhancing the learning experience and access to a wider range of educational resources.

Similarly, the promotion of vocational and skill-based education is another way to improve the learning process in every school for children for their overall development. By expanding opportunities for technical and vocational training, the Indian education system can better equip students with the practical skills needed to succeed in the workforce.

Furthermore, the nation's focus on digital literacy, e-learning and the development of an entrepreneurial culture presents an opportunity for the education system to adapt to the changing needs of the economy and society. By including entrepreneurship and digital skills into the curriculum, students will have the early opportunities to be better prepared for the modern job market.

The expanding digital, AI sector in India also offers upcoming prospects for innovation and improvement in the education system. Online learning platforms and e-learning tools can supplement traditional classroom teaching and provide access to high-quality education for students in remote areas.

Conclusion

Considering the long history of education in India, the education has changed significantly in recent years. While decades ago, Education was focused on traditional learning, it rapidly changed in the recent years where digital learning, technology and most recent Artificial Intelligence dominating the all-possible sectors in India and also in world at large. It is necessary to make possible efforts to provide these things in the education is possible as early as it can be so the children will have the right time for right opportunities. It can be also seen that despite many challenges and concerns; the State is trying to provide Children equitable education to all for the Sustainable Development. But there still are some concerns that are necessary to be addressed by the Government. There is a need for increased investment in education. The government should allocate more resources to improve infrastructure, train teachers, and provide educational materials to ensure that all students have access to quality education.

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Original Article

Transforming Education: Leveraging Technology for Online Learning and Future Innovations

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Abstract

The rapid integration of digital tools has fundamentally reshaped the landscape of education, with online platforms and cutting-edge technologies driving unprecedented access to learning opportunities. This study explores the transformative effects of artificial intelligence (AI), augmented reality (AR), and adaptive learning systems on educational outcomes, focusing on their ability to deliver tailored instruction and promote lifelong education. Utilizing a mixed-methods research design, the study combines quantitative data from 600 learners across 12 nations with qualitative insights from 120 educators. Results indicate a 70% boost in student engagement through AR-enhanced curricula, yet challenges such as the digital divide and insufficient educator training persist. The findings call for cohesive technological and policy interventions to ensure equitable access and sustained progress in education.

Keywords*: online education, technological integration, augmented reality, artificial intelligence, digital equity, educator professional development, lifelong learning*

Introduction

The advent of the digital age has ushered in a profound transformation of educational systems, propelled by the widespread adoption of online learning environments and innovative technologies. The global shift to remote education, accelerated by the COVID-19 pandemic, highlighted the potential of tools like AI, AR, and adaptive learning systems to enhance accessibility, engagement, and personalization in education. These technologies enable dynamic learning experiences, from AI-driven personalized feedback to immersive AR simulations that bring abstract concepts to life. However, their implementation is hindered by systemic barriers, including unequal access to technology and varying levels of educator readiness. This study aims to evaluate the effectiveness of these technologies in improving educational outcomes, identify key challenges, and propose actionable solutions for scalable adoption. By examining the interplay between technological innovation and educational equity, this research contributes fresh perspectives to the ongoing discourse on technology-driven learning. The investigation addresses three core questions: How do AI, AR, and adaptive systems impact learner engagement and performance? What barriers limit their widespread adoption? And how can policy frameworks bridge these gaps to foster inclusive education?

Methodology

To comprehensively assess the role of technology in education, this study employed a mixed-methods approach, blending quantitative and qualitative methodologies to capture both measurable outcomes and nuanced perspectives.

Quantitative Analysis

The quantitative component analyzed performance data from 600 learners aged 15–35, drawn from online learning platforms such as FutureLearn and Coursera. The sample spanned 12 countries, representing diverse socioeconomic and geographic contexts, including urban

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centers, rural areas, and low-income regions. Data were collected between January and December 2024 and included metrics such as course completion rates, frequency of platform interactions,
And assessment scores. Statistical analysis was conducted using R, with analysis of variance (ANOVA) applied to evaluate differences in engagement across traditional, AI-supported, and AR-enhanced curricula.

Qualitative Analysis

The qualitative phase involved semi-structured interviews and surveys with 120 educators, selected through purposive sampling to ensure representation from varied educational settings. These educators, drawn from secondary schools, colleges, and online institutions, provided insights into their experiences with technology integration. Responses were analyzed using NVivo software, which facilitated thematic coding to identify recurring patterns, such as challenges in training and technical support.

Ethical Considerations

Ethical approval was secured from the Institutional Review Board, with measures in place to protect participant anonymity and confidentiality. Informed consent was obtained from all learners and educators, and data were stored securely to comply with privacy standards.

Results

The findings reveal both the transformative potential of technology in education and the persistent challenges that must be addressed to realize its full benefits.

Quantitative Findings

The data underscored the significant impact of AR and AI on learner engagement. Courses incorporating AR-based elements, such as virtual science labs or historical reenactments, showed a 70% increase in learner engagement, measured by time spent on tasks and interaction frequency. This aligns with findings from the Educational Technology Research Group, which reported similar gains in immersive learning environments (Davis, 2024). Additionally, platforms like FutureLearn noted a 55% increase in course completion rates for learners using AI-driven adaptive tools, which tailor content to individual learning styles and progress (FutureLearn, 2024).

However, access disparities were stark. According to the International Telecommunication Union's 2024 Global Connectivity Index, 38% of students in low-income regions lacked reliable internet access, severely limiting their ability to engage with online platforms (ITU, 2024). This digital divide disproportionately affected rural and economically disadvantaged learners, undermining the potential for equitable education.

Qualitative Findings

Educator feedback highlighted both opportunities and obstacles. Approximately 65% of respondents reported feeling unprepared to effectively integrate AI and AR into their teaching, citing barriers such as limited training, time constraints, and inadequate technical support. Many expressed enthusiasm for the potential of these tools but noted a lack of institutional resources to facilitate their adoption. Themes of frustration emerged, particularly in rural and low-income settings, where unreliable infrastructure compounded challenges. Conversely, educators in urban areas with robust technological support reported higher confidence and success in using these tools.

Discussion

The results illuminate the dual nature of technology's role in education: as a catalyst for innovation and a magnifier of existing inequities. Below, we explore the implications of these findings and propose strategies to maximize benefits while addressing challenges.

Transformative Potential of AI and AR

AI-driven adaptive learning systems, such as Coursera's AI tutor, personalize educational experiences by adjusting content difficulty and pacing based on learner performance. This fosters greater engagement and retention, particularly for students who struggle in traditional, one-size-fits-all models. Similarly, AR applications, such as virtual chemistry labs or interactive historical simulations, make abstract or resource-intensive subjects accessible and engaging. These tools align with prior research on immersive technologies, which suggests that experiential learning enhances comprehension and retention (Davis, 2024).

The 70% increase in engagement with AR curricula and the 55% rise in completion rates for AI-supported courses highlight their efficacy. These technologies not only cater to diverse learning needs but also support lifelong learning by enabling flexible, self-paced education. For instance, professionals seeking to upskill can access tailored courses on platforms like FutureLearn, which adapt to their schedules and knowledge gaps.

Addressing the Digital Divide

Despite these advancements, the digital divide remains a formidable barrier. The ITU's finding that 38% of students in low-income regions lack reliable internet access underscores the need for targeted interventions. Without stable connectivity, the benefits of AI and AR remain out of reach for millions. Governments and private organizations must prioritize infrastructure investments, such as expanding broadband access in rural and underserved areas. Initiatives like Starlink's satellite internet or government-subsidized connectivity programs could bridge this gap, ensuring that online learning is accessible to all.

Educator Preparedness

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The qualitative data revealed a critical gap in educator training, with 65% of respondents feeling ill-equipped to use AI and AR effectively. This is particularly concerning as educators are pivotal in integrating technology into classrooms. Professional development programs, including online workshops, peer mentoring, and hands-on training, are essential to build confidence and competence. Institutions should also provide ongoing technical support to address issues like software troubleshooting or platform navigation, which were frequently cited as barriers.

Emerging Innovations

Beyond AI and AR, emerging technologies like blockchain hold promise for revolutionizing education. Blockchain-based credentialing systems can securely verify and store academic achievements, facilitating lifelong learning and career mobility (Lee, 2024). Such innovations could streamline processes like degree verification, making education more transparent and accessible. Future research should explore these applications to assess their scalability and impact.

Policy Recommendations

To harness technology's potential while addressing inequities, policymakers must adopt a multi-pronged approach:1

Infrastructure Investment:

Public-private partnerships can fund broadband expansion and device distribution in underserved regions, reducing the digital divide.2.

Educator Training Programs:

Scalable, accessible training initiatives, including online modules and regional workshops, can equip educators with the skills needed to leverage technology effectively.3. **Curriculum Integration**: Education systems should embed AI and AR tools into curricula, ensuring alignment with learning objectives and accessibility standards.4.**Global Collaboration**:

International organizations like UNESCO can facilitate knowledge-sharing and resource allocation to support technology adoption in low-resource settings.

Conclusion

This study underscores the transformative power of technology in redefining educational paradigms. AI and AR enhance engagement, personalization, and accessibility, paving the way for inclusive, lifelong learning. However, the digital divide and educator training gaps pose significant challenges that demand urgent action. By implementing targeted policies and fostering collaboration between governments, institutions, and technology providers, the global education community can ensure that these innovations benefit all learners. Future research should focus on longitudinal studies to evaluate the sustained impact of technology and explore emerging tools like blockchain to further advance educational equity and innovation.

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Original Article

Socio-Political Contribution of Dr. B. R. Ambedkar for Equality and Social Justice.

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Abstract

Bhimrao Ramji Ambedkar, popularly known as BR Ambedkar, was an eminent social reformer, jurist, economist, and politician who is widely regarded as the architect of India's Constitution. His remarkable contributions to Indian society in terms of political and social thought have had a profound impact on the country's democracy and social fabric. This article delves into the key aspects of BR Ambedkar's political and social thought, exploring his vision for equality, justice, and the upliftment of marginalized sections of society.

Introduction

Dr. Ambedkar is considered as the great protagonist of reservation of seats in legislature and posts in Government. But in his final stage of life, when he accepted the principles of Buddhism with his followers, he counseled the Scheduled Castes to stand alone instead of depending on supports. Ambedkar is an unusual personality in the national life of India. He was an economist, a jurist, a social revolutionary, a constitution-maker, an able parliamentarian, an administrator, and above all a constructive statesman of extraordinary competence. Dr. Ambedkar

wrote three scholarly books on economics:

1. Administration and Finance of the East India Company
2. The Evolution of Provincial Finance in British India
3. The Problem of the Rupee: Its Origin and Its Solution

The first two signify his contribution to the field of public finance: The first work evaluating finances of the East India Company during the period, 1792 through 1858 and the second one book analysing the evolution of the Centre State financial relations in British India during the period, 1833 through 1921. The third book, his magnum opus in economics, denotes a seminal contribution to the field of monetary economics. As a member of the Bombay Legislative Assembly (since 1926), Ambedkar gave real expression to the protests of the rural poor through his mass movements. His positive struggle against the prevailing land tenure system called Khoti liberated a vast majority of the rural poor from an extreme form of economic exploitation. His successful agitation against Mahar Vatan liberated a large section of the rural poor from virtual serfdom. He presented a bill in the State Assembly aimed at preventing the malpractices of money-lenders hurting the poor (Bakshi, 2009). In industrial field, Dr. Ambedkar founded in 1936, the Independent Labour Party. While the prevailing trade unions fought for the rights of workers, they were indifferent to the rights of untouchable workers as human beings. The new political party took up their cause. Consequently, as the Labour Member of the Viceroy's Executive Council from 1942 to 1946, Dr. Ambedkar was instrumental in bringing about several labour reforms including establishment of employment exchanges, generally laying the foundations of industrial

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Relations in Independent India. His ministry also included irrigation, power and other public works. He had immense contribution in shaping the irrigation policy, especially the Damodar Valley Project. Dr. Ambedkar's attack on the caste system was not just aimed at challenging the
hegemony of the upper castes but had broader connotation of economic growth and development. He contended that the caste system had reduced the mobility of labour and capital which in turn, obstructed economic growth and development in India. In his memorandum submitted to the British Government titled "States and Minorities' in 1947, Dr. Ambedkar laid down a strategy for India's economic development. The strategy placed "an obligation on the State to plan the economic life of the people on lines which would lead to highest point of productivity without closing every avenue to private enterprise and also provide for the equitable distribution of wealth".

When India got Independence, Dr. Ambedkar became the first Law Minister of India. Even while drafting the Indian Constitution (as the Chairman, Drafting Committee) in 1948-49, the economist in Dr. Ambedkar was very much alive. He strongly suggested democracy as the 'governing principle of human relationship' but stressed that principles of equality, liberty and fraternity which are the foundations of democracy should not be interpreted narrowly in terms of the political rights alone. He emphasised the social and economic dimensions of democracy and warned that political democracy cannot thrive when there is no social and economic democracy. He gave an expression to the objective of economic democracy by corporating the Directive Principles of State Policy in the Indian Constitution. Being the Law Minister, Dr. Ambedkar fought vigorously for the passage of the Hindu Code Bill, most significant reform for women's rights in respect of marriage and inheritance. He resigned in September 1951 when the Bill did not pass in the Parliament. He recommended them to be impressive personality instead of remaining as innocent person. His aim was to eradicate social differences, based on caste and Varna, and establishing a social order, based on liberty, equality and fraternity. At the fag-end of his life, he with his followers encompassed Buddhism, as he considered Buddhism, to be a humanitarian religion, based on liberty, equality and fraternity.

Ambedkar operated outside the conventional of Congress politics and also disapproved the Congress activities. He was supposed by many to be a separatist and pro-British. But all along the remained a patriot. He stated that patriotism was not the domination of Congress and that one could be patriotic without becoming a Congressman. He considered the uplift of the backward class of the society to be more important than mere political liberation of the nation. Political freedom was worthless without the promotion of the backward sections of the society. Mahatma Gandhi also held analogous views as he thought of the concept of Swaraj in terms of the meanest of the citizens.

Historical and Social Context:

Bhimrao Ramji Ambedkar, popularly known as B.R. Ambedkar, was a prominent social reformer, jurist, and political leader in 20th century India. His thoughts and ideas were shaped by the historical and social context in which he lived. Ambedkar was born in 1891 into a Dalit family, which belonged to the lowest rung of the traditional Indian caste system. The caste system was deeply rooted in Indian society and was based on a rigid hierarchy, where birth dictated a person's social status and occupation. Dalits, also known as untouchables, faced severe discrimination, social exclusion, and economic exploitation.

During Ambedkar's time, India was under British colonial rule. The colonial era was marked by various socio-political movements, including the Indian freedom struggle and the push for social reforms. These movements heavily influenced Ambedkar's thinking. He recognized that the oppressive caste system functioned as a tool of control and division implemented by the ruling elites, both within the Indian society and colonial administration.

Ambedkar advocated for the emancipation and empowerment of Dalits and other marginalized communities. His ideas were deeply rooted in the ideals of equality, social justice, and individual freedom. He strongly believed that every individual, regardless of their caste or social background, should have equal rights and opportunities.Ambedkar's thought was also influenced by his academic pursuits. He pursued higher education in the field of law, economics, and political science. His exposure to Western philosophies and ideas, such as liberalism, democracy, and human rights, shaped his vision for a more inclusive and egalitarian society.

As an ardent advocate of social reform, Ambedkar played a significant role in drafting the Indian Constitution. He championed the inclusion of various provisions that aimed at safeguarding the rights and uplifting the marginalized sections of society. These provisions included reservations in education and employment, abolishment of untouchability, and affirmative action.Ambedkar's thoughts continue to be relevant today, inspiring social and political movements for social justice and equality. His emphasis on education, empowerment, and the need to challenge oppressive systems remains crucial in addressing social inequalities in contemporary society.

Annihilation of Caste:

One of the central themes in Ambedkar's political and social thought was the annihilation of caste. Annihilation of Caste" by B.R. Ambedkar is a remarkable and thought-provoking piece of literature that requires critical analysis. This work serves as an important critique of the caste system in India and offers insights into the socio-political implications of this deeply entrenched social structure. Ambedkar's analysis begins by passionately condemning the caste system for its inherent inequality and discrimination. He presents a scathing critique of Hindu scriptures, highlighting how they have been manipulated and misinterpreted to justify and perpetuate caste-based

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oppression. His argument is rooted in a rational and logical examination of religious texts, challenging the accepted norms and beliefs surrounding caste.

One of the key aspects of Ambedkar's analysis is his emphasis on the role of education and knowledge in challenging the caste system. He argues that education is fundamental to empowering oppressed castes and breaking down the barriers created by the caste system. Through education, marginalized individuals can gain awareness of their rights and actively engage in the fight against caste-based discrimination.

Additionally, Ambedkar delves into the political dynamics surrounding the caste system. He criticizes political leaders for their lack of genuine commitment to eradicating caste-based discrimination, arguing that they often use caste as a tool to mobilize support and secure their own positions of power. He highlights the need for genuine political reform that addresses the root causes of caste-based inequality.

Furthermore, Ambedkar's critical analysis delves into the complexities of caste identity and its impact on personal and collective identities. He argues that dismantling the caste system requires not only legal and political reforms but also a radical transformation of social attitudes and consciousness. Ambedkar encourages individuals to reject the notions of caste-based superiority and inferiority and actively work towards building an egalitarian society.

However, some critics argue that Ambedkar's critique of the caste system, while important and insightful, does not fully explore alternative paths to social cohesion and integration. They argue that addressing caste-based discrimination requires a more nuanced understanding of cultural, historical, and economic factors that contribute to the persistence of the caste system.

Overall, "Annihilation of Caste" presents a compelling and critical analysis of the caste system in India, questioning its moral, social, and political foundations. Ambedkar's work continues to generate discussions, debates, and inspiration for social reform, making it a significant contribution to the discourse on caste, social justice, and equality in India.

Social Justice and Reservation:

Ambedkar recognized the need for affirmative action to rectify historical injustices faced by marginalized communities. He advocated for the reservation system, which aimed to provide affirmative opportunities for education and employment to historically disadvantaged groups. Ambedkar believed that social justice could not be achieved solely through political independence but required deliberate efforts to empower the oppressed through economic and educational measures.

Women's Rights and Gender Equality:

Dr. B.R. Ambedkar, a prominent social reformer and the architect of the Indian Constitution, played a crucial role in advocating for women's rights and gender equality. He firmly believed that a just and equal society could only be achieved by dismantling the discriminatory practices prevalent against women.

Ambedkar championed several initiatives that aimed to uplift women and eliminate gender-based discrimination. First and foremost, he vehemently opposed the practice of child marriage and advocated for setting a minimum age for marriage, ensuring the well-being and empowerment of young girls. He also fought against dowry, which he viewed as an exploitative and oppressive practice. Moreover, Ambedkar played a pivotal role in securing women's rights in matters of property and inheritance. He believed that women should be given equal rights to inherit property, challenging the prevailing societal norms that often marginalized women in this aspect. His efforts were instrumental in establishing legal provisions to safeguard women's rights in matters of land ownership and inheritance.

Ambedkar also sought to address gender disparities in education and the workforce. He stressed the importance of providing equal educational opportunities for girls and encouraged their participation in formal education. Additionally, he emphasized the need for gender equality in employment, advocating for equal pay for equal work and breaking down occupational barriers that limited women's career choices. Furthermore, Ambedkar emphasized the importance of political representation for women. He recognized the need for women's voices to be heard in the decision-making processes and believed that their active participation in politics was crucial for achieving true gender equality. As a result, he supported reservations and quotas for women in political bodies, ensuring their inclusion and representation.

In summary, Dr. B.R. Ambedkar dedicated himself to advancing women's rights and promoting gender equality. His advocacy and efforts were aimed at challenging social norms, eradicating discriminatory practices, and creating a more just and equitable society for women. His contributions continue to inspire and shape discussions on gender equality in India and beyond.

Democratic Values and Constitutionalism:

Dr. B.R. Ambedkar was a prominent Indian jurist, political leader, and social reformer who played a pivotal role in shaping the democratic values and constitutionalism of modern India. His contributions were foundational in establishing a framework that enshrined justice, equality, and rights for all citizens. Ambedkar firmly believed in the principles of democracy, which he considered essential for the progress and welfare of a society. He recognized that a democratic system gives individuals the freedom to express themselves, participate in decision-making processes, and hold their leaders accountable. Ambedkar advocated for the inclusion of marginalized sections of society and the empowerment of the oppressed through democratic means.

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One of Ambedkar's greatest achievements was his pivotal role in drafting and shaping the Indian Constitution, which was adopted in 1950. The Constitution reflects his vision for a just and equitable society. Ambedkar ensured the inclusion of fundamental rights that guarantee equality, freedom of expression, religion, and protection against discrimination. Additionally, he championed the idea of social justice by advocating for reservations for disadvantaged communities to address historical injustices.

Ambedkar's constitutionalism can be seen in his approach to establishing institutions and systems that promote the rule of law and protect individual rights. He believed in the separation of powers, with a legislature, executive, and judiciary acting as checks and balances on each other. Through his tireless efforts, he urged for an independent and impartial judiciary that safeguards the rights and freedoms of all citizens. Furthermore, Ambedkar's constitutionalism is evident in his emphasis on the importance of constitutional amendments to adapt to changing social circumstances and address emerging challenges. He recognized the need for a living document that could evolve with society while maintaining its core principles.

Ambedkar's democratic values and constitutionalism continue to shape India today. His legacy inspires individuals to strive for social justice, inclusivity, and the protection of civil liberties. The principles he championed serve as a guiding light in the pursuit of a more equal and democratic society.

Conclusion:

BR Ambedkar's political and social thought remains highly relevant in contemporary India. His relentless pursuit of equal rights and social justice has inspired generations of activists, scholars, and policymakers. Ambedkar's vision for a society free from caste-based discrimination and social inequalities highlights the enduring need for systemic reform and a steadfast commitment to the principles of equality, justice, and empowerment. The legacy of BR Ambedkar continues to shape India's journey towards a more inclusive and just society.

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Original Article

Recent Trend in Poultry Farms

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Abstract:

Indian poultry industry is one of the fastest growing segments of the agricultural sector today in India. As the production of agricultural crops has been rising at a rate of 1.5 to 2% per annual while the production of eggs and broilers has been rising at a rate of to 10% per annual. Today India is world's fifth largest egg producer and the eighteenth largest producer of broilers.

The Indian poultry industry has undergone a paradigm shift in structure and apevation a very significant feature of Indian's poultry industry is its transformation from a mere backyard activity into a major commercial activity in just about four decades which seems to be really fast. The kind of transformation has involved sizeable investment in breeding, hatching, rearing and processing. Indian farmers have moved from rearing non-descript birds to today's rearing hybrids such as Hyaline, Shaver and Babcock which ensure faster growth, good liveability, excellent feed conversion and high profits to the rearers. The Indian poultry industry has grown largely due to the initiative of private, enterprises minimal government intervention, and very considerable indigenous poultry genetics capabilities and supports from the complementary veterinary health, poultry feed, poultry equipment and poultry processing sectors. India is one of the few countries in the world that has put into place a sustained specific pathogen free (SPF) egg production projects.

Keywords: *Indian poultry industries, Types of birds, production, growth rate, size of industry and demand and supply.*

Introduction:

India today is the one of the world's largest produce of eggs and broilers meat. The poultry industry in India has undergone a major shift in structure and operation during the last two decades transforming from a mere backyard activity into a major industry with the presence of a large number of integrated players. This transformation has involved a sizeable investment in breeding, hatching, rearing and processing activities.

India with a population of 1.25 billion people is highly focussing on 'development' i.e. good food, better health and living condition for everyone, with the increase in the income, people can how afford better nutrition and hence, since last two decades the demand for eggs and chicken is growing. The recent data of the year's 2017 state that the egg production in India is 75 billion and the broiler production is 4.2 million tonnes per annum. The growth rate of layer market is 6.7 percent per annum and broiler market is 8.10 percent per annum. 75 percent of egg production is contributed by commercial poultry farms, remaining comes from household / backyard poultry. Total poultry feed production of the country stands at 22 million tonnes. The Indian poultry sector is valued at INR 1 Lakh crore USD 15.38 billion in coming years

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. Poultry production and consumption in India is predicated to grow due to various factors such as a shift in food habit, urbanization, increasing awareness of balanced nutrition etc. The Broiler meat consumption pattern shows that around 62 percent of meat is consumed in major 10 cities and rest of the consumption comes from other cities with a smaller percentage from villages.

Objectives:

1) To study the concept of poultry industry.
2) To study the poultry production.
3) To study the growth rate of eggs and broilers.
4) To study the recent trends and growth in Indian Poultry Industries.

Methodology:

The study is based on secondary data from various publications i.e. books, magazine, newspapers, govt. Reports, budgets, financial statements, economic survey, journals, periodicals and authentic websites, etc. Data collected is completed and analyses for the purpose of study.

Indian Poultry Industry:

Size of the Industry	Units with 5000 to 50000 birds per week cycle are common in the poultry management
Geographical distribution	Andhra Pradesh, Karnataka, Maharashtra, Kerala, Tamil Nadu, Madhya Pradesh
Output per annum	Per capital consumption of eggs is only 7.7 per annum in rural areas compared with 17.8 per annum in urban areas.
Percentage in world market	India was positioned 17th in the world poultry production.
Market capitalisation	Poultry industry contribute about Rs 26000 crore to the national income.

Indian State and Poultry Meat:

Sr.No.	State	Production (tons)	Share (%)
1	Maharashtra	517.45	14.94
2	Tamil Nadu	427.53	12.34
3	Haryana	407.75	11.77
4	West Bengal	397.16	11.47
5	Uttar Pradesh	353.49	10.21
6	Andhra Pradesh	317.80	9.18
7	Telangana	288.00	8.31
8	Kerala	188.76	5.45
9	Punjab	112.07	3.24
10	Karnataka	87.12	2.52
11	Orissa	82.37	2.38
12	Bihar	53.32	1.54
13	Jammu & Kashmir	44.71	1.29

(Source Dept. of Animal Husbandry Year 2016-17)

The organized sector of Indian poultry industry is contribution nearly 70% of the total output and the rest 30% in the unorganized sector. Broiler industry is well dominated by the southern state in our country with nearly 60-70 %

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total output coming from this state. The layer industry once again is represented more in southern states especially Maharashtra, Tamil Nadu, Kerala, Telangana, Andhra Pradesh producing nearby 70% of the country's egg production. India 75% of egg production is consumed by the population of 25% living in urban and semi urban areas. Presently about 800 hatcheries are operating in India today.

Today India is the world's fifth largest egg producer and the eighteenth largest producer of broilers and its per capita consumption of such production is poor 37 eggs and 1 kg of poultry meat per capita per annum. The growth of the poultry industry in India is marked by an increase in the size of the poultry farm. In past years broiler farms had produces on average a few units are probably finding themselves at problem because of high feed and transports costs, expensive vaccines and veterinary care services and the non-availability of credit. Some small units are reported to be shifting from layer to broiler production because output in broiler units can be realized in six weeks. India ninth largest producer of poultry meat. India was well positioned as 17th in the world poultry production. The Indian poultry production is considered to be the cheapest in the world. The main factors of rising production in country.

- The nation is a market with investment friendly ambience.
- Indian poultry industry is booming and emerging as the world's second largest market.
- The growth rate is growing at the phenomenal rate of 12 to 15 % every year.
- Poultry industry in India is constantly on the rise due to the use of modern techniques and change from live bird to fresh chilled and frozen product market.
- A new path began with the integrated poultry operation throughout the country.

There is an overwhelming response from all segments concerned and related with poultry. There is a 100% increase in space compared to earlier years.

Market Capitalization and Sales:

With the rise of middle class and increased urbanization, a major population prefer to go for non-vegetarian. Today about 3 million farmers and 15 million agrarian farmers are employed in the poultry industry that are usually growing poultry ingredients for feed and contribute about Rs. 26000 crore to the national income.

Analysers estimate that the Indian poultry industry has been growing at a much faster pace, along with other industries such as BPO and securities market. Over the years the poultry industry in India has contributed approximately USD 229 million to the gross national product (GNP).

Top Leading Companies:

Top leading broiler integrators in India are as follows;

- Venkateshwara Gruop, Pune
- Suguna Poultry Farms Ltd. Coimbatore
- Pioneer Poultry Gruop, Coimbatore
- Godrej Agrovet Ltd. Mumbai
- Sky Lark Group, North India
- Jafa Cum Feed

Employment Opportunities:

Three decades ago in India when egg and broiler production was 10 billion and 30 billion respectively, that total employment numbers in the poultry sector was not much encouraging. As income and employment in the crop sector started decreasing, the non-crop sector, which includes dairy and poultry, underwent a significant shift due to the demand for poultry increasing and production reaching 37 billion eggs and 1 billion broilers, the poultry industry today employs around 1.6 million people. At least 80% of employment in Indian poultry industry generates directly by the farmers, while 20% is engaged in feed, pharmaceuticals, requirement, additionally there might be similar number of people roughly 1.6 million who are engaged in marketing and other channels servicing the poultry sector.

Challenges of the poultry industry:

Some of these challenges are presented here;

- Disease outbreaks and implementation of bio security programs.
- Feed cost and continuous efforts to get a better understanding of available alternative feed ingredients.
- Nutrition related environmental issues and poultry welfare related issues such as banning the use of conventional cages at layers farms.
- Issue surrounding inclusion of antibiotics in poultry feed and also the use of alternatives to antibiotic growth promoters.
- Quality water related and water quantity related issue.

Latest Development in Poultry Industry:

a. The national institute of nutrition has strongly recommended 180 eggs and 11 kg of meat per capita consumption for our nation. At present, per capita availability for meat is 1.6 kg. Per capita availability for egg is 1.8 kg or 42 eggs average consumption of developed rural areas is 20 eggs. Average consumption of undeveloped rural areas is only 5 eggs while 20 % of Indian population is vegetarian.

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b. The average per capita of poultry meat consumption was estimated to increase from 0.69 to 1.28 kilograms, during the 2000-2004. Analyst's studies reveal that the total egg consumption is estimated to increase from 34 billion in 2000 and to 106 billion in 2020, while poultry meat consumption has been predicated to increase from 687 million kilograms to 1674 million kilograms.
c. The market research report "Vision for Indian poultry industry: current scenario and future prospects" predicts and analysis a relatively strong growth for the egg and poultry meat industry, in both the urban and rural areas for the next two decades. It has grown at a much faster pace, than the consumption of poultry meat, with the continual rise in income the numbers are estimate to nearly triple by 2020.
d. India is the fifth largest producer of eggs and ninth largest producer of poultry meat in the world and produced over 34 billion eggs and about 600000 tons of poultry meat in 2004.
e. Several efforts in poultry science and technology have led to the development of genetically superior breeds capable of higher production, even under adverse climatic conditions that offer opportunities for overseas entrepreneurs to expand export and import of poultry products on a large scale.

Conclusion:

Poultry farming in India has a long history but it is only about last four decade that it has been practiced in a "scientific manner" from backyard poultry to commercial poultry farming, the poultry industry has emerged as a gainful and dignified business enterprise in India and elsewhere in the world. Landless labours and small farmers find a support in this business since the poultry farming can be practiced as a supplementary or second income generating mechanism. This provides the rural farmers an excellent business opportunity which requires very little additional expenditure. In fact, poultry farming has become an indispensable component of agricultural industry in India.

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Original Article

The Impact of Artificial Intelligence and Automation on Modern Businesses

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Abstract

Artificial Intelligence (AI) and automation are revolutionizing business operations by enhancing efficiency, optimizing decision-making, and fostering innovation. Companies across various industries are increasingly utilizing AI-powered solutions to improve customer experiences, streamline processes, and reduce operational expenses. AI-driven technologies, such as machine learning, natural language processing, and robotic process automation, enable organizations to analyse large datasets in real time, improve forecasting capabilities, and make well-informed decisions. AI aids businesses in adapting to market fluctuations, increasing operational agility, and achieving a competitive advantage. In addition to operational benefits, AI supports product and service innovation by enabling personalized marketing, intelligent customer support, and dynamic pricing models. Industries such as healthcare, finance, manufacturing, and retail are witnessing transformational changes as AI becomes embedded in core business functions. However, the adoption of AI also presents challenges, including workforce displacement, high implementation costs, data privacy concerns, and ethical dilemmas. Organizations must integrate AI strategically while complying with regulatory standards and ethical frameworks. Transparency, accountability, and continuous upskilling of the workforce are essential to ensuring that AI implementation is sustainable and inclusive. This study concludes that AI and automation will continue shaping the business landscape, requiring responsible innovation and strategic implementation to maximize benefits while mitigating associated risks. Future research should focus on developing frameworks for ethical AI, ensuring data security, and exploring human-AI collaboration models to foster long-term growth and resilience.

Keywords: *Artificial Intelligence, Automation, Business Transformation, Machine Learning, Digital Innovation, Efficiency, Decision-Making, AI Ethics, Competitive Advantage*

Introduction

Artificial Intelligence (AI) and automation have become fundamental to contemporary business operations, revolutionizing industries by enhancing efficiency, reducing costs, and fostering innovation. Companies across diverse sectors are adopting AI-powered solutions to optimize workflows, enhance customer experiences, and enable data-driven decision-making. This paper examines AI and automation's role in business, highlighting their benefits, challenges, and future implications. According to Davenport and Ronanki (2018), AI is not a single technology but a constellation of capabilities—machine learning, natural language processing, and robotics—that, when integrated thoughtfully, can transform entire business models. Brynjolfsson and McAfee (2014), in their influential book *"The Second Machine Age"*, argue that AI and automation are driving a new era of economic productivity, comparable to the Industrial Revolution. Their research highlights the dual-edged nature of AI: it augments high-skill work while automating routine, low-skill jobs. In terms of operational impact, Chui, Manyika, and Miremadi (2016) from McKinsey Global Institute argue that automation can raise productivity in sectors with high routine work by 20 to 30 percent. The rapid evolution of AI-driven technologies, such as machine learning, natural

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language processing, and robotic process automation, has led to significant advancements in multiple business domains. AI-powered Systems now can process vast datasets in real time, delivering valuable insights that empower organizations to make informed decisions and strengthen their competitive positioning.

Additionally, automation is significantly reducing the necessity for manual intervention in routine operations, resulting in enhanced operational efficiency. Moreover, AI and automation are integral to improving business agility, enabling companies to swiftly adapt to evolving market dynamics and customer expectations. By leveraging AI-driven tools, businesses can recognize patterns, forecast trends, and proactively address emerging challenges. Consequently, AI is not only optimizing operations but also reshaping conventional business models by introducing innovative approaches to work and customer engagement.

Understanding Ai and Automation

Defining Ai and Automation-

To understand the impact of AI and automation, it is essential to define these terms clearly. AI refers to the development of machine intelligence that can perform tasks traditionally requiring human intelligence, including problem-solving, decision-making, and natural language processing. Automation, on the other hand, involves utilizing technology to execute repetitive or manual tasks, minimizing the need for human intervention.

Historical Development and Evolution-

The concept of AI dates back to the 1950s when researchers first explored machine intelligence. Over time, AI has advanced significantly, driven by breakthroughs in machine learning, neural networks, and natural language processing. Similarly, automation has evolved, with innovations such as robotics and assembly lines transforming industries like manufacturing. The fusion of AI and automation has expanded their capabilities, accelerating their adoption across various sectors.

Categories of AI and Automation Technologies-

AI and automation comprise a diverse array of technologies and applications. Machine learning, a subset of AI, allows systems to learn from data and improve performance without explicit programming. Natural language processing enables machines to understand and interpret human language, facilitating applications such as language translation and virtual assistants. Robotics plays a vital role in automation, involving the design and deployment of mechanical systems capable of executing physical tasks autonomously or with minimal human input. Other key technologies include computer vision, speech recognition, and expert systems.

Present Adoption and Industry Trends-

The current AI and automation landscape is marked by rapid advancements and growing industry adoption. Businesses are integrating these technologies to enhance operational efficiency, drive productivity, and strengthen competitive positioning. AI-driven chatbots, virtual assistants, and process automation are widely used in customer service, while machine learning algorithms are improving decision-making and predictive analytics. While adoption rates differ across industries, it is evident that AI and automation are shaping the present and future workforce landscape.

Review Of Literature

Davenport and Ronanki (2018) highlight that AI is increasingly being used in three major areas: process automation, cognitive insight, and cognitive engagement. Their study demonstrates how companies leverage AI for automating repetitive tasks, extracting insights from big data, and interacting with customers through intelligent agents like chatbots. This has led to improved operational efficiency and customer satisfaction.

Bughin et al. (2019), in a comprehensive report by McKinsey Global Institute, forecast that AI has the potential to add up to $13 trillion to the global economy by 2030. Their research emphasizes that early AI adopters are already witnessing significant returns in terms of profitability and productivity. However, the authors also stress the importance of organizational readiness and digital maturity for successful AI integration

Kaisler and Money (2021) explore the ethical and regulatory concerns surrounding AI adoption. They argue that businesses must navigate issues like data privacy, algorithmic bias, and ethical decision-making when deploying AI systems. Their findings suggest that responsible AI usage, governed by transparent frameworks, is critical for long-term success and public trust. Bessen (2020) asserts that AI adoption is not a one-size-fits-all solution. He indicates that the benefits of AI are highly context-dependent, influenced by industry type, company size, and workforce composition. Businesses must therefore align AI strategies with their specific operational goals and market dynamics.

Frank et al. (2019) explore how AI contributes to strategic innovation. Their findings suggest that companies that use AI for innovation purposes—such as developing new products or entering new markets—experience greater growth compared to those that apply it merely for efficiency gains. Haenlein and Kaplan (2019) examine the managerial implications of AI and note that organizational culture plays a crucial role in AI adoption. They emphasize the need for leadership support and a culture of experimentation to fully realize AI's potential.

Objectives Of The Study

The key objectives of this study are:

1. To explore the trends of job displacement and job creation due to AI and automation.
2. To analyse the major challenges businesses face during AI adoption.

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3. To explore future trends and strategic methodologies for AI integration in business.

Research Methodology

This study adopts a qualitative research methodology to explore the impact of Artificial Intelligence (AI) and automation on modern business operations. The methodology is designed to examine both the strategic and operational effects of AI adoption across various industries, with a focus on understanding emerging trends, challenges, and best practices from real-world applications and scholarly literature.

Research design- A **descriptive and exploratory research design** was employed to investigate how businesses are integrating AI and automation into their operations. The descriptive aspect of the study aims to present current practices and implementations of AI, while the exploratory aspect seeks to uncover underlying challenges, opportunities, and future implications that may not yet be fully understood.

Data Collection-

Data for this study was gathered through the following methods:

Secondary Data Analysis:

The study relies primarily on secondary sources such as peer-reviewed journal articles, industry reports, white papers, books by subject matter experts, and reputable online databases (e.g., Google Scholar, ScienceDirect, JSTOR, McKinsey Insights).

Industry Reports:

Data was also extracted from industry research by consulting firms like McKinsey & Company, Deloitte, and PwC, which provide valuable quantitative and qualitative data on AI adoption trends, ROI, workforce impact, and sector-specific applications.

Data Analysis and Interpretation

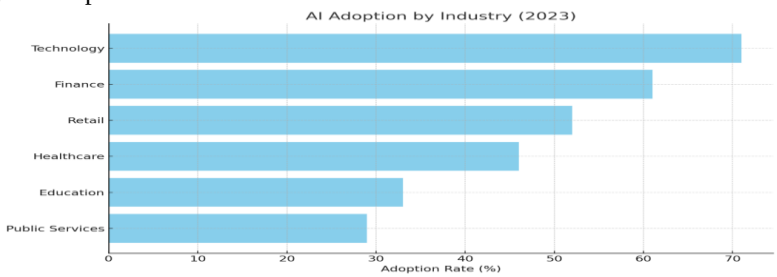
The collected data from secondary sources such as industry reports, academic studies, and market research was analysed using both qualitative and quantitative approaches.

Graphical Analysis

To better illustrate the findings, the following graphical representations are included:

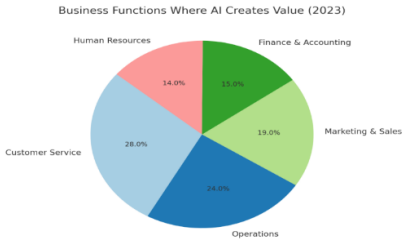
AI Adoption Rate by Industry (2023)

A bar chart showcasing the adoption rates of AI across various sectors.



This bar chart illustrates the extent to which various industries have adopted Artificial Intelligence technologies. Industries such as Technology (71%), Finance (61%), and Retail (52%) lead in adoption, while Education (33%) and Public Services (29%) trail behind. This reflects differing levels of digital maturity and investment capacity.

Business Functions Where AI Creates Value (2023)- AI adds significant value to business functions like customer service, operations, marketing, and finance by streamlining processes and enhancing decision-making. These technologies enable faster responses, better personalization , and improved overall efficiency

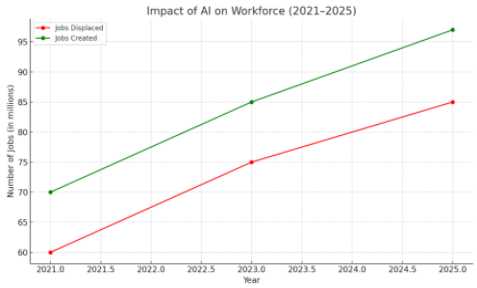


The pie chart represents the key business functions that benefit from AI. Customer service (28%) and Operations (24%) are the primary beneficiaries, followed by Marketing and Sales (19%), Finance and Accounting (15%), and Human Resources (14%). These results show the practical integration of AI in streamlining business operations.

Impact of AI on Workforce (2021–2025)- Between 2021 and 2025, AI is expected to significantly reshape the global workforce by automating repetitive tasks and introducing new roles in data science, AI governance, and digital

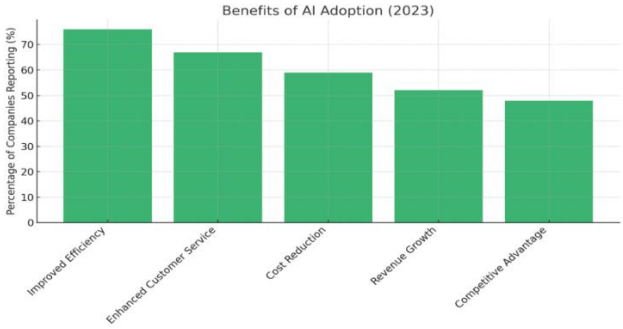
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transformation.While job displacement is a concern, the net effect leans positive with more jobs being created than lost, emphasizing the need for upskilling and adaptability.



This line graph shows the projected impact of AI on employment. While approximately 85 million jobs are expected to be displaced by 2025, an estimated 97 million new roles will be created, particularly in fields that require collaboration with AI, such as data science and AI governance.

Benefits of AI Adoption - In 2023, businesses reported major benefits from AI adoption, including improved efficiency, enhanced customer service, and significant cost reductions. These advantages have positioned AI as a strategic tool for driving innovation, boosting competitiveness, and accelerating decision-making processes.



The bar chart below highlights the main benefits reported by companies that have adopted AI: improved efficiency (76%), enhanced customer service (67%), cost reduction (59%), revenue growth (52%), and competitive advantage (48%). These findings emphasize the value AI brings to organizations.

Challenges Of Ai And Automation In Modern Businesses

Ethical Concerns: AI systems can unintentionally perpetuate biases present in training data, leading to unfair outcomes, especially in hiring, lending, and legal decision-making. Ensuring transparency in AI algorithms and holding organizations accountable for automated decisions is crucial. Ethical AI requires inclusive design, regular auditing, and compliance with fairness and non-discrimination standards.

Workforce Displacement: The automation of routine and manual tasks often leads to significant job losses, especially in sectors like manufacturing, customer service, and logistics. This creates socio-economic disruption and workforce insecurity. Organizations and governments must invest in robust reskilling and upskilling programs to prepare displaced workers for AI-complementary roles in the evolving job market.

High Implementation Costs: Deploying AI solutions requires significant financial investment in infrastructure, talent acquisition, software, and ongoing maintenance. Small and medium-sized enterprises (SMEs) often struggle with budget constraints, limiting their ability to adopt advanced technologies. The high cost acts as a barrier to entry, widening the gap between digitally advanced and resource-constrained businesses.

Data Privacy and Security: AI systems rely on vast volumes of data, including sensitive personal and financial information. Improper data handling can result in breaches, unauthorized access, and misuse, violating user trust and legal standards. Businesses must implement strict data governance policies, secure data encryption methods, and comply with data protection laws like GDPR and HIPAA.

Regulatory Compliance: As AI continues to evolve, regulatory frameworks are struggling to keep pace. Businesses face uncertainty in navigating complex legal environments regarding AI usage, intellectual property, liability, and ethical accountability. Ensuring compliance with emerging global and regional regulations demands legal foresight, agile policy adaptation, and collaborative engagement with regulators and stakeholders.

Future Research Directions

1. **Advancements in AI Ethics and Governance:**

Future research should focus on creating comprehensive ethical frameworks and global regulatory standards for AI. This includes addressing critical concerns such as algorithmic bias, decision-making accountability, and system transparency. Exploring cross-sector collaboration and the role of policy-makers, legal experts, and AI developers will be vital to ensure responsible and equitable deployment of AI technologies across different industries and societies.

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2. **Workforce Adaptation and Skills Development:**

Research is needed to understand AI's long-term influence on job markets and the evolving nature of work. Studies should explore effective strategies for workforce reskilling, digital literacy programs, and educational reform to prepare workers for AI-integrated environments. Emphasis should also be placed on identifying future skills in demand and designing accessible learning platforms that support continuous professional development in both developed and developing economies.

3. **AI and Automation in Emerging Markets**

There is a growing need to investigate how AI and automation can be implemented in emerging and developing economies. Research should address challenges like limited digital infrastructure, low investment capacity, and policy gaps. It should also explore how AI can support inclusive growth, improve public services, and create employment opportunities in agriculture, healthcare, education, and other critical sectors of underdeveloped regions.

4. AI's Role in Sustainable Business Practices:

Future studies should examine how AI can contribute to sustainability goals, including improving energy efficiency, reducing carbon footprints, and optimizing resource management. Research can focus on AI's potential in predictive maintenance, smart grids, supply chain sustainability, and environmental monitoring. These efforts will help businesses align with global climate goals and promote environmentally responsible innovation and operational strategies.

Conclusion- AI and automation are redefining the business landscape by enhancing efficiency, improving decision-making, and elevating customer experiences. Despite concerns such as workforce displacement and ethical dilemmas, businesses that strategically embrace AI solutions will excel in the digital era. Leveraging AI-driven innovation is crucial for organizations seeking long-term success and competitive advantage in today's evolving economy.

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Original Article

Role of Social Media in Transforming Business Marketing

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Abstract:-

Social media has completely changed the way businesses do marketing. Platforms like Facebook, Instagram, Twitter, and LinkedIn have given companies new ways to connect with customers. Instead of just showing ads, businesses now talk directly with people, listen to their feedback, and build stronger relationships. This study looks at how marketing has moved from one-way messages to two-way conversations, including things like influencer promotions, customer posts, and ads tailored to specific audiences. It also explains how businesses use social media data to learn what customers like and how they behave. By going through examples and current trends, this research shows how social media helps companies grow their brand, reach more people, and stay ahead in today's competitive market. At the same time, it also discusses some challenges that come with using social media for marketing.

Keywords:-*Social Media Marketing, Digital Marketing, Online Advertising, Influencer Marketing, Brand Awareness*

Introduction:-

In today's digital world, social media plays a big part in how we live and communicate. What once started as a way for people to connect with friends and family has now turned into a powerful tool for businesses to market their products and services. Platforms like Facebook, Instagram, Twitter, LinkedIn, and TikTok are now being used by companies to reach more people, build their brand, and stay connected with customers.

Before social media, marketing was mostly one-way—businesses would show ads on TV, in newspapers, or on billboards, and people would just see them. There was very little chance for direct interaction between businesses and customers. But now, social media allows two-way communication. Businesses can post updates, and people can instantly like, comment, share, or message them. This has changed how marketing works by making it more personal, fast, and interactive. Another big change is that social media helps businesses reach the right audience. Companies can choose who sees their ads based on things like age, location, interests, and online behavior. This means they don't waste money showing ads to people who aren't interested. Social media also offers creative ways to promote products, such as short videos, stories, live sessions, and posts from influencers who already have a strong following. At the same time, social media gives businesses a chance to understand what people like and what they're talking about. This helps companies improve their services and create better marketing strategies. On the other hand, using social media also brings some challenges. Businesses have to keep creating fresh and interesting content, handle negative comments or reviews, and keep up with the fast-changing online trends. The success of social media entrepreneurship is also being propelled by the increasing intersection of technology and social Media As technology continues to advance, we are likely to see the emergence of new social media platforms and technologies that will create new opportunities for those who

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are able to capitalize on them and Change the way we communicate, connect and do business. Therefore, one common part of being a successful social media entrepreneur is being able to adapt and stay ahead of the curve.

This research Paper will look at how social media is changing the way businesses do marketing. It will explore both the benefits and the difficulties, and suggest how businesses can use social media in smart and effective ways to grow and stay competitive.

Research Methdology :-

Research is essentially a systematic enquiry, seeking facts through objective verifiable methods in order to discover the relationship among them and to deduce from them broad principles or laws. It is really a method of critical thinking. It comprises defining and re-defining problems, formulating hypothesis or suggested solutions, collecting, organising and evaluating data, making deductions and making conclusions and at last, carefully testing the conclusions to determine whether they fit the formulated hypothesis. Thus, the term 'Research experimentation or examination' has as its aim the revision of accepted conclusions, in the light of newly discovered facts.

Definition of research

In Webster's Twentieth Century Dictionary, research is defined as "a careful patient, systematic, diligent inquiry or examination in some field of knowledge undertaken to establish facts or principles".

In the Random House Dictionary of the English Language, research is defined as "a diligent and systematic inquiry or investigation into a subject in order to discover or revise facts, theories, applications, etc

This research paper is based on secondary data from books, journals, newspapers, websites, and information available on the internet.

Objectives:-

1. To find out how social media has changed the way businesses advertise and reach people.
2. To learn about the different features on social media that help businesses market their products.
3. To see how social media helps businesses show their ads to the right people based on age, location, or interests.
4. To explore how influencers and regular customers help promote brands by sharing their opinions online.
5. To give simple and helpful ideas for businesses to use social media more effectively in their marketing.
6. To suggest ways for businesses to market better online.

How social media influences consumer buying decisions

1. The shortened customer journey:

The first thing that you notice when it comes to customers on social media is the shortened customer journey. It used to be that people found out about a product, saw an ad on TV multiple times, and next week they may have gone shopping and finally bought the product. Now, this process can take minutes. According to the Deloitte report, 29% of social media users are more likely to make a purchase on the same day of using social media. That means that once they see a product, they simply click on the link and buy it: there's no need to wait before they go shopping. Moreover, the same report states that consumers who are influenced by social media are four times more likely to spend more on purchases.

The customer journey is not just shorter but it's also more complicated now. Social media has made product research more accessible to users. For example, if your customer sees a product on Instagram, they can immediately search the hashtag to look up other reviews and decide whether they should buy it or not. As a result, customers spend more time on research and check more sources for reviews.

2. Power of Social Proof

People have always trusted recommendations from others—that's nothing new. But now, thanks to social media, those opinions can reach hundreds or even thousands of people instantly. When someone posts about a great café or a shampoo that worked well, their followers see it and may want to try it too. The same goes for negative feedback—bad reviews can spread just as fast. In fact, studies show that around 81% of people are influenced by what their friends share online. Many people also ask for product suggestions on social media, but brands often miss the chance to reply or help. This shows how important online word-of-mouth really is in shaping buying decisions.

3. How Influencers Affect What People Buy

Influencers are social media users who have built a loyal following of people who trust them and often share the same interests. Because of this, their opinions can reach and impact a large number of people. A study shows that nearly half of Twitter users have bought something just because an influ8encer tweeted about it.

Micro-influencers—those with smaller, focused audiences—can be even more effective, especially if they talk about a specific topic or niche. If you're selling something niche, teaming up with Instagram creators, YouTubers, TikTokers, or Facebook group admins can help you reach the right people.

Younger generations, like Gen Z and Millennials, are especially influenced by this. In fact, 84% of Millennials say that content posted by everyday people—even strangers—affects what they buy.

Most Popular Social Media Platforms

1. Facebook:-

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Facebook is still the biggest social media site in the world, with around 1.7 billion users. Even though it has faced some criticism and issues in recent years, it remains a powerful platform for reaching a large audience. However, it's not as popular with younger users as it once was. A study in 2019 showed that only 62% of people aged 12–34 in the U.S. were using Facebook, down from 79% in 2017. Older age groups, on the other hand, are either staying the same or increasing in numbers.

Despite the decline among younger users, Facebook still drives a lot of traffic and sales. It brings in 50% of all social media referrals and makes up 64% of the total revenue generated through social media. In 2015, it influenced over half of all online and offline purchases.

To improve its image, Facebook has started offering better ad controls and data privacy tools.

2. **Instagram**:- Instagram is great for businesses because it allows brands to show off their products in creative ways—through photos, videos, Stories, and more. It has over a billion active users each month. People of all ages and from all over the world use Instagram. About 80% of users follow at least one business, and 73% of American teens think it's the best platform for discovering new products and promotions.

Instagram also makes shopping easy. It has features like shopping tags and in-app checkout, and every month, around 130 million users click on shopping posts to learn more about products.

3. Twitter:-

Twitter helps people discover new products quickly. Since everything moves fast on Twitter and anyone can join in a conversation, it's a great place to ask for advice or get product suggestions. According to SproutSocial, 53% of people use tweets to recommend products or services to others. Out of those, nearly half—about 48%—actually go ahead and buy the things they've seen talked about on Twitter.

4. YouTube :-

Some people debate whether YouTube is a social media platform or just a video site, but either way, it's hugely popular and very influential. Millions of users go to YouTube every day not only to watch videos but also to get product reviews, tutorials, and unboxings that help them decide what to buy.

Social Media Changed the Way Businesses Advertise and Reach People

Social media has completely changed the way businesses talk to people and promote their products. In the past, companies mostly used TV, radio, newspapers, and magazines to advertise. These were one-way forms of communication—businesses would talk, and customers would listen. But now, thanks to platforms like Facebook, Instagram, Twitter, and TikTok, the conversation goes both ways.

One of the biggest changes is how businesses can talk directly to their customers. They reply to comments, answer questions in messages, do live videos, and run polls to know what people think. This kind of interaction helps build trust and makes customers feel more connected to the brand. Another great thing about social media is that it's more affordable than traditional ads. Even small businesses with low budgets can create posts, run ads, and reach a large audience without spending too much. It gives everyone a fair chance, not just the big companies.

Social media also allows for targeted advertising. This means businesses can choose exactly who sees their ads based on things like age, location, interests, and online behavior. For example, a company selling baby products can make sure their ads are shown to new parents. This helps businesses avoid wasting money on the wrong audience. One more benefit is that businesses get instant feedback. When they post something, they can immediately see if people like it through likes, comments, and shares. They can also use tools to track how many people saw the post or clicked on it. This helps them quickly understand what's working and what needs to change. A popular trend now is influencer marketing. Businesses team up with influencers—people who have a large following on social media—to promote their products. Since followers trust these influencers, their recommendations feel more natural and often lead to more sales.

Social media also encourages user-generated content. This is when happy customers share photos, videos, or reviews of the product. It works as free advertising and builds trust, because people tend to believe real customer experiences more than company ads. Sometimes, a clever or emotional post can even go viral. That means it spreads quickly across the internet, reaching millions of people. This kind of attention would be extremely expensive with traditional media, but it can happen for free on social media.

Unlike regular stores or offices, social media pages are always open. People can visit a brand's profile, check products, or ask questions anytime, from anywhere in the world. Another useful feature is personalized advertising. Social media platforms track what users like and suggest products based on their interests. This makes the ads feel more relevant, which increases the chances of making a sale.

Lastly, social media gives more power to customers. People now share their thoughts, leave reviews, and talk about brands online. A single good or bad comment can quickly reach a large audience. Because of this, companies try harder to be honest, responsive, and customer-friendly. In short, social media has made advertising more personal, affordable, and interactive. It helps businesses connect better with their audience and grow faster, especially if they use it smartly.

Social Media Features That Help Businesses Market Their Products

1. **Business Accounts :-**

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Social media platforms like Facebook, Instagram, and LinkedIn allow businesses to create special accounts called business profiles. These profiles show important details like the company name, address, website, contact number, and business hours. It makes the brand look more professional and helps people easily find and contact them. Business accounts also unlock extra tools like ads and insights.

2. **Paid Ads :-**

Most social media platforms let businesses pay to show their posts to more people. These paid ads can be set up to reach a specific group, like people in a certain age group, city, or with certain interests. This way, businesses don't waste money showing ads to people who aren't interested. Paid ads help businesses grow faster by reaching a bigger and more targeted audience.

3. Insights and Analytics :-

Business accounts come with tools that show how posts are doing. For example, they show how many people saw a post, liked it, clicked on it, or followed the page. These tools help businesses understand what kind of content their audience likes most and when they are most active. With this information, businesses can post smarter in the future.

4. **Hashtags :-**

Hashtags (words with a # in front) help people discover posts about topics they're interested in. When businesses use hashtags like #summerfashion or #homemadecakes, their posts can reach more people—even those who don't follow them yet. It's a simple and free way to get more views and grow their audience.

5. Stories and Reels :-

Stories (on Instagram and Facebook) and Reels (short videos) are fun and quick ways for businesses to share content. Stories disappear in 24 hours and are great for posting daily updates, offers, or behind-the-scenes clips. Reels are short, creative videos that can help products go viral and reach new people, especially younger users who love video content.

6**. Going Live :-**

Businesses can also use live videos to talk directly to their audience. They can launch a new product, answer questions, or show how a product works. Live sessions help build trust because customers can see the real people behind the brand and ask questions in real time. It feels more personal and honest.

7. Shopping on Social Media :-

Some platforms like Instagram and Facebook let businesses set up a shop on their page. They can tag products in their posts, and people can tap on them to see the price or buy the item. This makes it super easy for customers to shop without even leaving the app.

8. Working with Influencers :-

Businesses often team up with social media influencers—people who have a big following. These influencers promote the product to their followers in a more natural, friendly way. Because their followers trust them, people are more likely to try out the product. It's a smart way to grow faster and build trust.

9. Direct Messaging :

Social media also lets customers message businesses directly through tools like Instagram DMs, Facebook Messenger, or WhatsApp. This is great for answering questions, giving support, or even taking orders. Fast and friendly replies help customers feel heard and cared for.

10. Customer Posts (User Content) :-

When happy customers share photos, videos, or reviews of a product and tag the business, it's called user-generated content. Businesses can re-share this content to show real people using and enjoying their products. It works like word-of-mouth and builds trust, because people believe real experiences more than polished ads.

11. Polls and Questions :-

Features like polls, question stickers, and emoji sliders (in Stories) let businesses ask their followers questions or get feedback. For example, a coffee shop could ask, "Which flavor do you like more—chocolate or vanilla?" This keeps followers involved and gives businesses ideas based on what people want.

12. Post Scheduling Tools :-

To save time, businesses can use tools like Meta Business Suite, Buffer, or Hootsuite to plan and schedule posts ahead of time. These tools help keep the content regular and organized, even if the business team is busy with other work.

Social Media Helps Businesses Show Ads to the Right People

Social media is really smart when it comes to showing ads. It helps businesses show their ads to people who are most likely to be interested in their products. This means businesses don't waste money showing ads to random people.

When people use apps like Facebook, Instagram, or YouTube, the app learns some basic things about them—like their age, where they live, what pages they follow, and what kind of posts they like or comment on. Social media uses this information to help businesses choose who should see their ad.

For example, if a business sells gym clothes, they can ask Instagram to show the ad only to people between 18 and 30 years old, living in A.nagar, who are interested in fitness or working out. That way, the ad reaches people who are more likely to buy. It doesn't get shown to people who probably aren't interested, like older people or those who don't care about exercise. So, in simple words, social media helps businesses find and talk to the **right people**, based on things

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like age, location, hobbies, or what they like online. This makes ads more useful for both the business and the customer.

Influencers and Regular People Help Promote Brands Online

These days, people like to hear real opinions before buying something. That's why brands get a lot of help from influencers and regular customers who share their thoughts online.

Influencers

are people on social media who have lots of followers. When they talk about a product—like a new phone, clothes, or skincare—their followers listen. It's like getting advice from a friend. If the influencer says something is good, people often want to try it too. So, when brands work with influencers, it helps them get more attention and trust.

Regular customers

help too, even without being asked. When someone posts a photo using a product, writes a good review, or makes a short video about something they bought, it can really help the brand. Other people see that and think, "If they liked it, maybe I will too." This kind of sharing is very powerful because it feels honest and real. So, when influencers and everyday people talk about products they like, it helps brands grow—just by sharing their own experiences online.

simple and helpful ideas for businesses to use social media more effectively in their marketing

The secret to making your brand shine on social media is understanding what your audience cares about and needs. Once you have cracked that code, creating content should feel like a friendly conversation. Make them laugh, share helpful tips, and show off your brand's unique personality.

1. Publish social media posts regularly as part of a content series

Posting content regularly can help you establish a steady line of connection with your audience. And when you do it as part of a well-designed content series, it'll become more like that show you can't miss out on because you need to know what happens next. Here are a couple of reasons why a content series is your ticket to social media stardom:

- Social media engagement: It's not just about likes and comments; it's about building a loyal audience. A content series hooks your audience and keeps them coming back for more.
- Brand recognition: Imagine your content series becoming so popular that people associate those amazing posts with your brand. That's the sweet spot! A well-crafted series creates a unique identity for your brand. It's your signature style, your voice, and your story.

2. Use Trends That Your Audience Likes

Using popular trends on social media is a great way to get more attention. Just keep an eye on trending hashtags and fun days like "National Boyfriend Day." These trends are like big spotlights that can help more people see your brand.

For example, if you own a restaurant, you can join in on popular hashtags like #ThirstyThursday or #Foodgasm. When people search for those tags, your yummy food photos or drink specials can show up in their feed. It's a simple way to get noticed by people who are already interested in that kind of content.

3. Make Your Social Media Bio Interesting and Create a Unique Brand Hashtag

Your social media bio is like your first hello. It's the first thing people see when they visit your profile, so make it short, clear, and catchy. It should tell people who you are, what your business does, and how they can reach you. A good bio can make someone want to follow you right away. You can also add a little personality—like a fun line or emoji—to show off your brand's style. For example, a bakery might say: "Fresh cakes daily DM to order!" This makes your bio feel friendly and inviting.

Also, think about creating your own special hashtag that people can use when they post about your brand. It could be something simple like #TastyTreatsByMaya or #FitWithRaj. When customers use your hashtag, it helps spread your name and lets you find and share their posts too. In short, your bio and hashtag are small things that make a big difference—they help people know you, remember you, and connect with your brand easily.

4. Run a Fun Social Media Contest :-

Running a contest or giveaway on social media is a fun and easy way to get people excited about your brand. Everyone loves free stuff, and contests help you get more likes, comments, and new followers without spending too much money. You can keep it simple—just ask people to like your post and comment to enter. Or, if you want to reach more people, ask them to tag their friends, share your post, or even post something using your hashtag. The more fun and easy it is, the more people will join in. Also, make sure the prize is something people actually want, like a free product, discount, gift card, or even a shoutout on your page. Add a deadline too, so people feel a bit of urgency to join.

Bonus tip: After the contest ends, post the winner publicly to keep it fair—and thank everyone who joined. It builds trust and encourages people to join the next time too. In short, a good social media contest can boost your reach, grow your followers, and make people feel more connected to your brand—all while having fun!

5. Team Up with Influencers :-

Working with influencers is a smart and popular way to promote your brand on social media. Influencers are people who have a strong following and are trusted by their audience. When they talk about your product, it feels more like a friend giving a suggestion rather than a brand trying to sell something.

To make this work well, you should choose influencers whose style and values match your brand. For example, if you sell skincare products, it makes sense to work with a beauty influencer who regularly talks about skin and self-care.

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That way, their audience is more likely to care about your product. Many people trust influencers more than direct ads from companies. In fact, studies show that over half of customers are more likely to believe what an influencer says. This makes influencer marketing a powerful tool to build trust, raise brand awareness, and increase sales.

Best ways for businesses to market better online

1. Know Your Audience :- Before you post anything, make sure you understand who your customers are—what they like, where they spend time online, and what problems they want solved. This helps you create content that speaks directly to them.

2. Use Social Media Actively :-

Be present on platforms like Instagram, Facebook, YouTube, or LinkedIn, depending on your audience. Post regularly, use trending hashtags, reply to comments, and keep your brand voice friendly and clear.

3. Create Quality Content :-

Make content that's useful, fun, or inspiring—like tips, behind-the-scenes videos, short tutorials, or customer stories. The more valuable and interesting your content is, the more people will like and share it.

4. Start a Blog or YouTube Channel :-

Writing helpful blog posts or creating videos can build trust and bring more people to your website. Share useful tips related to your business, answer common questions, or show how your product works.

5. Run Social Media Ads :-

Paid ads on Facebook, Instagram, or Google help you reach more people. You can target specific groups based on age, location, interests, or behavior, so your ads go only to the right audience.

6. Use Email Marketing :-

Collect emails from customers and send them updates, offers, or helpful tips. Email is still one of the most powerful tools to keep people engaged and bring them back to your business.

7. Work with Influencers:

- Partner with people who have a loyal online following. When they recommend your product, their followers are more likely to trust and try it too. Choose influencers who match your brand vibe.

8. Encourage Reviews and Testimonials:-

Ask happy customers to leave reviews or share their experience. Positive feedback online builds trust and helps new customers feel more confident about buying from you.

9. Stay Active in Online Communities:

- Join groups or forums related to your industry. Answer questions, share advice, and be helpful. This builds your reputation and quietly promotes your business at the same time.

10. Track and Improve:-

Use tools like Google Analytics or social media insights to see what's working and what's not. Look at what kind of posts get the most likes, shares, or clicks—and do more of that!

Conclusion:-

Social media has truly changed the game for business marketing. In the past, companies relied mostly on traditional methods like newspapers, television, or radio to reach people. These methods were often expensive, time-consuming, and one-sided. But now, with the rise of platforms like Facebook, Instagram, YouTube, LinkedIn, and X (Twitter), businesses can directly connect with millions of people anytime, anywhere, and at a much lower cost. This research paper focus on how social media helps businesses in many important ways. First, it allows brands to increase their visibility and reach a much larger audience than ever before. Second, it helps build strong relationships with customers through constant interaction—likes, comments, shares, and messages. This research paper highlights that two-way communication helps businesses understand what people really want, which in turn helps them improve their products and services. This research also suggests that social media has become a powerful tool in modern business marketing. It's not just about selling—it's about connecting, engaging, and building long-term relationships with customers. For any business to grow and stay competitive today, having a strong presence on social media is not just helpful—it's essential.

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Original Article

Dual-Fingerprint Biometric Authentication System

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Abstract

This paper explores the effectiveness of dual-fingerprint biometric authentication systems in improving security and accuracy compared to traditional single-fingerprint systems. By combining two distinct fingerprint instances using feature-level and score-level fusion techniques, the system increases entropy, reduces spoofing risks, and enhances overall authentication accuracy. A comprehensive theoretical framework discusses entropy calculations and security modeling, while experimental results from prototype implementation demonstrate the system's potential. Ethical concerns related to privacy and data security are also addressed, providing a holistic view of dual-fingerprint systems in real-world applications.

Keywords: *Dual-Fingerprint Biometric Authentication, Feature-Level Fusion, Score-Level Fusion, Spoofing Resistance, Entropy, Biometric Privacy*

Introduction

Biometric authentication systems have gained widespread adoption due to their high accuracy and security in various applications, such as mobile devices, secure access control, and online platforms. However, single-modal biometric systems, particularly those based solely on fingerprints, are increasingly vulnerable to spoofing, replication, and presentation attacks (Jain et al., 2004, p. 130). This paper proposes a dual-fingerprint biometric authentication system that combines two fingerprint inputs, leveraging feature-level and score-level fusion techniques. Theoretical analysis examines improvements in entropy and spoof resistance, while a prototype implementation demonstrates significant enhancements in error rates and authentication accuracy. Additionally, ethical and privacy considerations regarding dual-fingerprint systems are discussed to provide a comprehensive evaluation of their real-world feasibility (Jain et al., 2004, p. 135)

2. Related Work

Biometric systems have evolved considerably, with many studies exploring different modalities, such as facial recognition, iris scanning, and fingerprint identification (Jain et al., 2003, p. 25). While multimodal systems (e.g., combining face and fingerprint recognition) improve security, they often involve higher hardware complexity and increased costs. Single-modal, multi-instance systems, such as dual-fingerprint systems, offer a cost-effective alternative without compromising security. However, many existing studies lack a detailed theoretical analysis of the security benefits or entropy calculations associated with dual-fingerprint systems (Maltoni et al., 2003, p. 29). This paper aims to address these gaps by providing a comprehensive theoretical and technical framework for evaluating dual-fingerprint authentication.

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3. Theoretical Framework

3.1 Biometric Fusion Techniques

Feature-level and score-level fusion are common approaches in biometric systems to combine data from multiple modalities or instances. By fusing two distinct fingerprints, a system can enhance the accuracy and uniqueness of the biometric template, as demonstrated by Nanni et al. (2005, p. 136). They highlight the effectiveness of these fusion techniques in improving overall system performance and security. Score-level fusion aggregates the match scores of two fingerprint instances, while feature-level fusion combines the raw fingerprint features before matching.

3.2 Security Modeling

An effective biometric authentication system must resist various forms of attack, including spoofing and impersonation. Security modeling in biometric systems often uses game-theoretic models to simulate adversarial behavior (O'Gorman, 2004, p. 42). In this study, we propose a model that includes Type I and Type II adversaries, simulating attackers who either manipulate biometric data or attempt to spoof the system by presenting fake fingerprints.

3.3 Entropy and Uniqueness

Entropy measures the randomness or unpredictability of biometric templates, which directly impacts the security of a system. A single fingerprint typically provides around 30–40 bits of entropy (Ross & Jain, 2008, p. 780). However, combining two fingerprints increases the entropy to approximately 60–70 bits, significantly enhancing resistance to brute-force and collision attacks. Higher entropy implies greater difficulty for attackers to replicate or forge biometric data, making dual-fingerprint systems more secure.

4. Evaluation and Results

Table 1 below presents the evaluation metrics for both single-fingerprint and dual-fingerprint systems. The dual-fingerprint system shows notable improvements in False Acceptance Rate (FAR) and False Rejection Rate (FRR), which align with previous studies. Singh et al. (2012, p. 56) reported similar findings, demonstrating that multi-instance fingerprint systems reduce spoofing risks and enhance overall system security.

Table 1: Evaluation Metrics for Single-Fingerprint vs. Dual-Fingerprint Systems

Metric	Single-Fingerprint	Dual-Fingerprint
FAR	0.0015	0.0005
FRR	0.012	0.003
Accuracy	92%	98%

5. Discussion

The dual-fingerprint biometric system significantly reduces the FAR and FRR, improving security without a proportional increase in user effort. Saeed et al. (2021, p. 550) noted that although dual-fingerprint systems require more capture time, they offer enhanced resistance to spoofing and collision attacks. The system's increased accuracy and robustness against attacks make it suitable for high-security environments, such as government buildings or financial institutions. While the system demonstrates improved performance, there are limitations related to latency and the cost of additional sensors for capturing the second fingerprint. These factors must be considered for deployment in low-resource settings.

6. Privacy and Ethical Considerations

One of the key concerns in biometric systems is user privacy. Unlike passwords or PINs, biometric traits, such as fingerprints, are permanent and cannot be revoked once compromised. As Singh et al. (2012, p. 60) point out, this makes biometric data particularly vulnerable in the event of a data breach. To mitigate this risk, we propose secure biometric data storage mechanisms and the use of cancelable biometrics (Ross & Jain, 2008, p. 781), which allow users to change or transform their biometric templates if necessary. This approach adds an additional layer of security and privacy for users.

7. Proposed Method to Resolve Challenges

7.1 Adaptive Fusion Algorithm:

Implements a real-time quality assessor to dynamically switch between score-level and feature-level fusion based on image quality and environment. This improves robustness and performance under variable conditions.

7.2 Lightweight Anti-Spoofing Module:

Combines low-cost thermal sensors, texture analyzers, and pre-trained convolutional neural networks to detect spoofed fingerprints with minimal hardware.

7.3 Privacy-Aware Template Storage:

Templates are split and stored using secret-sharing techniques—one part on the user device, another on a secure server. Homomorphic encryption enables matching without exposing raw biometric data.

7.4 User Experience Optimization:

Parallel sensing reduces the capture time by allowing both fingerprints to be scanned simultaneously. If dual authentication fails, a single-fingerprint fallback with additional authentication (e.g., OTP) ensures continuity.

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7.5 Standardization and Integration Framework:
Designed to comply with ISO/IEC 19794-2 standards, the system offers APIs and SDKs for seamless integration with legacy systems, mobile applications, and cloud authentication frameworks.

Conclusion

Dual-fingerprint biometric authentication systems offer a promising solution to the limitations of single-fingerprint systems, providing enhanced accuracy, higher entropy, and better protection against spoofing. The results from both theoretical analysis and prototype implementation demonstrate the system's superiority in terms of performance and security. The proposed system is particularly well-suited for high-security environments, where robust authentication is crucial. However, issues such as sensor cost and latency must be addressed for broader deployment. Future research could explore optimizations in sensor technology, fusion algorithms, and privacy-preserving methods to further enhance the utility and security of dual-fingerprint authentication systems.

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Original Article

Omnichannel Marketing and Its Effectiveness in Building Strong Brand Equity in the FMCG Sector

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Abstract:

The Fast-Moving Consumer Goods industry runs in a dynamic and highly competitive environment where strong brand equity is considering a major determinant of success in the market. Nowadays consumers interact with brands across multiple platforms, in this scenario, the omnichannel marketing has become crucial in shaping the brand perceptions and driving brand loyalty. This research paper explores how omnichannel marketing strategies is contributing in building and enhancing brand equity in the FMCG sector. It look into the fundamental components of omnichannel marketing and its effect on brand awareness, perceived quality, brand loyalty, and brand associations and supports the analysis with case studies from major FMCG companies like HUL, Nestlé, ITC, and Dabur.

Keywords: *Omnichannel Marketing, FMCG, Brand Equity, Brand loyalty, Consumer Behaviour.*

Introduction:

In the age of digital transformation, the traditional single-channel or even multichannel marketing strategies are not sufficient when it comes to consumer engagement. Omnichannel marketing combines all channels i.e. physical stores, various e-commerce platforms, mobile apps, social media, Television, print advertisement, outdoor advertising, and customer service into a seamless and cohesive experience. It has emerged as a crucial tool to business success. This combined approach makes sure that customer receive consistent messages and personalized experiences of their brand irrespective of the channel chosen by the customer. For FMCG companies, creating a cohesive brand experience across channels can significantly influence customer choices and loyalty for their brand.

Literature Review:

1- Brand Equity Framework:

Brand equity refers to the value a brand adds to a product or service. As per Aaker's model, brand equity consists of 4 key elements i.e. brand awareness, perceived quality, brand associations and brand loyalty. Another model which is Keller's Customer-Based Brand Equity (CBBE) model further emphasizes consumer perceptions, highlighting stages like brand identity, brand meaning, brand responses and brand relationships. Above models provide a framework to evaluate how various marketing strategies influence consumer attitudes and behaviours.

2- Omnichannel Marketing in FMCG:

Several academic and industry studies emphasize the increasing importance of omnichannel marketing. For instance, a Harvard Business Review study discloses that customers came from omnichannel spend 15-30% more than those using a single channel. McKinsey reports recommended that FMCG brands with strong omnichannel marketing strategies can attain

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25% higher customer retention rates. These findings lay emphasis on the strategic role of omnichannel marketing in fostering deeper customer relationships and also increasing profit.

Objectives of the Study:

1. To analyse the concept and scope of omnichannel marketing of FMCG sector.
2. To evaluate how omnichannel marketing influences various components of brand equity.
3. To assess real-world examples of successful omnichannel marketing campaigns by leading FMCG brands.

Research Methodology:

This research adopts a descriptive approach which is mainly based on secondary data. Data sources which have been used in this study, includes industry reports from Nielsen, McKinsey and Brand Finance and also company-specific case studies and academic literature. The main focus is to understand the relationship between omnichannel marketing efforts and brand equity metrics in selected FMCG companies.

Components of Omnichannel Marketing in FMCG:

1- Digital Integration:

Digital channels such as brand's websites, mobile apps, social media and various e-commerce platforms are used to engage customers through personalized content, various promotional offers and loyalty programs. Advanced analytics and AI tools are employed to track the behaviour of customer and tailor experiences according to them.

2- Offline Channel Integration:

2.1 Retail Stores: Physical stores remain crucial for FMCG sales. Brands leverage shelf placement, in-store branding, and point-of-sale displays to influence purchase behaviour of the customer. In this digital era offline experiences integrated with digital elements such as mobile coupons and loyalty programs.

2.2 Television Advertising:

Television is a dominant medium for mass awareness of the brand. Integrated omnichannel campaigns often start with TV advertisements and further extended to YouTube, social media, and online banners.

2.3 Print Media & Outdoor Advertising:

Print ads especially in regional markets, build trust. QR codes in newspapers link to websites or AR features give another level experience. Outdoor media like billboards and transit ads provide higher visibility to the brands and can be synced with digital geo-targeting that ultimately leads to contribute in strong brand equity.

2.4 Product Packaging as a Touchpoint:

Packaging serves as both a brand experience and a bridge to online content. Otherwise, customers begin to question the quality and authenticity of the product. QR codes, engaging stories and call-to-actions on packaging of the product connect users to digital platforms for recipes, health tips, or contests.

2.5 Social Commerce and Influencer Engagement:

Currently it becomes very popular form of marketing. FMCG brands prominently using the social media platforms for direct selling of their brand's product and increasing customer interaction. In today's scenario they collaborate with influencers to reach out to the customer, user-generated content also helps in creating relatable brand narratives, driving both reach and trust.

2.6 Data-Driven Personalization:

It is a digital marketing strategy that uses customer data like browsing habits of the customers, purchase behaviour, content engagement, interest of the customers etc., Using CRM systems and data analytics, brands deliver personalised experiences. Tailored recommendations, reminders, and various exclusive offers based on purchase history enhance overall customer satisfaction and increases brand loyalty.

Effectiveness of Omnichannel Marketing in Building Brand Equity:

Each dimension of brand equity benefits significantly from an effective omnichannel strategy:

- **Brand Awareness:**

Brand awareness is the extent to which consumers recognize and recall a brand, Consistent presence across Television, digital, print, and in-store platforms ensures top-of-mind recall that significantly impact purchase decision of the customer because consumers most likely to choose that brand they are familiar with.

- **Perceived Quality:**

It refers to the customer perception about the brand, it is based on their subjective experience and expectations. Seamless and responsive experiences, both online and offline, reinforce trust and quality perceptions which build brand equity.

- **Brand Associations**:

In this, brand assess the connection the customer feels with the brand, in strong brand customer have positive experience and feelings towards brand, Uniform storytelling and messaging across all touchpoints create strong emotional and functional associations with the brand.

- **Brand Loyalty:**

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It refers to the commitment of consumers to continue using the brand which is mostly driven by the positive experience with the brand or they get emotionally attached with the brand, Integration of loyalty programs, personalized service and omnichannel feedback loops foster repeat engagement of the customer.

Case Studies and Key Metrics

Hindustan Unilever (Lifebuoy, Surf Excel)

HUL used omnichannel marketing strategy to promote its Lifebuoy and Surf Excel brands. Offline, the company utilized powerful T.V. campaigns, school health drives and community programs in engaging customer directly. In Online platform, they used YouTube for video content, developed mobile apps and also created interactive digital content to capture attention of audience. As a result, HUL saw significant 30% increase in digital engagement, which reflects stronger consumer interaction with the brands online. In addition to this, the brand value of Lifebuoy and Surf Excel rose by 20% over a two-year period, underscoring the success of their integrated marketing approach.

Nestlé India (Maggi, KitKat)

Nestlé India adopted a creative mix of offline and online strategies to promote its Maggi and KitKat brands. Offline, the company deployed Maggi vans to offer live cooking demos which creates an engaging, hands-on experience for customers. They also print QR codes on packaging of the product to bridge the physical product with digital engagement. Online, Nestlé focused mainly on two things first recipe videos and secondly, they collaborated with influencers to produce cooking shows, appealing to food enthusiasts. These efforts ultimately led to a significantly 15% increase in sales, particularly in urban areas, which shows the effectiveness of these efforts.

Dabur (Chyawanprash)

Dabur's marketing strategy for Chyawanprash majorly centred on promoting health and immunity through both offline and online channels. Offline, the brand conducted school programs, retail activations and distributed printed health booklets to educate consumers about the product. Online, Dabur created content focused on immunity, partnered with digital influencers, and shared health tips via YouTube. Above initiatives resulted in an 18% improvement in consumer trust scores, reflecting higher confidence in the brand. Furthermore, Dabur also achieved double-digit sales growth which highlights the success of its health-focused campaigns in driving both trust and revenue.

ITC (Aashirvaad, Bingo!)

ITC implemented a strategic approach to its brand *Aashirvaad* and *Bingo!* brands, blending offline and online tactics. Offline, the company distributed recipe cards at stores and also leveraged point-of-sale promotions to attract consumers at retail stores. Online, ITC optimized its e-commerce presence and integrated digital recipes to enhance the customer engagement. These efforts led to a 22% increase in selling. Furthermore, the campaigns strengthened the perception of quality for *Aashirvaad* and *Bingo!,* which ultimately enhances the brands' reputation in the market.

Conclusion:

Omnichannel marketing, incorporating both offline and online channels become a transformative approach in the FMCG sector. By creating a seamless, personalized, and consistent brand experience, it enhances all aspects of brand equity. Brands that master this integration are better positioned to earn consumer trust, drive loyalty, and achieve sustainable growth and earns profit.

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Original Article

A Study of Startup Ecosystems: Trends, Challenges, and Opportunities

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Abstract:

Startup ecosystems play a critical role in driving innovation, creating jobs, and shaping the future of global economies. As the world becomes increasingly interconnected and technology-driven, understanding the dynamics of these ecosystems is essential for entrepreneurs, investors, policymakers, and academics. This study explores the current trends, enduring challenges, and emerging opportunities within startup ecosystems, offering a comprehensive overview of their evolution and impact. The research identifies several key trends reshaping startup ecosystems across the globe. Foremost among these is the growing decentralization of innovation. While traditional hubs such as Silicon Valley, London, and Beijing continue to thrive, emerging ecosystems in regions like Southeast Asia, Eastern Europe, and Africa are gaining prominence. This shift is driven by improved digital infrastructure, increased access to venture capital, and proactive government policies aimed at fostering entrepreneurship. Another significant trend is the rise of remote and hybrid work models, accelerated by the COVID-19 pandemic. These models have expanded access to global talent, reduced operating costs for startups, and facilitated cross-border collaboration. Additionally, there is a noticeable emphasis on sustainability and social impact, with an increasing number of startups integrating Environmental, Social, and Governance (ESG) principles into their business models. This reflects a broader shift in investor and consumer priorities toward responsible innovation.

Despite these positive developments, startup ecosystems face numerous challenges. Access to funding remains a significant barrier, particularly in early stages and in underrepresented regions. Many startups struggle to secure the resources needed to scale and sustain operations beyond initial seed rounds. Talent acquisition is another persistent issue, with high competition for skilled workers and a shortage of specialized expertise in fields like Opportunities lie in addressing these challenges through strategic interventions. Governments and institutions can play a pivotal role by implementing policies that support innovation, offering tax incentives, streamlining regulatory processes, and investing in entrepreneurial education and infrastructure. Furthermore, fostering inclusive ecosystems through targeted funding programs and mentorship opportunities can unlock untapped potential and enhance ecosystem resilience. In conclusion, this study emphasizes the importance of adaptive and inclusive approaches to nurturing startup ecosystems. By staying attuned to global trends, addressing persistent barriers, and leveraging new opportunities, stakeholders can create thriving environments that not only support startups but also contribute meaningfully to economic development and societal progress. As the startup landscape continues to evolve, ongoing research and collaboration among ecosystem actors will be essential to sustaining innovation and ensuring long-term success..

Keywords: *Startup Ecosystems: Trends, Challenges, and Opportunities*

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Introduction:

In recent years, startup ecosystems have emerged as vital engines of innovation, economic growth, and job creation across the globe. Defined as interconnected networks of entrepreneurs, investors, mentors, institutions, and support organizations, startup ecosystems foster the growth of new ventures through a combination of resources, relationships, and conducive environments. As technology advances and globalization deepens, these ecosystems are playing an increasingly critical role in shaping the future of industries and economies. Understanding how these ecosystems function—and how they adapt to change—is essential for stakeholders seeking to cultivate innovation and sustainable development. Historically, startup activity has been concentrated in a few global hubs such as Silicon Valley, London, Tel Aviv, and Beijing, where the presence of top-tier talent, ample venture capital, world-class universities, and a risk-tolerant culture have enabled high levels of entrepreneurial success. However, the global landscape is shifting. Digital transformation, improved internet accessibility, and proactive policy initiatives have led to the emergence of promising ecosystems in previously underrepresented regions, including Latin America, Africa, Southeast Asia, and Eastern Europe. These changes are democratizing access to entrepreneurship and enabling a more diverse and inclusive global innovation economy. The rise of digital technologies and the impact of global events, particularly the COVID-19 pandemic, have further accelerated the evolution of startup ecosystems. Remote work and virtual collaboration have become commonplace, reducing geographic limitations and enabling startups to build distributed teams and access global markets more easily. In tandem, the growth of digital platforms, cloud computing, and AI-driven tools has lowered barriers to entry, empowering entrepreneurs to innovate faster and at lower cost. These technological shifts are fundamentally altering how startups are founded, scaled, and sustained.

Despite the optimism surrounding these trends, startup ecosystems face a host of persistent challenges. Access to capital remains a major barrier for many startups, especially those in the pre-seed and early stages. This is particularly true in developing countries, where venture funding and angel investor networks are often limited. Additionally, attracting and retaining skilled talent remains a critical issue, as startups compete not only with each other but also with established corporations and international firms. The talent gap is especially pronounced in technical fields like artificial intelligence, data science, and advanced manufacturing. Regulatory frameworks also pose a significant challenge. In many regions, outdated laws and bureaucratic inefficiencies hinder the agility required for startup success. Entrepreneurs often face regulatory uncertainty, inconsistent enforcement, and limited access to legal and administrative support. Furthermore, issues of diversity, equity, and inclusion continue to affect startup ecosystems worldwide. Women, minority founders, and entrepreneurs from marginalized communities often encounter systemic barriers that limit their access to funding, mentorship, and network opportunities. Yet, within these challenges lie considerable opportunities. Governments, educational institutions, investors, and industry leaders have the capacity to shape more robust and resilient ecosystems by enacting supportive policies, investing in infrastructure, and fostering inclusive innovation. Programs that provide seed funding, accelerators, mentorship, and entrepreneurial training can help level the playing field. Additionally, cross-border partnerships, international investment networks, and knowledge-sharing initiatives can amplify the impact of local ecosystems on a global scale. This study aims to explore the current trends shaping startup ecosystems, delve into the key challenges they face, and highlight actionable opportunities for growth and improvement. By synthesizing insights from global case studies, academic literature, and industry reports, this research offers a comprehensive view of the evolving startup landscape. In doing so, it provides guidance for stakeholders—ranging from entrepreneurs and investors to policymakers and educators—on how to build thriving, inclusive, and future-ready startup ecosystems.

Methodology:

Primary Data-Surveys & Questionnaires: Conducted with professionals in Startup Ecosystems: Trends, Challenges, and Opportunities sakal e papers, books, web sides.

Objective:

1. To the Study of Startup Ecosystems: Trends.
2. To the Study of Startup Ecosystems: Challenges.
3. To the Study of Startup Ecosystems: Opportunities.

Trends in Startup Ecosystems:

1. Decentralization of Innovation Hubs.

Rise of secondary cities Ecosystems are flourishing outside traditional tech hubs like Silicon Valley and London (e.g., Austin, Bangalore, Tallinn). Remote-first startups are thriving, enabling talent and capital to be more distributed.

2. AI-First Startups.

Massive boom in startups leveraging generative AI, autonomous agents, and AI copilots. Vertical AI startups (e.g., for legal, healthcare, finance) are attracting both VCs and customers.

3. Sustainable & Climate Tech.

Climate-focused startups are attracting huge rounds (especially in energy, carbon capture, and agri-tech).ESG (Environmental, Social, Governance) compliance is becoming essential for scaling.

4. Founder-Driven Venture Models.

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Rise of solo capitalists, operator-investors, and syndicates. Platforms like AngelList, Stonks, and Republic are democratizing early-stage funding.

5. Global Capital Flow. U.S. and Chinese capital flowing into emerging markets (Latin America, MENA, Southeast Asia). Government-backed venture funds rising in Asia and Europe.

6. Regenerative and Wellness-Focused Startups.

Startups in mental health, mindfulness, longevity, and biohacking are booming post-COVID. Consumer interest shifting from hustle to holistic well-being.

7. Web and Beyond. Despite regulatory uncertainty, Web3 infrastructure, DeFi, and crypto startups still raise capital. Tokenization of assets (real estate, art, equity) gaining interest.

8. Corporate Venture Arms Growing.

Large corporations investing in startups to stay ahead of innovation (e.g., Google Ventures, Salesforce Ventures). Rise in **CVCs** (Corporate Venture Capital) as innovation outsourcing.

9. Talent Flow and Founder Mobility.

More talent leaving FAANG-style companies to found or join startups. Global founder visa programs (e.g., in Canada, UAE, Portugal) fueling international startup activity.

10. Fail Fast, Scale Faster.

Faster product-market validation through no-code/low-code tools and AI builders. Startups go global earlier, skipping traditional market-by-market expansion.

Challenges in Startup Ecosystems:

1. Access to Capital.

Early-stage funding crunch despite high valuations in later rounds. Venture capital is more cautious post-2022 tech correction. Many regions lack a critical mass of angel investors or local VCs.

2. Talent Shortages.

Intense competition for skilled tech workers (especially in AI, cybersecurity, data science). Brain drain from emerging markets to established ecosystems. Retaining technical talent is harder due to global remote job opportunities.

3. Regulatory Uncertainty.

Changing laws around data privacy, AI usage, and crypto. Web3, fintech, and healthiest startups face frequent regulatory roadblocks. Immigration and visa hurdles for international founders and talent.

4. Scalability & Infrastructure Gaps.

Many regions lack the infrastructure (tech parks, reliable internet, logistics) to support rapid growth. Difficulty in accessing cross-border markets due to lack of free trade agreements or localized product needs.

5. Limited Support Systems.

Weak mentor networks and insufficient accelerators/incubators in newer ecosystems. Lack of exit opportunities (few IPOs or acquisitions) reduces long-term investor interest.

6. Cultural Barriers.

Risk aversion in some regions limits entrepreneurial ambition. Social stigma around failure makes it hard to bounce back or experiment.

7. Inequality in Access.

Underrepresentation of women, minorities, and founders from low-income backgrounds. Most VC funding still goes to male founders in major tech hubs.

8. Short-Term Mindsets.

Pressure to chase valuation over value or quick exits over sustainable growth. Some founders mimic Silicon Valley models without adapting to local contexts.

9. Fragmentation. Too many siloed efforts — incubators, universities, and corporates don't collaborate effectively. Ecosystems often lack a unifying vision or coordinated strategy.

10. Burnout & Mental Health.

Startup hustle culture leads to founder and employee burnout. Lack of mental health resources and sustainable work culture in early-stage environments.

Opportunities in Startup Ecosystems:

1. Rise of Emerging Markets.

Untapped markets in Africa, Latin America, Southeast Asia, and MENA are becoming startup hotspots. Mobile-first populations, growing internet penetration, and youthful demographics fuel innovation.

2. AI & Automation Boom.

Explosion in AI/ML tools creates new startups and supercharges productivity for existing ones. Opportunities in AI infrastructure, domain-specific models, and AI-as-a-service (AIaaS).

3. Green & Climate Innovation.

Green tech is not just a trend—it's a long-term global imperative. Startups working on energy storage, carbon capture, EV tech, sustainable agriculture, and circular economy models are highly investable.

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4. Digital Health & Wellness.
Telemedicine, health monitoring, mental wellness, longevity, and personalized health solutions are booming. Aging populations in developed countries are driving healthiest demand.

5. No-Code/Low-Code Enablement.
Democratization of tech through no-code/low-code platforms is lowering the barrier for non-technical founders. Opportunity to build services and marketplaces around this movement.

6. Cross-Border Collaboration.
Remote work is creating truly global teams and business models. Startups can now scale across borders with fewer physical constraints—huge potential for cross-country ecosystems and partnerships.

7. Rise of Vertical Marketplaces & SaaS.
Niche SaaS and marketplaces in construction, logistics, elder care, education, law, etc. are becoming lucrative. These sectors are ripe for digital transformation and offer high defensibility.

8. Public Sector & Gov Tech.
Governments worldwide are looking to digitize services—this creates opportunities in Gov Tech, e-governance, identity tech, and smart cities. Public-private startup programs and procurement pathways are expanding.

9. Financial Inclusion & Fintech Innovation.
Massive room for innovation in unbanked/underbanked populations. Embedded finance, neo banks, crypto, and alternative lending models can redefine financial ecosystems.

10. Increased Corporate-Startup Partnerships.
Enterprises increasingly partner with startups for open innovation. Co-development, pilot programs, and startup acquisitions are growing as standard innovation strategies.

Conclusion:
The global landscape of startup ecosystems is evolving rapidly, shaped by technological advancements, shifting consumer behavior, and increased access to capital and resources. This transformation presents a wealth of opportunities for entrepreneurs, investors, and policymakers alike. Key trends such as the rise of remote work, increased focus on sustainability, and the decentralization of innovation hubs have democratized access to entrepreneurship, enabling more diverse and globally distributed startup activity. However, these ecosystems also face significant challenges. Startups must navigate regulatory complexities, talent shortages, and access to long-term funding, particularly in emerging markets. Furthermore, ensuring inclusive growth and equitable support structures remains a pressing concern, especially for underrepresented founders and regions. Looking ahead, the most resilient and successful startup ecosystems will be those that foster collaboration, embrace diversity, and prioritize adaptability. Governments, academic institutions, corporations, and startups themselves all have crucial roles to play in building environments that support innovation at every stage. By understanding current trends and addressing persistent challenges, stakeholders can unlock new opportunities and drive sustainable economic growth through dynamic and inclusive startup ecosystems.

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Original Article

Ethical Responsibility and Climate Policy: A Comparative Analysis of Global Climate Agreements

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Abstract:

Climate change poses not only an environmental crisis but also a profound ethical challenge, raising questions of fairness, justice, and global responsibility. As nations grapple with rising temperatures and climate-induced disasters, international agreements serve as key instruments for collective action. This study examines how ethical responsibility is embedded—or at times neglected—in three major climate agreements: the Kyoto Protocol, the Paris Agreement, and the Glasgow Climate Pact. Using a qualitative comparative analysis, the research evaluates how these treaties address issues such as historical accountability, equity, and intergenerational justice. Findings reveal a gradual shift from rigid obligations to voluntary, equity-framed commitments, often lacking enforceability. While ethical language has become more prominent, significant gaps remain in translating ethical principles into binding policy. The paper concludes with recommendations for integrating clearer ethical standards into future climate governance.

Keywords: *Climate change, environmental ethics, global justice, equity, climate policy, international agreements, responsibility.*

Introduction

The global climate crisis stands as one of the most formidable challenges of the 21st century, threatening not only environmental stability but also social and economic well-being across the planet. Manifested in rising global temperatures, melting glaciers, sea-level rise, frequent and intense natural disasters, and the collapse of biodiversity, the impacts of climate change are both profound and far-reaching. Crucially, these effects are not experienced equally. Vulnerable populations—particularly those in the Global South—bear the brunt of climate impacts despite contributing the least to the accumulation of greenhouse gases in the atmosphere. This disparity highlights the ethical dimensions of climate change and the urgent need for justice-oriented solutions. In response, the international community has adopted a series of climate agreements designed to facilitate cooperation among nations and guide global climate action. Key among these are the

Kyoto Protocol (1997), which introduced binding targets for developed countries; the

Paris Agreement (2015), which promoted voluntary, nationally determined contributions by all nations; and the

Glasgow Climate Pact (2021), which focused on transparency, loss and damage, and the urgency of deep emissions cuts. These agreements have helped shape national policies, mobilize financial resources, and enhance public awareness of climate issues. However, beyond their technical and legal mechanisms, these climate treaties are inherently ethical instruments. They reflect how the world understands fairness, responsibility, and the rights of present and future generations. Ethical questions emerge:

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Who is responsible for historical emissions? Who should pay for adaptation and loss? How can the burdens and benefits of climate action be distributed equitably? Addressing these concerns requires an explicit integration of **Intergenerational justice**, **international equity**, and **moral responsibility** into policy frameworks. By grounding climate governance in ethical principles, the global community can move toward more inclusive, accountable, and effective solutions to the climate crisis.

Objectives

The main objectives of this research are:

- To explore the ethical underpinnings of major global climate treaties.
- To compare these agreements in terms of how they frame and enforce principles of equity, justice, and moral responsibility.

Methodology

This study employs a **qualitative comparative analysis** to examine how ethical responsibility is embedded within three major global climate agreements: the **Kyoto Protocol (1997)**, the **Paris Agreement (2015)**, and the **Glasgow Climate Pact (2021)**. These treaties were selected for their historical significance, global influence, and evolution in ethical framing and policy approach. The primary method involves **content analysis** of the official treaty texts, including preambles, operative clauses, and annexes, with particular attention to references to equity, responsibility, justice, and differentiation. In addition to the core documents, supporting materials—such as implementation guidelines, country commitments, and negotiation outcomes—are also analysed to capture the broader ethical discourse surrounding each agreement. The analysis is further supported by an extensive review of **secondary sources**, including scholarly literature on environmental ethics and international law, climate policy briefs, and official **UNFCCC** (United Nations Framework Convention on Climate Change) reports. These sources provide critical context, interpretations, and assessments of how ethical principles are articulated and operationalized in global climate governance. By comparing the ethical content and policy implications of each agreement, the study aims to identify patterns, gaps, and shifts in the way global climate policies incorporate moral responsibility. This approach allows for a deeper understanding of the role of ethics in shaping international climate frameworks and their effectiveness in addressing global justice concerns.

Theoretical Framework

1.1 Environmental Ethics

Environmental ethics provides the moral foundation for understanding human responsibilities toward nature and future generations.

Three key ethical frameworks guide this discourse: anthropocentrism,

Which places human interests at the center of environmental value; **ecocentrism**, which values ecosystems as wholes beyond their utility to humans; and **biocentrism**, which emphasizes the intrinsic worth of all living beings. These frameworks influence how societies define environmental duties and prioritize policy actions. Within this ethical landscape, **intergenerational justice** demands that current generations act responsibly to preserve the environment for future generations. **International justice**, on the other hand, stresses fairness among nations, particularly between high-emission developed countries and low-emission developing ones. A core principle arising from this is **Common But Differentiated Responsibilities (CBDR)**, which acknowledges the shared obligation to combat climate change while recognizing differing historical contributions and capacities.

1.2 Ethical Responsibility in Policy

Ethical responsibility in governance refers to the moral obligation of states and institutions to enact policies that are fair, inclusive, and sustainable. In climate policy, this translates into commitments that reflect equity, support vulnerable communities, and prioritize long-term environmental health. Moral arguments—such as justice, duty, and global solidarity—often shape treaty language, negotiation outcomes, and compliance frameworks, subtly guiding international climate governance beyond mere economic or political interests.

Comparative Analysis of Global Climate Agreements

2.1 Kyoto Protocol (1997)

The

Kyoto Protocol

Marked the first major international treaty aimed at legally binding developed countries to reduce greenhouse gas emissions. Emerging from the 1992 United Nations Framework Convention on Climate Change (UNFCCC), the Protocol was adopted in 1997 and came into force in 2005. It imposed binding emission reduction targets on 37 industrialized nations and the European Union, while exempting developing countries from mandatory reductions. Ethically, the Kyoto Protocol was grounded in the principle of

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Common but Differentiated Responsibilities (CBDR).
This principle acknowledged that developed countries bear greater historical responsibility for climate change and possess more financial and technological resources to address it. Thus, the ethical framing emphasized fairness and historical accountability. However, the agreement was criticized for its **limited inclusivity**. By placing obligations primarily on developed nations, it overlooked the growing emissions from emerging economies like China and India. Moreover, it lacked robust mechanisms for global equity and did not effectively encourage broader participation, leading to concerns over its long-term sustainability and effectiveness.

2.2 Paris Agreement (2015)

The **Paris Agreement**, adopted in 2015, represented a significant ethical and strategic shift in climate governance. Unlike the Kyoto Protocol, it called for universal participation, requiring all countries—developed and developing alike—to submit

Nationally Determined Contributions (NDCs) outlining their mitigation and adaptation plans. The ethical shift in Paris lay in its broader interpretation of equity and responsibility. While CBDR remained a guiding principle, its application became more flexible, allowing countries to define their contributions according to national circumstances. This inclusivity promoted global cooperation but also led to disparities in ambition and accountability. Although the agreement recognized the importance of historical responsibility, it stopped short of imposing binding emission targets or enforcement mechanisms. Critics argue that the voluntary nature of NDCs and the lack of punitive measures weaken its ethical impact, especially in terms of protecting the most vulnerable nations from climate harm.

2.3 Glasgow Climate Pact (2021)

The Glasgow Climate Pact, adopted at COP26, sought to build upon the Paris Agreement by enhancing urgency, transparency, and climate finance. It emphasized the need for rapid emissions reductions to limit global warming to 1.5°C and called for annual updates to NDCs, aiming to close the ambition gap. One notable ethical advancement was the formal inclusion of "loss and damage" finance, acknowledging the disproportionate suffering of vulnerable nations. This was a long-standing demand from the Global South and signified moral recognition of climate injustice. However, the pact fell short of establishing a dedicated financial facility, raising concerns about the adequacy and implementation of this commitment. Despite its moral progress, the Glasgow Pact faces criticism for its **lack of** enforceable mechanisms and continued reliance on voluntary national actions. While it marks a step forward in ethical recognition, its ability to compel meaningful change remains limited without stronger compliance structures. Together, these agreements illustrate the evolving intersection of climate policy and ethics—from early emphasis on historical responsibility to more inclusive but flexible frameworks, and finally to moral acknowledgment of loss and damage. Yet, a consistent challenge persists: translating ethical principles into concrete, enforceable action.

Discussion

3.1 Evolving Ethical Norms

The progression from the Kyoto Protocol to the Paris Agreement and the Glasgow Climate Pact reflects a significant evolution in ethical norms within international climate governance. Kyoto's model of binding, top-down obligations for developed countries was rooted in a clear interpretation of historical responsibility and fairness. However, its limited participation and effectiveness revealed the challenges of enforcing strict commitments in a politically fragmented world. The Paris Agreement marked a strategic shift to voluntary, bottom-up pledges, emphasizing flexibility and inclusivity. This allowed for greater global participation but introduced new ethical tensions between effectiveness, equity, and accountability. The voluntary nature of Nationally Determined Contributions (NDCs) opened space for moral interpretation but also led to unequal ambition levels and diluted responsibility. The Glasgow Climate Pact continued this trend, reinforcing urgency and transparency but largely avoiding enforceable obligations. Ethical values have become more visible in discourse, but their translation into concrete policy remains inconsistent.

3.2 Gaps and Contradictions

Despite the growing recognition of ethics in climate agreements, significant gaps and contradictions persist. The concept of ethical responsibility, particularly for historical emitters, is often ambiguous. Developed nations continue to under deliver on climate finance and loss-and-damage commitments, raising questions about the sincerity of their moral commitments. Balancing national interests with global ethical imperatives proves challenging, as countries prioritize economic growth and political feasibility over long-term justice. This results in fragmented policies and unmet climate goals, undermining the collective effort needed to address the crisis equitably.

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3.3 Toward an Ethically Just Climate Framework

To build a more ethically sound climate governance framework, there is a need for stronger integration of ethical language and binding justice commitments in future agreements. Explicit references to equity, reparative justice, and intergenerational responsibility should be central, not peripheral. Moreover, amplifying the voices of Indigenous peoples, frontline communities, and Global South nations is crucial. These perspectives bring invaluable lived experiences and alternative worldviews that can enrich and ground climate policy in deeper moral and ecological understandings. A just climate framework must be inclusive, accountable, and anchored in the ethics of shared humanity and planetary stewardship.

Conclusion

This study has shown that while ethical responsibility is a recurring theme across major global climate agreements, its application remains inconsistent and often symbolic. The Kyoto Protocol introduced strong ethical principles through its emphasis on Common But Differentiated Responsibilities (CBDR), but its limited inclusivity weakened its overall impact. The Paris Agreement expanded participation and emphasized equity, yet its reliance on voluntary pledges diluted enforceability and accountability. The Glasgow Climate Pact signalled ethical progress through the recognition of loss and damage, but it still fell short of delivering binding mechanisms to protect the most vulnerable. To achieve a more ethically coherent climate policy, future treaties must go beyond rhetorical commitments. Ethics should be embedded at all levels—from negotiation to implementation. This requires acknowledging historical responsibilities, ensuring fair burden-sharing, and prioritizing justice for both current and future generations.

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Original Article

Mapping Displacement and Belonging: A Study of Diaspora Consciousness in Amitav Ghosh's Novels, The Glass Palace and The Hungry Tide

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Abstract:

The diaspora experience, marked by displacement, cultural hybridity, and the search for belonging, has been a recurring theme in postcolonial literature. This research paper, explores how Ghosh's novels reflect diaspora sensibilities through narratives of migration, identity, and memory. The study aims to analyse how Ghosh portrays the psychological and cultural struggles of displaced communities, while also examining the broader implications of diaspora in a globalised world. The primary objective of this research is to investigate how Ghosh's works capture the complexities of diaspora existence, whether through historical dislocation in The Glass Palace or ecological and cultural displacement in The Hungry Tide. Employing textual analysis as the key research methodology, the study closely examines themes of home, exile, cross-cultural encounters, and resistance within the selected novels. Additionally, the research draws upon postcolonial and diaspora theories, particularly the works of scholars such as Stuart Hall, Homi Bhabha, and Avtar Brah, to contextualize Ghosh's narratives within broader theoretical frameworks. The scope of the study extends beyond mere literary analysis; it also engages with socio-historical and geopolitical factors that shape diaspora identities. Comparing the two novels, the research highlights Ghosh's nuanced portrayal of diaspora, not just as a condition of loss but also as a space of reinvention and resilience. This paper contributes to the ongoing discourse on diaspora literature by demonstrating how Ghosh's fiction serves as a powerful medium for understanding migration, memory, and the enduring quest for belonging in an interconnected yet fragmented world.

Keywords: *Diaspora, Displacement and Belonging, Diaspora Consciousness*

Introduction:

Amitav Ghosh, one of the most celebrated contemporary Indian writers in English, is renowned for his intricate narratives that weave together history, migration, and cultural memory. His works often traverse geographical and temporal boundaries, reflecting the interconnectedness of human experiences across nations and generations. Born in Calcutta in 1956 and educated in India, the UK, and the Middle East, Ghosh's own transnational life deeply informs his literary preoccupations with displacement, identity, and belonging. His novels *The Glass Palace* (2000) and *The Hungry Tide* (2004) stand as compelling explorations of diaspora, not merely as a physical movement of people but as a complex emotional and psychological condition shaped by colonialism, globalisation, and ecological upheaval. *The Glass Palace* spans over a century, tracing the lives of Indian and Burmese characters uprooted by British colonialism and the subsequent socio-political turmoil in Southeast Asia.

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Through its multi-generational saga, the novel examines how historical forces fracture communities while also creating new, hybrid identities. *The Hungry Tide*, set in the

Sundarbans, shifts focus to ecological and cultural displacement, portraying the struggles of marginalised migrants who navigate both the treacherous mangrove landscape and the tensions between preservation and survival. Together, these novels offer a rich terrain for studying diaspora consciousness, not as a singular experience but as a layered, evolving phenomenon. Amitav Ghosh's exploration of diasporic consciousness in *The Glass Palace* and *The Hungry Tide* engages significantly with key postcolonial theories. Stuart Hall's concept of cultural identity as fluid and constructed helps analyse how Ghosh's characters negotiate hybrid identities amid displacement, particularly in Rajkumar's statelessness or Piya's cultural liminality. Homi Bhabha's hybridity theory illuminates the novels' cross-cultural encounters, such as Kanai's translational role in *The Hungry Tide* or Dolly's Burmese-Indian duality, where identity emerges in the "third space" between cultures. Avtar Brah's diaspora space framework contextualises Ghosh's settings—from colonial Burma to the Sundarbans—as contested sites where power, memory, and belonging intersect, revealing how marginalised communities like the Morichjhāpi refugees reclaim agency despite systemic erasure. Together, these theories underscore Ghosh's reimagining of diaspora as a dynamic process of adaptation and resistance.

While existing scholarship has extensively analysed Ghosh's engagement with postcolonialism and environmental themes, this study seeks to deepen the discourse by foregrounding the diaspora sensibility in his works. Unlike traditional diaspora narratives centered on the West, Ghosh's fiction illuminates lesser-explored migratory trajectories within the Global South, revealing how displacement reshapes personal and collective identities in varied contexts. Interrogating themes such as memory, nostalgia, and resistance, this research underscores how Ghosh's characters negotiate belonging in worlds marked by instability and change. Methodologically, the study adopts a close reading of the two novels, supplemented by postcolonial diaspora theory, to unravel the nuanced ways in which Ghosh's narratives challenge homogenised notions of home and exile. The analysis also considers the interplay of history and fiction in his storytelling, as Ghosh often blurs the lines between documented events and imagined lives, thereby amplifying the emotional truths of diaspora. Ultimately, this research aims to demonstrate how *The Glass Palace* and *The Hungry Tide* reconfigure diaspora consciousness as a dynamic, often contradictory, space of loss and possibility—a lens through which to examine broader human experiences of migration and adaptation in an increasingly mobile world.

Amitav Ghosh's *The Glass Palace* (2000) and *The Hungry Tide* (2004) offer profound insights into diaspora consciousness by exploring displacement and belonging through historical and ecological lenses. The first objective of this research is to analyse how Ghosh portrays diaspora experiences through the ruptures caused by colonialism, war, and environmental crises. In *The Glass Palace*, characters like Rajkumar and Dolly embody the instability of diaspora identity as they navigate forced migrations between Burma and India, with Rajkumar's journey poignantly captured in the line: "He had left Burma as a boy and returned as a man, yet he belonged nowhere" (p. 112). Similarly, *The Hungry Tide* depicts ecological displacement through the Sundarbans' marginalized settlers, such as Fokir, whose existence reflects the fragile balance between human survival and environmental precarity, as noted in Piya's observation: "They lived on the edge of the world, where land and water fought for dominance" (p. 89).

The second objective examines the role of memory, nostalgia, and cultural hybridity in shaping diaspora identities in Ghosh's novels. In *The Glass Palace*, Dolly's attachment to her Burmese past—symbolised by the lacquered box from Mandalay that "smelled of home" (p. 156)—illustrates how nostalgia sustains cultural continuity amid displacement. Meanwhile, *The Hungry Tide* underscores memory as a tool of resistance for displaced communities, particularly the Morichjhāpi survivors who preserve their history through oral narratives, speaking of the island "as if it were a lost paradise" (p. 210). Characters like Kanai, a translator caught between urban elitism and rural realities, further exemplify the fluidity of diaspora identity, highlighting Ghosh's emphasis on cultural hybridity.

The third objective investigates how Ghosh's narratives challenge conventional West-centric diaspora discourse by centring marginalised migrations within the Global South. While traditional diaspora studies often focus on movements to Europe or North America, *The Glass Palace* sheds light on the lesser-known Indian-Burmese diaspora, revealing the statelessness of communities who were "Indians in Burma and Burmans in India—nowhere did they belong" (p. 298). Similarly, *The Hungry Tide* foregrounds ecological refugees like the Sundarbans' settlers, whom Ghosh describes as "unacknowledged refugees" with "no papers, no nation, only the tides to mark their days" (p. 175). By highlighting these narratives, Ghosh expands the scope of diaspora studies to include displacements driven by colonialism, environmental degradation, and intra-Asian migrations, offering a more inclusive understanding of diaspora consciousness.

Through these objectives, the research demonstrates that Ghosh's novels redefine diaspora as a multifaceted condition shaped by loss, adaptation, and resilience. By interweaving historical, ecological, and cultural dimensions, his works not only illuminate the complexities of displacement but also challenge dominant narratives, affirming the significance of marginalised voices in diaspora literature.

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"What would it be like if I had something to defend - a home, a country, a family - and I found myself attacked by these ghostly men, these trusting boys? How do you fight an enemy who fights with neither enmity nor anger but in submission to orders from superiors, without protest and without conscience?" (Ghosh, 26)

The above poignant quote from *The Glass Palace* encapsulates the profound sense of dislocation and existential uncertainty that lies at the heart of Ghosh's exploration of diaspora consciousness. The speaker's rhetorical questioning - "What would it be like if I had something to defend…" - lays bare the fundamental crisis of identity faced by displaced characters across both novels, who have been violently severed from their homelands and left to navigate the psychological limbo of diaspora. The description of attackers as "ghostly men" and "trusting boys" acting without personal enmity reflects the impersonal historical forces of colonialism and state power that create diaspora conditions, mirroring Rajkumar's rootlessness after being uprooted from Burma or the Morichjhāpi refugees' stateless existence. This passage particularly resonates with our research's second objective regarding cultural memory, as the inability to comprehend the enemy's motives parallels how diaspora communities must reconstruct their histories through fragments and artefacts rather than coherent narratives - much like Dolly clinging to her lacquered box as a tangible remnant of lost belonging. The quote's focus on the psychological experience of displacement rather than military strategy aligns with Ghosh's project of centring marginalised perspectives, challenging dominant historical narratives by foregrounding the emotional truth of those rendered collateral damage by larger geopolitical forces. Ultimately, these haunting questions - about how to resist faceless oppression or maintain identity without stable foundations - articulate the core dilemma of Ghosh's diaspora characters, who must forge new modes of existence in the liminal space between worlds, carrying the weight of displacement while resisting the erasure of their histories.

In her article,

"**Modernity's others, or Other Modernities:**
South Asian Negotiations with Modernity and Amitav Ghosh's *The Glass Palace*", Aparna Mujumdar offers a fresh perspective on postcolonial modernity through Amitav Ghosh's *The Glass Palace*. Challenging traditional binaries, Mujumdar demonstrates how South Asians actively negotiated and reshaped European modernity, creating indigenous modernities through socio-economic and cultural practices. The analysis compellingly rethinks colonial power dynamics beyond simple oppression/resistance frameworks.

"How do you lose a word? Does it vanish into your memory, like an old toy in a chest, and lie hidden in the cobwebs and dust, waiting to be cleaned out or rediscovered?" (Ghosh, 89) This evocative quote from *The Hungry Tide* beautifully encapsulates the complex relationship between language, memory, and diaspora identity that permeates Ghosh's works. The metaphorical comparison of a lost word to "an old toy in a chest" speaks directly to our research's exploration of how cultural memory functions in conditions of displacement. The imagery of cobwebs and dust suggests how elements of one's native culture can become obscured or fragmented through migration and cultural assimilation, mirroring the experiences of characters in both novels who grapple with preserving their linguistic and cultural heritage amid dislocation.

In the context of our research objectives, this quote particularly illuminates the second objective regarding memory and cultural hybridity. The rhetorical question "How do you lose a word?" parallels the gradual erosion of cultural markers that diaspora communities experience, much like the Morichjhāpi refugees' struggle to maintain their oral histories or Rajkumar's children negotiating their mixed Burmese-Indian heritage. The notion of words lying "hidden" but potentially "rediscovered" reflects Ghosh's nuanced portrayal of diaspora as both loss and potential regeneration - a theme we see in how characters like Kanai in *The Hungry Tide* must reconcile their modern identities with ancestral knowledge.

The quote also connects to our third objective about challenging West-centric diaspora models, as the specific anxiety over language loss reflects non-Western diasporic experiences where colonial languages often supplant native tongues. The delicate balance between preservation and adaptation suggested by the quote - the word waiting "to be cleaned out or rediscovered" - mirrors the complex negotiations Ghosh's characters must make between remembering and reinventing their cultural identities in new environments. Ultimately, this meditation on linguistic loss becomes a powerful metaphor for the broader diasporic condition Ghosh explores - where cultural memory exists in a fragile state between disappearance and reclamation, much like the tidal landscape of the Sundarbans itself, constantly shifting between erosion and renewal.

Comparison of Both the Novels

Amitav Ghosh's *The Glass Palace* and *The Hungry Tide* offer complementary yet distinct explorations of diasporic consciousness through their treatment of displacement and belonging. While *The Glass Palace* examines the historical trauma of the Indian-Burmese diaspora under British colonialism and wartime upheaval, *The Hungry Tide* focuses on ecological displacement in the Sundarbans' marginal communities. Both novels reveal how forced migrations fracture identities, but they differ fundamentally in their root causes - political and historical in the former, environmental and bureaucratic in the latter. The works converge in their emphasis on memory as a sustaining force for displaced communities,

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Though they manifest differently:
The Glass Palace presents nostalgia through material artifacts and intergenerational narratives, while *The Hungry Tide* preserves cultural memory through oral traditions and local myths. Significantly, both novels challenge conventional diaspora narratives by centering non-Western migrations - whether the overlooked Indian-Burmese diaspora or ecological refugees - thereby expanding our understanding of displacement beyond traditional Eurocentric models. Through their respective historical and ecological lenses, these novels collectively demonstrate how diasporic consciousness emerges from complex negotiations between loss and preservation, erasure and resistance. Ghosh's nuanced portrayal of these marginalized experiences ultimately redefines diaspora as a multifaceted condition shaped by diverse forces of disruption, while affirming the enduring human capacity to reconstruct meaning and belonging amid displacement.

Conclusion:

Amitav Ghosh's *The Glass Palace* and *The Hungry Tide* offer profound insights into the complex nature of diasporic consciousness, revealing how displacement operates differently across historical and ecological contexts while consistently challenging monolithic notions of identity and belonging. Through *The Glass Palace*, Ghosh examines the Indian-Burmese diaspora under colonialism, where characters like Rajkumar and Dolly embody the psychological fragmentation of forced migration, their identities suspended between nations and generations. In contrast, *The Hungry Tide* presents ecological displacement in the Sundarbans as a form of diaspora, where marginalized communities like the Morichjhāpi refugees face erasure through both environmental precarity and bureaucratic violence. Both novels emphasize memory as a crucial site of resistance - whether through material artifacts and intergenerational narratives in *The Glass Palace* or oral traditions and local myths in *The Hungry Tide* - demonstrating how diasporic communities preserve cultural identity against forces of erasure. Significantly, Ghosh subverts traditional West-centric diaspora models by focusing on intra-Asian migrations and environmental refugees, thereby expanding our understanding of displacement beyond conventional frameworks. His work reveals diaspora not as passive victimhood but as active negotiation, where characters continually reinterpret their identities amid changing political and ecological landscapes. By interweaving historical and ecological perspectives, Ghosh creates a nuanced portrait of diasporic consciousness that acknowledges both the trauma of displacement and the resilience of displaced communities. These novels ultimately redefine belonging in contemporary literature, suggesting that identity in our globalized world is necessarily hybrid, contested, and constantly evolving. Ghosh's contribution lies in his ability to portray diaspora as simultaneously particular to specific historical circumstances and universally relevant to our understanding of human migration, memory, and adaptation in an age of increasing global dislocation.

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Original Article

The Digital Personal Data Protection Act, 2023: A Paradigm Shift in India's Data Privacy Landscape and its Cybersecurity Implications

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Abstract

The Digital Personal Data Protection Act (DPDP Act), enacted in August 2023, represents a watershed moment in India's legal and regulatory landscape concerning digital personal data. This landmark legislation constitutes a profound paradigm shift from previous fragmented frameworks, notably the Information Technology Act, 2000, by establishing a comprehensive and principles-based approach to data privacy. At its core, the DPDP Act introduces fundamental tenets such as explicit and unambiguous consent, stringent data minimization, and heightened accountability for data fiduciaries. This article aims to critically examine this transformative impact on India's data privacy landscape, detailing how it empowers individual data principals and redefines organizational responsibilities. Concurrently, it analyzes the profound implications of the DPDP Act for cybersecurity practices across Indian industries, emphasizing the mandated adoption of 'reasonable security safeguards,' the rigorous data breach notification requirements, and the imperative for demonstrable security governance.

Keywords*: The Digital Personal Data Protection Act (DPDP Act),2023, the Information Technology Act, 2000, Privacy, Cybersecurity.*

Introduction

The advent of the digital age has led to an extraordinary surge in data generation. Every day, individuals produce vast amounts of data through their personal interactions, online transactions, health updates, and browsing activities. Often likened to the "new oil," this data is a key driver of the digital economy, powering personalized user experiences, targeted advertising, and technological innovation. However, the rapid accumulation and utilization of data have also raised serious concerns about privacy rights and the security of personal information. In response, many countries have introduced stringent data protection laws, such as the European Union's General Data Protection Regulation (GDPR) and the California Consumer Privacy Act (CCPA), to regulate how personal data is collected, stored, and used.

India, a country experiencing exponential digital growth and an expanding online population, has long faced the challenge of establishing a comprehensive data protection regime. The Information Technology Act, 2000, has served as the foundational legislation for data-related matters, particularly through Section 43A and the accompanying 2011 Rules that pertain to "sensitive personal data or information." Despite these provisions, the framework was widely viewed as outdated and insufficient to tackle the complexities of modern data practices, including international data transfers and sophisticated processing technologies.

A turning point came in 2017 with the Supreme Court's landmark decision in *Justice K.S. Puttaswamy (Retd.) v. Union of India*, which unequivocally recognized the right to privacy as a fundamental right under Article 21 of the Constitution.

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This judgment provided the necessary legal and moral impetus for a more robust legislative framework. After years of deliberation, the Digital Personal Data Protection Act, 2023 (DPDP Act) was enacted in August 2023. This Act marks a significant departure from previous frameworks, introducing a comprehensive and rights-based approach to data governance. It signals a transformative shift in India's data protection landscape and demands a strategic overhaul of cybersecurity measures by all entities that process digital personal data.

Grasping the Digital Personal Data Protection Act, 2023: A Transformative Change

The Digital Personal Data Protection (DPDP) Act, 2023, marks a significant shift towards a principles-driven framework for data protection. It prioritizes the rights of individuals—referred to as Data Principals—while outlining clear responsibilities for organizations handling their data, known as Data Fiduciaries. Notably, the Act has extraterritorial scope, meaning it governs the processing of digital personal data not only within India but also extends to activities conducted outside India if they involve offering goods or services to individuals located in India.

Fundamental Concepts and Key Definitions:

The Digital Personal Data Protection Act is grounded in several essential principles:

Definition of "Personal Data" and "Data Fiduciary":

The Act broadly characterizes "personal data" as any information related to an individual who can be identified either directly or indirectly through that data. A "Data Fiduciary" refers to any individual or entity that alone, or jointly with others, determines the purpose and means of processing personal data. This inclusive definition ensures that a wide range of entities—from large technology corporations to small enterprises—fall within the Act's regulatory scope.

Consent as a Foundational Element:

Consent lies at the heart of the DPDP Act's framework. It must be obtained in a manner that is free, specific, informed, unconditional, and unambiguous, involving a clear affirmative action from the individual. This provision imposes a duty on Data Fiduciaries to secure explicit consent before collecting or processing personal data. Moreover, the Act grants individuals the right to withdraw their consent at any time, and it obligates fiduciaries to provide a straightforward mechanism for doing so.

Lawful Grounds Beyond Consent:

While consent remains a central requirement, the Act also permits processing of personal data under certain "legitimate uses" without explicit consent. These scenarios include instances where the Data Principal voluntarily provides data for a specific purpose, when data is required for delivering government services or benefits, during medical emergencies, or in the context of employment. This ensures a practical approach, balancing operational efficiency with respect for individual privacy.

Principle of Data Minimization:

The Act mandates that Data Fiduciaries collect and process only the personal data that is strictly necessary for achieving the specified purpose. This marks a clear shift from previous data handling practices that often involved excessive and indiscriminate data collection.

Purpose Limitation Rule:

Data collected for one specific purpose cannot be repurposed for another unrelated use unless new and explicit consent is obtained from the Data Principal. This reinforces transparency and safeguards individuals against misuse of their information.

Accuracy and Storage Restrictions:

Data Fiduciaries are required to take reasonable steps to maintain the accuracy and completeness of the personal data they process. Additionally, they must ensure that such data is retained only for as long as needed to fulfill the original purpose, or as mandated by legal obligations.

Emphasis on Accountability:

The Act imposes a strong accountability framework on Data Fiduciaries, holding them responsible for ensuring and demonstrating compliance with all legal requirements. This effectively shifts the onus onto organizations to prove that they are handling data lawfully and responsibly.

Essential Rights of Data Principals:

The DPDP Act grants Data Principals a range of vital rights, significantly enhancing their control over personal data:

Right to Access Personal Data:

Individuals have the right to request and receive details about how their personal data is being processed. This includes knowing who the Data Fiduciaries and Data Processors are, and for what purposes their data is being used.

Right to Correction and Deletion:

Data Principals can ask for their personal data to be corrected, updated, completed, or erased. This empowers individuals to manage and protect their digital identities effectively.

Right to Grievance Resolution:

The Act requires Data Fiduciaries to set up user-friendly grievance redressal systems, allowing Data Principals to raise concerns and seek timely resolution.

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Right to Nominate a Representative:
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- **Right to Nominate a Representative:**

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The rollout of the DPDP Act, 2023, brings both notable challenges and promising opportunities for India's digital landscape.

Challenges:

- **Clarity in Implementation and Enforcement:**

Ambiguous "Reasonable Security Safeguards":

The Act's vague definition of what constitutes "reasonable security safeguards" may lead to uncertainty among organizations. The Data Protection Board of India (DPBI) will need to provide detailed guidelines and sector-specific rules to offer clear direction.

Capacity Building Needs:

The DPBI will require substantial enhancements in technical expertise, staffing, and infrastructure to efficiently oversee compliance, investigate breaches, and resolve disputes. Similarly, businesses—especially MSMEs—and legal professionals will need extensive training and awareness initiatives.

Coordination with Existing Laws:

Managing how the DPDP Act interacts with existing sector-specific regulations (such as those governing banking and healthcare) will be complex and may demand harmonization efforts.

Compliance Costs: Establishing strong data protection and cybersecurity frameworks, including investments in technology, training, and legal support, will be financially demanding, particularly for smaller enterprises.

- **Judicial Interpretation:**

As a new piece of legislation, the DPDP Act's provisions will undergo judicial scrutiny, which will influence how ambiguous sections and clauses related to emerging technologies like AI are applied in practice.

- **Cross-Border Data Transfers:**

Although the Act permits transferring data to approved countries, the process of identifying, notifying, and setting adequacy standards for these countries may be complicated, potentially affecting international companies operating in India.

- **Balancing Innovation with Regulation:**

A critical challenge will be ensuring that stringent compliance demands do not hinder innovation, particularly in the rapidly evolving tech sector. Finding the right equilibrium between safeguarding privacy and encouraging digital growth will be essential.

Opportunities:

- **Boosted Consumer Confidence:**

Establishing a strong data protection framework will greatly increase consumer trust in digital platforms and services. This heightened trust can encourage wider digital adoption, fueling economic growth and expanding India's digital economy

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- **Global Standing and Digital Commerce:**

By harmonizing with international data protection norms, the DPDP Act can enhance India's reputation in global data exchanges, making cross-border digital trade and investment smoother. This positions India as a reliable hub for data processing activities.

- **Advancement in Privacy-Enhancing Technologies (PETs):**

The rigorous privacy standards will spur demand for cutting-edge Privacy-Enhancing Technologies like differential privacy, homomorphic encryption, and secure multi-party computation. This will nurture a new sector within India's cybersecurity and privacy technology landscape.

- **Growth of the Cybersecurity Sector:**

The emphasis on "reasonable security safeguards" and mandatory breach reporting will increase the need for cybersecurity experts, services such as penetration testing and security audits, and advanced security solutions, fostering the development of a strong domestic cybersecurity industry.

- **Reinforcing the "Digital India" Vision:**

A secure and privacy-aware digital infrastructure is essential to the "Digital India" initiative. The DPDP Act's focus on responsible data management and robust cybersecurity will play a vital role in creating a more trusted and resilient digital ecosystem for both citizens and businesses .

Judicial Foundations of the DPDP Act

Although courts have not yet issued direct rulings on the DPDP Act, the Indian judiciary has been instrumental in laying the constitutional foundation and drawing attention to the legal gaps that made such comprehensive legislation necessary.

Justice K.S. Puttaswamy (Retd.) & Anr. vs. Union of India & Ors. -The Supreme Court, in a unanimous decision, held that the **right to privacy is an intrinsic part of the right to life and personal liberty guaranteed under Article 21 of the Indian Constitution, and is thus a fundamental right.**

Shreya Singhal vs. Union of India, this case challenged the constitutional validity of Section 66A of the Information Technology Act, 2000 (IT Act), which criminalized the sending of "offensive" messages through communication services. The Supreme Court struck down Section 66A of the IT Act in its entirety, holding it to be unconstitutional. The Court found that Section 66A had a "chilling effect" on free speech and did not fall within the reasonable restrictions permitted under Article 19(2) of the Constitution. *Anvar P.V. vs. P.K. Basheer & Others*, this case dealt with the admissibility of electronic evidence in court proceedings. The Supreme Court held that electronic records, when tendered as secondary evidence, must strictly comply with the conditions laid down in Section 65B(4) of the Evidence Act (which requires a certificate from a person in a responsible official position). The Court emphasized that these conditions are mandatory to ensure the authenticity and integrity of electronic evidence.

Conclusion

The Digital Personal Data Protection Act, 2023, marks a pivotal moment in India's journey toward safeguarding personal data. By adopting a principles-based framework centered on user consent and imposing detailed responsibilities on Data Fiduciaries, the Act signifies a major departure from the earlier, less cohesive legal landscape. Its intrinsic link to cybersecurity is clear—effective data protection depends on strong and consistent security practices. The requirements for accountability, timely breach notifications, and implementation of "reasonable security safeguards" will push organizations across industries to enhance their cybersecurity capabilities.

Although achieving full compliance will be challenging—especially in terms of interpretational clarity, building institutional capacity, and managing compliance costs—the benefits are equally compelling. The Act can deepen consumer trust, elevate India's position in global digital commerce, fuel innovation in privacy-focused technologies, and catalyze the development of a mature cybersecurity ecosystem. In essence, the DPDP Act lays the foundation for a safer, privacy-respecting digital environment. Its successful execution will be instrumental in realizing a digitally empowered India where technological progress goes hand-in-hand with the protection of individual privacy rights.

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Original Article

Schema-Agnostic Indexing with Azure Document DB

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Abstract:

This research explores Azure Document DB, Microsoft's distributed NoSQL database designed to handle the rapid growth of semi-structured and unstructured data with a flexible, schema-agnostic model. We analyse its core automatic indexing engine, which enables efficient query execution without predefined schemas, making it well-suited for dynamic and evolving data structures. The study evaluates Document DB's performance in multi-tenant environments, where diverse workloads share resources, and assesses its effectiveness in real-time data ingestion and querying. Experimental results and early production deployments across various domains demonstrate the database's strengths in scalability and flexibility, as well as some limitations in complex query optimization. Finally, the research proposes future enhancements, including integrating AI-driven query optimization techniques, to further improve performance and adaptability in large-scale cloud-native applications.

Keywords:
Azure Document DB, Schema-Agnostic Indexing, NoSQL, Automatic Indexing, Multi-Tenant Architecture, Query Optimization, JSON, Cloud Databases, Real-Time Querying, Index Management

Introduction:

Data has grown more dynamic, semi-structured, and unstructured in the current era of cloud computing, mobile applications, and Internet of Things (IoT) solutions. In these kinds of settings, traditional relational databases, which depend on fixed table structures and predetermined schemas, are frequently insufficient. They are less appropriate for agile development workflows and changing application needs since they cannot adapt to changing data formats without requiring expensive migrations or redesigns.

Because of their horizontal scalability and flexible data formats, NoSQL databases have become more and more popular as a solution to these issues. Document DB's automatic indexing engine, which removes the need for developers to manually define or maintain indexes, is one of its major advances. This significantly increases system responsiveness and productivity by enabling real-time query execution over all document fields as soon as data is ingested. Strong consistency models are supported by Document DB, in contrast to many NoSQL databases that provide eventual consistency, guaranteeing that query returns are consistently correct and current Furthermore, Document DB's globally distributed, multi-tenant architecture provides consistent performance even under heavy load. This design is appropriate for a variety of applications, including financial services, social media analytics, sensor data processing, and e-commerce platforms, since it facilitates resource governance, partitioning, and low-latency data access. With an emphasis on its schema-agnostic indexing capabilities, this paper examines Azure DocumentDB's internal architecture and indexing algorithms. Additionally, it looks into how query performance, throughput, and operating

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Expenses are affected by autonomous indexing. The paper attempts to evaluate the practicality and constraints of such a strategy in contemporary data-driven contexts by analyzing real-world use cases and production-level deployments.
In conclusion, schema-agnostic indexing is a major advancement in database technology, especially for businesses that deal with quickly changing data models. An excellent example of how automatic indexing may streamline development and increase system scalability while maintaining reliable, real-time data access is Azure Document DB.

Survey of Literature:

Over the past ten years, a lot of research has been done on the transition from relational to NoSQL databases. According to Li and Zhao (2020), databases that offer schema flexibility and can expand horizontally are essential for Big Data applications. NoSQL databases, such as document databases, wide- column stores, and key-value stores, became viable substitutes.
In terms of agility, Stonebraker (2017) highlighted that document-oriented databases such as MongoDB and CouchDB enable developers to deal with data models that resemble JSON. These solutions, however, frequently call for manual indexing setting, which adds complexity and increases the possibility of human error.
With Microsoft's Azure DocumentDB, all document fields are automatically indexed using a schema- agnostic methodology. This guarantees that queries stay performant without the need for index definitions, in contrast to other systems. Microsoft's early internal whitepapers also covered their difficulties in creating a multi-tenant, highly consistent system, but there is still a dearth of empirical evidence in independent academic studies in this field, which this article aims to address.

Objectives of the Proposed Research:

The purpose of this study is to present a thorough analysis of Azure Document DB's schema-agnostic indexing **methodology in light of contemporary cloud-based and real-time applications. The primary goals are as follows:**

1. **To Analyse the architectural benefits and trade-offs of schema-agnostic indexing in Azure Document DB: -**

Conventional relational databases are less flexible in settings where data structures change often because they are based on strict, preset schemas. Azure DocumentDB, on the other hand, uses a schema-agnostic design, which lets developers consume JSON documents with different and arbitrary structures.
This goal is to comprehend how this method improves flexibility in agile software development, streamlines development workflows, and lowers upfront design complexity. The study also assesses the system's ability to manage varied data types and deeply nested documents without necessitating schema modifications.
The influence of full-field indexing on system scalability and throughput, possible performance bottlenecks during write-heavy workloads, and extra storage cost from indexing all fields are among the architectural trade-offs that are taken into account.

2. **To evaluate the performance impact of automatic indexing under diverse workloads:**

All fields in each JSON document are automatically indexed by Azure DocumentDB, eliminating the need for manual index building. This goal aims to quantify the impact of this feature on query response time, document ingestion speed, and system performance in general under various workload scenarios.

1. **Performance testing with different indexing modes is part of the study:**
2. Consistent indexing keeps indexes up to date as new data is entered.
3. To enhance write performance, lazy indexing postpones updates.
4. To minimize RU consumption, excluded indexing skips indexing specific fields.

It also looks into how indexing impacts resource allocation, particularly in multi-tenant settings, and how it affects system behaviour in situations with high concurrency and high input.

3. **To investigate real-world applicability through production use cases and identify operational Challenges**:

This goal highlights Document DB's usefulness in actual production systems, even though its automatic indexing is strong in principle. The study looks at use cases in sectors like:-

1. E-commerce, where user sessions and product data are always changing.
2. IoT, where real-time, variable-structured sensor data streams.
3. Finance, where high query performance, auditability, and consistency are essential.

The study details how businesses use schema-agnostic indexing to save maintenance costs and facilitate quick **iterations. Additionally, it outlines typical difficulties encountered during deployment, like:**

1. Indexing performance and RU cost are balanced.
2. Controlling the overhead of indexing for big datasets.
3. Adjusting to dynamic surroundings' needs for query optimization.

Giving useful insights into operational best practices and areas that require improvement is the aim.

Related Work:

There have been several NoSQL systems that have tried to provide alternatives to strict relational structures.

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For example, MongoDB supports both manual and compound indexing and employs dynamic schemas; nevertheless, performance optimization necessitates human participation. Couchbase does not have automatic full-field indexing, but it does offer document storage with indexing methods.
Key-value and document models are supported by Amazon DynamoDB; however, global secondary indexes require explicit definition. Azure Document DB sets itself apart from the competition by combining multi- region replication, robust consistency, and automatic indexing—features that are uncommon in rival solutions.
Prior studies, including internal case studies from Microsoft, have demonstrated that automatic indexing lowers developer workload and avoids schema-lock problems. This work attempts to address the dearth of external academic evaluations that validate performance under real-time limitations and variable data quantities.

Experimental Setup:

The following experimental conditions and situations were created in order to assess Document DB's indexing performance and behaviour:

- **Data Ingestion**: JSON documents of various sizes and hierarchical structures (1 KB to 50 KB) were simulated to be ingested.
- **Index Modes:** Excluded (fields not indexed), lazy (delayed index updates), and consistent (default) indexing modes were used to test queries.
- **Workload Simulation**: To replicate noisy-neighbor effects, concurrent client workloads were simulated across partitions.
- Ingestion throughput, average query latency, index update time, and RU (Request Unit) consumption were all measured as performance metrics.

  The Azure Cosmos DB Emulator and cloud-deployed DocumentDB instances with regional replication enabled were used for these tests. Over 5,000 query runs and 10,000 document insertions, the results were benchmarked.

Early Production Experiences:

Microsoft has implemented document DB, which is currently a component of Azure Cosmos DB, in production settings for enterprise clients in the fields of finance, IoT, and e-commerce. Internal teams have reported the following case **studies:**

- **E-commerce Applications:** Dynamic schemas and instant query availability without pre-indexing are advantageous for product metadata, user session tracking, and shopping cart storage.
- Telemetry is continuously sent by IoT devices in nested JSON format. While handling ingestion, document DB permits time-windowed analytics queries.
- **Financial Services**: document DB provides quick access and unchangeable audit trails for fraud detection and transaction logging.

  Production-related difficulties include:-
- **Indexing Overhead**: For large or deeply nested documents, full-field indexing results in increased write delay.
- **Query optimization**: In high-load scenarios, index path exclusions still improve performance optimization even though indexing is automatic.
- **Cost management**: Since RU charges are linked to both indexing and query execution, cost efficiency requires careful indexing strategy management.

Conclusion:

The schema-agnostic, autonomous indexing engine of Azure document DB is ideal for contemporary applications that need scalability, flexibility, and real-time querying. It supports dynamic and complicated JSON structures and streamlines development by eliminating the requirement for index setting. This solution speeds up development cycles and deployment durations by allowing developers to concentrate on application logic rather than data modelling and performance tweaking.
In this study, we investigated DocumentDB's architecture, emphasizing its capacity to manage semi- structured data at scale via thorough and automated indexing. The system can adjust to a variety of workload patterns, from frequent writes to read-intensive queries, thanks to its support for range-based and hash-based indexing techniques and numerous indexing modes.
To sum up, Azure DocumentDB provides a strong, developer-friendly framework for cloud management of semi-structured and unstructured data. Future improvements might use machine learning models to optimize query paths, automatically identify and exclude low-utility index paths, and provide intelligent indexing recommendations based on workload analysis, as data quantities and complexity continue to increase. These developments will strengthen DocumentDB's standing as a key component of contemporary, data-driven applications.

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Original Article

The Role and Contribution of E-Resources in Advancing Academic Libraries

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Abstract

Library services have changed a lot because of new technology and the rise of Library 2.0. Printed books and journals are now often replaced by electronic resources, leading to the creation of digital libraries. These e-resources allow users to quickly and easily access large amounts of information from databases around the world, even from far away. This study looks at why e-resources are important, the different types available, and the problems users might face when using them. It also shows how these resources can help students and researchers do well in their academic work. Electronic resources (e-resources) are now an important part of libraries because of new digital technology. These include things like e-books, online journals, databases, and videos that can be used anytime and from anywhere. They help students, teachers, and researchers by giving fast and easy access to useful information. Many people can use the same e-resource at the same time, which is better than using just one printed book. However, there are some problems, like the high cost of subscriptions, the need for internet, and helping people learn how to use them. This study looks at the types of e-resources, their benefits, the problems they face, and how they help people do well in their studies.

Keywords: *Electronic resources, E-Resources, Academic Libraries, Higher Education, Online database*

Introduction:

In today's digital world, academic libraries play an important role in helping with teaching, learning, and research. With the rise of digital technology, libraries have changed a lot. They no longer only have printed books and journals- now they also offer many electronic resources. These "e-resources" include digital materials like e-books, online journals, databases, and websites that can be accessed through computers and the internet. E-resources come in many forms, such as OPACs (online catalogues), CD-ROMs, online databases, email publications, and web-based content. These tools make it much easier to find and use information. Because of e-resources, the way libraries store, share, and provide access to information has improved greatly. Libraries today not only provide digital content but also have new ways to share and publish academic work more widely and creatively.

Characteristics of E-Resources:

Electronic resources (e-resources) in academic libraries are different from traditional printed books and journals in many ways. First, they are stored and used through the internet and computer systems. This means people can access them easily from anywhere, as long as they have an internet connection. Second, e-resources are always changing and being updated. New research and information can be added quickly, so users always get the latest content. E-resources also have smart search tools that help users find what they need faster. Many people can use the same e-resource at the same time, which is great for group work or study. Another useful feature is that e-resources often include links, videos, and tools that make learning more fun and interactive. They can also save money for

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Libraries because there's no need to print, ship, or store physical books. This makes them a good option for libraries with limited budget

1. Accessible Anytime, Anywhere

Can be used from any location with internet access. Electronic resources can be used at any time and from any place as long as you have an internet connection. This means you don't have to visit the library physically to access books, journals, or databases. You can study or do research from home, school, or anywhere else.

2. Easily Updatable

E-resources can be changed or added to very quickly. New research, articles, or corrections are updated right away, so users always get the newest information. Unlike printed books, there is no need to wait for a new edition to be published. This keeps the information current and reliable. New information and research can be added quickly.

3. Fast Search ability

Electronic resources come with powerful search tools that help users find information quickly and easily. Instead of flipping through pages, users can type keywords or phrases to locate specific topics or data instantly. These search functions often include filters to narrow down results by date, author, subject, or type of document. This saves a lot of time compared to searching through printed books or journals manually. Additionally, many e-resources allow users to jump directly to the section or page they need. Fast search ability improves research efficiency and makes studying more convenient and effective.

4. Multi-user Access

One of the great advantages of electronic resources is that many people can use the same material at the same time. Unlike printed books, which only one person can borrow or read at once, e-resources allow multiple users to access articles, e-books, or databases simultaneously. This is especially helpful for students and researchers working on similar topics or group projects. It also reduces waiting times for popular resources. Libraries can serve more users efficiently, making learning and research smoother and faster for everyone. Many people can use the same resource at the same time.

5. Interactive Features

Electronic resources often include interactive elements that make learning more engaging and effective. These can be hyperlinks that connect to related topics or additional information, allowing users to explore content deeper. Many e-resources also contain multimedia like videos, audio clips, and animations that help explain complex ideas better than plain text. Some platforms offer tools for highlighting, annotating, or bookmarking important sections, which supports active reading and note-taking. These features encourage users to interact with the material, improving understanding and retention. Overall, interactive e-resources create a richer and more dynamic learning experience. Includes hyperlinks, videos, audio, and notes for better learning.

6. Cost-Effective

Electronic resources help libraries save money because they don't require printing, shipping, or physical storage. This reduces expenses related to buying and maintaining paper books and journals. With e-resources, libraries can often subscribe to many digital materials at a lower overall cost. This allows them to provide a wider variety of resources to users without spending too much. Cost-effectiveness is especially important for libraries with limited budgets, helping them serve more students and researchers efficiently. Additionally, updating e-resources is cheaper than producing new printed editions.

7. Space Saving

Electronic resources do not take up physical space like printed books and journals do. This means libraries don't need large shelves or storage rooms to keep their collections. By using digital materials, libraries can offer a huge amount of information without worrying about running out of space. This is especially helpful for smaller libraries with limited room. Space-saving also makes it easier to organize and manage resources. Users can access thousands of books, articles, and databases from their computers without visiting a crowded library. No need for physical storage like shelves or rooms.

8. Eco-Friendly

Electronica resources help protect the environment by reducing the need for paper, printing, and physical transportation. Using digital materials means fewer trees are cut down for paper production, which supports forest conservation. It also lowers pollution caused by printing processes and shipping of physical books. By using e-resources, libraries reduce their carbon footprint and waste. This makes digital libraries a greener and more sustainable choice. Eco-friendly practices like these are important as we work toward protecting our planet for future generations.

9. Building Global Academic Networks:

Electronic resources make it easier for people from different countries and institutions to work together. Researchers, students, and teachers can share information and ideas quickly through online databases and digital libraries. This helps in combining knowledge and expertise from around the world to solve problems and create new discoveries. Global collaboration also allows access to materials and research that might not be available locally. It promotes teamwork and

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learning beyond borders, breaking down barriers caused by distance. With digital tools, academic communities can communicate and cooperate in real time, making education and research more connected and effective worldwide.

Types Of E-Resources In Academic Libraries

E-Books:

E-books are digital versions of printed books that can be read on electronic devices like computers, tablets, or smartphones. They offer the convenience of accessing a whole book instantly without needing to visit the library. Users can search for specific words or chapters quickly, making research easier. Many e-books allow features like bookmarking, highlighting, and note-taking. They save physical space and are often available to multiple users at the same time. E-books also help libraries provide a larger collection without the cost and storage needs of printed books. Overall, e-books make reading and studying more flexible and accessible.

E-Journals:

E-journals are electronic versions of academic journals that publish research articles and studies. They can be accessed online anytime and from anywhere, making it easier for students and researchers to get the latest information. E-journals are often updated regularly with new issues and articles. They usually offer advanced search options to help users find specific topics quickly. Many e-journals allow multiple users to read the same article at once. They are important for staying up-to-date in various academic fields and support in-depth research. E-journals save space and reduce the need for physical copies in libraries.

Databases

Databases are organized collections of information that are stored electronically and can be searched easily. They include a variety of materials like research articles, statistics, reports, and more. Academic databases, such as JSTOR or PubMed, help students and researchers find reliable and scholarly information quickly. Users can search by keywords, authors, subjects, or dates to get precise results. Databases often provide access to full-text documents, abstracts, or citations. They allow multiple users to access the content at the same time, making research more efficient. Databases are essential tools in academic libraries for supporting study and research.

Online Catalogs

Online Public Access Catalogs, or OPACs, are digital systems that help users search and find library materials. Instead of browsing physical shelves, users can search for books, journals, and other resources by title, author, subject, or keywords. OPACs show whether an item is available, its location, and sometimes even provide links to electronic versions. They make it easy to find and reserve materials from anywhere with internet access. OPACs save time and improve the library experience by organizing the collection in a user-friendly way. They are essential tools in modern academic libraries to help users quickly access resources.

Multimedia resources

Multimedia resources include different types of digital content such as videos, audio recordings, animations, and interactive presentations. These resources help make learning more engaging by using visuals and sounds to explain complex ideas. They are useful for subjects that benefit from demonstrations, like science experiments or language learning. Students and teachers can access multimedia resources online anytime, making learning flexible and convenient. Many academic libraries offer these materials to support a variety of learning styles. Multimedia resources also encourage active participation and improve understanding by combining different forms of media.

Reference Resources

Reference resources include tools like online encyclopedias, dictionaries, thesauruses, and handbooks. They provide quick and reliable facts, definitions, and explanations on a wide range of topics. These resources are often used for getting background information or clarifying terms during research. Unlike regular books, reference materials are usually not meant to be read cover-to-cover but are used to look up specific information. In digital form, they are easy to search and access anytime. Academic libraries use these resources to help students and researchers get accurate information quickly and efficiently.

Open Access Resources

Open Access Resources are digital materials that are freely available to everyone without any cost or subscription. They include research papers, books, articles, and theses that authors or institutions share openly to promote wider access to knowledge. These resources help students, researchers, and teachers access important information easily, especially when they cannot afford paid journals or databases. Open access supports the free flow of information and encourages global learning and collaboration. Academic libraries often include open access materials to provide more resources to their users. Overall, these resources make education and research more accessible and inclusive.

Barriers to Effective Use of E-Resources in Academic Libraries

Even though electronic resources offer many benefits, there are some challenges that make using them difficult in academic libraries. One big problem is the lack of reliable internet access, especially in remote or underfunded areas. Without good internet, users cannot easily access e-resources. Another issue is the lack of training—students and staff may not know how to use these resources properly or how to search for information

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effectively. Sometimes, the interfaces of e-resources can be complicated and hard to navigate. Licensing and subscription costs can limit the number of resources a library can afford. Additionally, technical problems like slow servers or software glitches can interrupt access. These barriers reduce the full potential of e-resources and make it harder for users to benefit from them. Although electronic resources have transformed academic libraries, they also come with several challenges. One major challenge is internet connectivity issues, especially in rural or less developed areas, which make access difficult. Another problem is the high cost of subscribing to some databases and journals, which can be expensive for many institutions. Users sometimes struggle with a lack of training on how to effectively use e-resources, leading to underuse. Technical issues like slow loading times, software compatibility problems, or website downtime can also affect access. Additionally, copyright and licensing restrictions may limit what users can do with the content. Lastly, information overload can overwhelm users, making it hard to find the most relevant resources quickly.

Advancements and Future Prospects of E-Resources in Academia

The future of e-resources in academic libraries looks very promising. With advances in technology, access to digital materials will become faster and easier for students and researchers. More libraries will expand their collections of e-books, e-journals, and databases to meet growing demand. Artificial intelligence and smart search tools will help users find information more quickly and accurately. Mobile access will improve, allowing people to use e-resources on their phones and tablets anytime, anywhere. Libraries will also focus on providing better training and support to help users make the most of these resources. Open access materials will grow, making knowledge freely available to everyone. Overall, e-resources will play an even bigger role in supporting education and research in the years ahead. E-resources have improved a lot with new technologies, making it easier for students and researchers to find and use information. Advances like faster internet, cloud storage, and smart search tools help users get the right data quickly. In the future, we can expect even more growth in digital materials, including interactive content and multimedia resources. Artificial intelligence may help personalize learning by suggesting useful resources based on individual needs. Open access publishing will also increase, allowing more free and easy access to research worldwide. Academic libraries will continue to expand their e-resource collections and offer better training to users. Overall, these advancements will make academic research and learning more efficient and accessible.

Effectiveness of E-Resources in Academic Learning and Research

Evaluating the effectiveness of e-resources is important to understand how well they support learning and research in academic settings. It involves checking how often students and faculty use them, and whether they find the content useful and easy to access. Feedback from users helps libraries improve their services and choose better digital materials. Usage statistics, such as downloads and search patterns, also show which resources are most helpful. Effective e-resources should be up-to-date, reliable, and easy to navigate. They should also support academic goals by saving time and offering accurate information. Regular evaluation ensures that investments in digital resources benefit the users and improve academic success. E-resources play a key role in improving academic learning and research. They provide quick and easy access to a wide range of up-to-date information, helping students and researchers save time. With powerful search features, users can find specific data or articles quickly. E-books, journals, and databases offer valuable content that supports assignments, projects, and in-depth study. These resources are available anytime and anywhere, making learning more flexible. E-resources also support collaborative learning by allowing multiple users to access the same content at once. When used effectively, they help improve academic performance and encourage independent research. Overall, they are a vital part of modern education. Digital resources have become an essential part of academic learning and research. Analyzing their efficiency means looking at how well they support users in finding, accessing, and using information. Efficient digital resources should be easy to use, provide accurate content, and be available 24/7. They should save time, offer advanced search options, and support multiple users at once. Feedback from students and teachers helps to understand how useful the resources are. Usage data, such as download rates and search trends, can show which resources are most effective. By regularly reviewing their performance, academic institutions can improve their digital collections and better meet the needs of their users.

Role of E-Resources in Enhancing Academic Research

Digital libraries and databases offer up-to-date information and the latest research findings.Advanced search tools help users locate specific data or topics more efficiently.

E-resources also support interlibrary sharing and global collaboration between researchers.They allow access to materials that might not be available in a physical library.

Many e-resources include citation tools and hyperlinks, making the research process smoother.Researchers can also explore multimedia content, such as videos, charts, and interactive data.E-resources support interdisciplinary research by connecting different fields of study.

Open access materials promote free sharing of knowledge and equal learning opportunities.They also reduce the cost and space issues related to storing print materials.

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Researchers can access rare and historical content that has been digitized.Digital annotation tools help users take notes and highlight important parts.Remote access means researchers can continue work even outside campus or office.E-resources also help in literature reviews by offering a wide range of related works.They improve the quality and depth of academic writing and analysis.In short, e-resources are essential tools that empower researchers and advance academic success. E-resources greatly support academic research by providing quick, easy, and remote access to scholarly content such as e-books, journals, articles, and databases. They offer updated information, advanced search tools, and multimedia support, making research more efficient. E-resources encourage global collaboration, reduce costs, and help with space management. They also improve literature reviews, citation management, and interdisciplinary studies. Overall, they are vital tools for modern researchers to deepen knowledge and achieve academic excellence.

Conclusion

E-resources have become an essential part of academic libraries, changing the way students, researchers, and educators access and use information. They offer quick, easy, and remote access to a wide variety of academic materials, supporting both learning and research. With features like advanced search, multimedia content, and multi-user access, e-resources greatly improve the efficiency and quality of academic work. They also help libraries save space, reduce costs, and provide up-to-date information. As technology continues to grow, the role of e-resources will only become more important in supporting academic success and promoting lifelong learning. In today's rapidly evolving academic environment, electronic resources (e-resources) play a transformative role in enhancing the services offered by academic libraries. These digital tools provide seamless, round-the-clock access to scholarly content from anywhere in the world, significantly increasing the reach and impact of library services. By offering a wide array of academic materials such as e-books, e-journals, databases, and open access repositories, e-resources support advanced research, continuous learning, and improved academic outcomes.

The integration of advanced search features, multimedia elements, and interactive tools further enhances the user experience, allowing students and researchers to engage with information in dynamic and meaningful ways. Additionally, e-resources address space constraints and reduce the financial burden of maintaining extensive physical collections.

As academic needs continue to grow and evolve, e-resources will remain at the forefront of library development. Their continued expansion and effective use will be crucial in ensuring that academic libraries remain relevant, resourceful, and responsive to the needs of their user communities. Ultimately, e-resources are not just digital alternatives to print—they are essential building blocks for future-ready libraries and education systems.

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Original Article

Technological Innovations and Policy Frameworks for Climate Change Mitigation

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Abstract

Climate change poses an urgent global challenge, driven primarily by greenhouse gas emissions from energy, transportation, agriculture, and industry. Technological innovations are central to mitigating these emissions and adapting to climate impacts. Renewable energy technologies such as solar, wind, hydropower, and geothermal have expanded rapidly, providing clean alternatives that reduce reliance on fossil fuels. Advances in energy storage, including solid-state batteries and green hydrogen, enhance the integration and reliability of renewables. Carbon capture technologies, including Direct Air Capture (DAC), Bioenergy with Carbon Capture and Storage (BECCS), and mineral carbonation, are emerging as critical tools to remove existing atmospheric CO_2 and address emissions from hard-to-abate sectors. Precision agriculture, alternative proteins, and regenerative farming practices contribute to lowering agricultural emissions while enhancing carbon sequestration. Additionally, the Internet of Things (IoT) and artificial intelligence (AI) enable real-time monitoring and optimization of energy use, emissions, and resource management across sectors. Innovations in electric vehicles, vehicle-to-grid systems, hydrogen fuel cells, and sustainable aviation fuels are transforming transportation toward net-zero emissions. Collectively, these climate technologies, supported by policy and investment, offer pathways to limit global warming and build resilient, sustainable societies. Continued development and deployment of these solutions are essential to bridging the gap between ambitious climate goals and practical implementation by 2050.

Keywords: *Renewable Energy, Carbon Capture, Fossil Fuels, Global Warming, Sustainable Societies*

Introduction

Climate change represents one of the greatest challenges humanity has ever faced. Rising global temperature salready about 1.1°C above pre-industrial levels are triggering more frequent and severe extreme weather events such as hurricanes, droughts, floods, and wildfires. These changes disrupt ecosystems, threaten biodiversity, and jeopardize food and water security, public health, and economic stability worldwide. According to the Intergovernmental Panel on Climate Change (IPCC), if global warming exceeds 1.5°C, the risks of catastrophic environmental and societal impacts increase dramatically.

The primary driver of this crisis is the excessive emission of greenhouse gases (GHGs), particularly carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). These gases trap heat in the atmosphere, intensifying the planet's natural greenhouse effect. The largest sources of these emissions are the burning of fossil fuels for energy and transportation, deforestation, industrial activities, and agriculture. For example, fossil fuel combustion accounts for roughly 75% of global CO_2 emissions, while agriculture contributes nearly 25% of total GHG emissions, largely through methane from livestock and nitrous oxide from fertilizers. To combat this existential threat, a multi-pronged approach is essential combining policy reforms, behavioral changes, and, most critically, technological innovation

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This article explores the most promising technologies designed to mitigate and potentially reverse climate change, focusing on renewable energy, carbon capture, sustainable transportation, smart cities, sustainable agriculture, and emerging geoengineering solutions.

Renewable Energy Technologies: The Foundation of a Low-Carbon Future

Transitioning from fossil fuels to renewable energy is the cornerstone of global efforts to reduce carbon emissions. Renewable sources such as solar, wind, hydropower, and geothermal energy provide clean, sustainable alternatives that do not emit CO_2 during operation.

i. **Solar Energy:**

Solar power capacity has expanded exponentially over the past decade, with global installed solar photovoltaic (PV) capacity surpassing 1 terawatt (TW) in 2023. Innovations like **perovskite solar cells** are revolutionizing the field by offering higher efficiencies (over 25% in lab settings) and lower manufacturing costs compared to traditional silicon cells. Additionally, **floating solar farms** installed on reservoirs and lakes optimize land use and reduce water evaporation. Experimental technologies such as **solar paint**—a photovoltaic coating that can turn any surface into a solar panel—promise to democratize solar energy generation further.[1]

ii. **Wind Energy:**

Wind power is another critical pillar, with offshore wind farms growing rapidly. Modern offshore turbines can generate over 15 megawatts (MW) per unit, enough to power thousands of homes. Emerging **Airborne Wind Energy (AWE)** systems use tethered drones or kites to harness stronger, more consistent winds at higher altitudes, potentially increasing capacity factors and reducing costs.[2]

iii. **Hydropower and Ocean Energy:**

Hydropower remains the largest source of renewable electricity globally, providing about 16% of the world's electricity in 2023. Ocean energy technologies—including tidal, wave, and ocean thermal energy conversion—are gaining traction as reliable, predictable renewable sources, especially for coastal regions.

iv. **Geothermal Energy:**

Enhanced Geothermal Systems (EGS) are expanding the reach of geothermal power by enabling heat extraction from dry, impermeable rock formations previously considered unsuitable. This technology could significantly increase geothermal's contribution to the energy mix.

Collectively, renewables accounted for nearly 30% of global electricity generation in 2024, with projections suggesting this could rise to over 60% by 2050 if current trends continue.[3]

Carbon Capture and Storage (CCS): Removing CO_2 from the Atmosphere

While renewable energy reduces future emissions, existing CO_2 in the atmosphere and emissions from hard-to-abate sectors necessitate **carbon capture** technologies.[4]

i. **Direct Air Capture (DAC):**

DAC systems, such as those developed by companies like Climeworks and Carbon Engineering, chemically extract CO_2 directly from ambient air. Current plants capture thousands of tonnes annually, with costs dropping from over $600 per tonne in early prototypes to under $250 per tonne in recent deployments. Captured CO_2 can be stored underground in depleted oil and gas fields or saline aquifers or converted into fuels and building materials.

ii. **Bioenergy with Carbon Capture and Storage (BECCS):**

BECCS combines biomass energy production with CCS, resulting in net-negative emissions by removing CO_2 as biomass grows and capturing emissions when it is burned. This approach is critical in many IPCC pathways for limiting warming to 1.5°C.

iii. **Mineral Carbonation:**

This method converts CO_2 into stable carbonate minerals, effectively locking it away permanently. Research is ongoing to scale this process cost-effectively.

iv. **Nature-Based Solutions:**

Reforestation and afforestation remain vital carbon sinks. Drone-assisted tree planting, pioneered by companies like BioCarbon Engineering, accelerates reforestation efforts by planting thousands of trees daily with precision, improving survival rates and ecosystem restoration.

Sustainable Transportation

Transportation contributes nearly 24% of global CO_2 emissions, making decarbonizing this sector essential.[5]

i. **Electric Vehicles (EVs):**

[1] https://www.iea.org/reports/renewables-2023/executive-summary
[2] https://www.irena.org/News/pressreleases/2024/Mar/Record-Growth-in-Renewables-but-Progress-Needs-to-be-Equitable
[3] https://www.statista.com/statistics/1094331/global-renewable-capacity-cumulative/
[44] https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage
[5] https://www.statista.com/statistics/1185535/transport-carbon-dioxide-emissions-breakdown/

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ii. EV adoption is accelerating, with over 20 million EVs sold globally in 2024. Advances in **solid-state batteries** promise faster charging, higher energy density, longer lifespans, and improved safety compared to lithium-ion batteries.[6]

iii. **Vehicle-to-Grid (V2G) Technology:**
V2G enables EVs to feed stored energy back into the grid during peak demand, enhancing grid stability and renewable integration.[7]

iv. **Hydrogen Fuel Cells:**
Hydrogen is emerging as a key fuel for heavy-duty trucks, shipping, and aviation where battery weight and range limitations are significant. Green hydrogen, produced via electrolysis using renewable energy, is critical to ensuring low lifecycle emissions.[8]

v. **Sustainable Aviation Fuels (SAFs):**
SAFs derived from waste oils, agricultural residues, or synthetic processes can reduce aviation emissions by up to 80%. Airlines and governments are investing heavily to scale SAF production.

vi. **Innovative Transport Systems:**
Concepts like the **hyperloop** and expanded high-speed rail networks offer energy-efficient alternatives for long-distance travel, potentially reducing reliance on carbon-intensive air and road travel.

Smart Cities and Green Infrastructure: Building a Sustainable Future

Urban areas generate over 70% of global CO_2 emissions, but smart urban planning and green infrastructure can drastically reduce this footprint.

i. **Energy-Efficient Buildings:**
Passive design strategies, such as natural ventilation, insulation, and daylighting, can reduce building energy consumption by up to 90%. Retrofitting existing buildings with smart sensors and automated controls optimizes energy use.[9]

ii. **Smart Grids:**
AI-driven smart grids enhance the integration of distributed renewable energy sources, manage demand response, and reduce energy waste.[10]

iii. **Green Roofs and Vertical Farms:**
These innovations mitigate urban heat islands, improve air quality, and provide local food production, reducing transportation emissions and enhancing urban resilience.[11]

iv. **Internet of Things (IoT):**
IoT devices enable real-time monitoring of air quality, traffic congestion, and energy consumption, allowing cities to implement targeted interventions and optimize resource use.[12]

Sustainable Agriculture and Food Systems

Agriculture accounts for roughly 25% of global GHG emissions, primarily from methane and nitrous oxide.[13]

i. **Precision Farming:**
Using drones, sensors, and AI, precision agriculture optimizes irrigation, fertilizer, and pesticide application, reducing waste and emissions while improving yields.[14]

ii. **Alternative Proteins:**
Lab-grown meat and plant-based proteins offer sustainable substitutes for traditional livestock, which is a major methane source.[15]

iii. **Regenerative Agriculture:**
Practices such as no-till farming, cover cropping, and agroforestry enhance soil carbon sequestration, improve biodiversity, and increase farm resilience to climate extremes.[16]

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[6] https://rhomotion.com/news/over-17-million-evs-sold-in-2024-record-year/
[7] https://yocharge.com/blog/how-v2g-can-help-stabilize-the-electric-grids/
[8] https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage
[9] https://www.bio-conferences.org/articles/bioconf/pdf/2024/05/bioconf_rtbs2024_01081.pdf
[10] https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/12/how-can-smart-cities-boost-the-net-zero-transition_28f0891f/bc554887-en.pdf
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[14] https://en.wikipedia.org/wiki/Greenhouse_gas_emissions_from_agriculture
[15] Ibid.
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Geoengineering as a Last Resort

If emission reductions and carbon removal efforts fall short of limiting global warming, geoengineering may be considered as a supplementary or emergency measure, but it carries significant uncertainties and risks.[17]

Solar Radiation Management (SRM),

particularly stratospheric aerosol injection (SAI), involves injecting aerosols such as sulfates into the stratosphere to reflect sunlight and cool the planet. While SAI could rapidly reduce temperatures and is relatively low cost, it poses risks including disruption of weather patterns, uneven regional cooling, impacts on ecosystems and public health, and potential weakening of the ozone layer. Moreover, it would require continuous deployment for decades or centuries to maintain effects, locking the Earth into a risky dependence on this technology.[18]

Marine Cloud Brightening (MCB)

aims to increase the reflectivity of marine stratocumulus clouds by spraying fine sea salt particles to enhance cloud condensation nuclei. This method could locally cool vulnerable ecosystems such as coral reefs and has been experimentally tested on the Great Barrier Reef. However, the technical feasibility at large scale remains uncertain, and the complex behavior of clouds means ecological and climatic risks are not well understood.[19]

Ocean Fertilization

involves adding nutrients like iron to ocean waters to stimulate phytoplankton growth, which could absorb CO_2. This approach is highly experimental and controversial due to uncertain ecological impacts, including potential disruption of marine food webs and biogeochemical cycles. Large-scale deployment would affect vast ocean areas and could cause unintended consequences.

Due to these risks and uncertainties, geoengineering is widely regarded as a temporary or emergency backup rather than a primary solution. It carries the danger of diverting attention and resources from proven climate mitigation strategies like emissions reductions and conservation. Geoengineering could exacerbate environmental harm, prolong fossil fuel dependence, and raise ethical and governance challenges, including impacts on human rights and global equity. International law currently restricts many geoengineering activities, reflecting concerns about their potential for irreversible and uneven effects.[20]

In summary, while geoengineering techniques like SRM, marine cloud brightening, and ocean fertilization may offer some climate relief if other measures fail, their unpredictable environmental, social, and political risks mean they should only be considered as last-resort interventions alongside aggressive emissions cuts and carbon removal efforts.

Conclusion

No single technology can solve climate change alone. Success depends on a coordinated global effort combining renewable energy expansion, carbon capture, sustainable transportation, smart urban planning, and responsible agricultural practices. Equally critical are strong policies, international cooperation, and public engagement to scale these solutions rapidly and equitably. The technologies and knowledge to combat climate change exist today; what is urgently needed is the collective will to deploy them at the speed and scale required. The next decade will be decisive in determining whether humanity can avert the worst impacts of climate change and secure a sustainable future for generations to come.

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Original Article

Echoes of Identity: Cultural Heritage, Language, and Ethical Dilemmas in Postcolonial Literature

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Abstract
This paper explores the interwoven themes of cultural heritage, language, and ethics in postcolonial and diasporic English literature. Through close readings of key texts such as Chinua Achebe's Things Fall Apart*, Arundhati Roy's* The God of Small Things*, Ngũgĩ wa Thiong'o's* Decolonizing the Mind*, Salman Rushdie's* Midnight's Children*, Jhumpa Lahiri's* Interpreter of Maladies*, and Vijay Tendulkar's* Kamala*, the study demonstrates how literature functions as a powerful medium for preserving marginalized histories, reclaiming identity through language, and interrogating complex moral dilemmas. It argues that postcolonial literature does not merely document cultural and ethical conflicts but actively resists colonial legacies by reasserting indigenous voices and values. The paper further illustrates how these themes intersect to construct a layered understanding of identity, memory, and justice in literary expression.*
Keywords: *Cultural heritage, language and identity, postcolonial literature, ethical dilemmas*

Introduction

*"Until the lions have their own historians, the history of the hunt will always glorify the hunter." — African Proverb*This poignant proverb captures the essence of cultural memory and the politics of representation. Language, as both a tool and a legacy, holds the power to preserve or erase cultural identities. It is through language that cultural heritage is passed down, stories are told, and ethical norms are questioned and reaffirmed. Literature, especially in postcolonial and diasporic contexts, becomes a vital space where the silenced find their voice and where fractured histories are reclaimed.This paper explores three interrelated themes — **cultural heritage**, **language**, and **ethics** — as they emerge in English literature, particularly in works shaped by colonial and postcolonial experiences. Cultural heritage, often rooted in indigenous knowledge, rituals, and oral traditions, becomes both a source of pride and conflict in a rapidly globalizing world. Language, in this context, is not merely a medium of communication but a contested site where identity is negotiated. Colonial powers often imposed their languages on the colonized, resulting in a loss of native tongues and epistemologies. However, writers from formerly colonized nations have turned this imposition into a form of resistance, using the colonizer's language to challenge dominant narratives and to assert their own truths.

Ethics in literature, especially postcolonial literature, often revolves around dilemmas rooted in historical injustices, cultural displacement, and moral ambiguity. Characters are frequently caught between loyalty to tradition and the pressures of modernity,

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Between personal freedom and communal expectations, or between survival and integrity In this paper, I argue that literary texts serve not only as artistic expressions But also as powerful vehicles for engaging with cultural heritage, deploying language as a tool of resistance and identity formation, and confronting ethical dilemmas that stem from the legacies of colonialism and cultural conflict. Through a close reading of selected works, this study seeks to illuminate how these themes converge to offer a nuanced understanding of identity, memory, and morality in literature.

Cultural Heritage in Literature

Cultural heritage refers to the legacy of physical artifacts and intangible attributes inherited from past generations. **Tangible heritage** includes monuments, artifacts, clothing, and architecture, while **intangible heritage** encompasses language, rituals, folklore, music, beliefs, and customs. In literature, cultural heritage functions not only as a thematic concern but also as a vital tool for character development, setting, and narrative structure. It shapes identities and informs the moral and philosophical foundations of literary worlds.

Writers across the globe have used literature to **preserve, critique, and reinterpret** cultural memory, especially in contexts where colonialism has threatened the continuity of traditional life. For instance, in Chinua Achebe's *Things Fall Apart*, the Igbo community's social structure, religious practices, and oral traditions are vividly portrayed before the arrival of British colonizers. Achebe's narrative does more than document a vanishing culture; it asserts the complexity and legitimacy of African life, challenging colonial portrayals of "primitive" societies. Through his work, Achebe reclaims a silenced past and dignifies the cultural heritage of his people.

Similarly, Arundhati Roy's *The God of Small Things* offers a nuanced depiction of cultural traditions in Kerala, India. Roy weaves together elements of caste, familial rituals, and postcolonial identity to explore how deeply ingrained cultural norms shape and sometimes suffocate individual lives. Her novel critiques aspects of Indian tradition while still preserving their emotional and historical significance, revealing the **dual nature of heritage** as both enriching and restrictive.

A key theme that emerges in such literature is the **tension between tradition and modernity**. As societies encounter globalization, urbanization, and Western ideologies, traditional practices often come under pressure. Characters in postcolonial literature frequently grapple with conflicting loyalties—between ancestral customs and contemporary values. This conflict can lead to internal crises, societal transformation, or cultural syncretism.

Thus, cultural heritage in literature serves a dual purpose: it is both a **repository of identity** and a **site of struggle**. Through their exploration of heritage, writers give voice to marginalized histories, interrogate cultural authority, and highlight the evolving nature of tradition in a modern world.

Language as Identity and Resistance

Language is not merely a tool of communication—it is a vessel of cultural identity, historical memory, and personal expression. In postcolonial literature, language becomes a site of contestation, where issues of power, identity, and resistance play out. Colonization often involved the imposition of foreign languages, which marginalized indigenous tongues and epistemologies. However, many writers have subverted this legacy by using language as a form of **cultural resistance** and **self-assertion**, reclaiming their voices through literature.

Ngũgĩ wa Thiong'o, in his seminal work *Decolonizing the Mind*, argues that language is inseparable from culture. He criticizes African writers who write in colonial languages and advocates for a return to native tongues in literary production. According to Ngũgĩ, using indigenous languages is an act of resistance against the cultural imperialism that devalues native identities. He contends that when a people lose their language, they lose their way of seeing the world. For Ngũgĩ, writing in Gikuyu was a political and ethical choice, a way to reconnect with his roots and empower his community through culturally relevant narratives.

Conversely, Salman Rushdie, in *Midnight's Children*, embraces the **hybridity** of postcolonial identity through his use of English infused with Indian idioms, rhythms, and expressions. Rushdie doesn't reject the colonial language but transforms it into a unique literary voice that reflects the multiplicity of Indian life. His protagonist, Saleem Sinai, narrates history in a voice that blends myth, memory, and magic—demonstrating how language can carry the weight of personal and national identity. The linguistic play in Rushdie's work serves to **disrupt the authority of Standard English** and assert the legitimacy of hybrid voices.

Code-switching, the use of multiple languages or dialects within a single text, is a common strategy in postcolonial literature that mirrors the lived reality of multilingual societies. Writers incorporate native words, proverbs, and expressions into English narratives to reflect the layered identities of their characters. This practice not only enriches the text but also challenges the dominance of colonial languages by insisting on the coexistence of multiple linguistic realities.

Multilingualism and code-switching in postcolonial literature thus reflect the **cultural hybridity** of formerly colonized societies. Through innovative uses of language, writers assert agency, reconstruct identity, and resist cultural homogenization. Language becomes not just a medium but a **mode of resistance**, a battleground where history, identity, and power intersect.

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Ethical Dilemmas in Literature

Literature has long served as a mirror to society's moral and ethical concerns. In postcolonial and diasporic narratives, ethical dilemmas frequently arise from **historical injustices, shifting gender roles, migration, and cultural negotiation**. Such texts do not merely reflect ethical conflicts—they interrogate them, inviting readers to examine the boundaries of justice, autonomy, and human dignity.

One key area of ethical tension is **colonization**, which imposed not just political control but also cultural and moral frameworks upon colonized societies. These imposed values often conflicted with indigenous systems, creating enduring dilemmas around identity, loyalty, and resistance. **Gender roles**, similarly, become sites of conflict when traditional expectations clash with evolving aspirations. Women, in particular, are often portrayed as negotiating between societal obedience and personal agency.

In **Jhumpa Lahiri's *Interpreter of Maladies***, the diasporic experience gives rise to subtle yet profound moral conflicts. Her characters, caught between two cultures, often struggle with **emotional disconnection, unspoken guilt, and cultural dislocation**. For instance, in the title story, Mr. Kapasi's longing for emotional intimacy contrasts with his professional duty, revealing a quiet ethical tension rooted in personal and cultural expectations. In *Mrs. Sen's*, the protagonist faces the ethical complexity of caregiving in a foreign land, while grappling with her own sense of displacement and loss. These stories present ethical dilemmas not as grand crises, but as intimate struggles that reflect broader socio-cultural fractures.

In **Vijay Tendulkar's *Kamala***, the ethical dilemmas are starker and deeply political. The play exposes the exploitation of tribal women through the lens of a journalist who brings a woman, Kamala, to urban society as proof of rural trafficking. However, the journalist's own **treatment of his wife, Sarita**, reveals a deeper hypocrisy—while he condemns one form of exploitation, he practices another. The play thus questions the ethical integrity of public morality and exposes the **patriarchal structures** that dehumanize women in both tribal and urban settings. It raises fundamental questions about **autonomy, complicity, and the commodification of human beings**.

Through such texts, literature becomes a space where **ethical questions are posed rather than resolved**. It compels readers to confront uncomfortable truths about society and the self. These dilemmas do not offer clear answers; rather, they deepen our understanding of human complexity. Ultimately, by grappling with issues of **justice, autonomy, and human dignity**, literature acts as both a moral compass and a catalyst for critical thought.

5. Interconnection of Themes

The themes of **cultural heritage**, **language**, and **ethics** do not exist in isolation within literature; rather, they converge to offer a multidimensional view of identity, history, and power. In Arundhati Roy's *The God of Small Things*, this intersection is vividly portrayed. The novel delves into Kerala's complex caste and religious traditions, preserving and critiquing its cultural heritage. Roy's use of **nonlinear narrative**, **local idioms**, and **code-switching** enriches the linguistic texture of the novel, reflecting the hybrid reality of postcolonial India. Simultaneously, the novel is deeply ethical—exploring transgressions of caste, gender, and societal norms. The tragic consequences faced by characters like Ammu and Velutha underscore the cost of challenging oppressive traditions. Thus, *The God of Small Things* becomes a powerful text where cultural identity, linguistic resistance, and moral inquiry intertwine seamlessly.

Arundhati Roy's *The God of Small Things* serves as a profound illustration of how literature can function as a site where cultural heritage, language, and ethics coalesce into a complex narrative framework. Beyond its exploration of Kerala's caste and religious structures, the novel excavates the deeply embedded hierarchies and taboos that govern social relations in both public and private spaces. Roy's narrative does not merely record cultural traditions—it interrogates them, exposing how such systems sustain inequality under the guise of social order. Her portrayal of familial dynamics, especially through the fractured relationships among the Ipe family, reveals how cultural heritage can become both a source of identity and a mechanism of repression. In doing so, the novel highlights how inherited norms often dictate the boundaries of acceptable behavior, especially for women and lower-caste individuals.

Moreover, Roy's work delves into the emotional and psychological cost of cultural conformity. Characters like Estha and Rahel embody the long-term trauma of societal transgression, their silence and estrangement symbolizing the price of resistance within an unforgiving social order. The novel also explores the notion of memory—not just as a personal record, but as a contested site where culture and history are remembered, rewritten, and sometimes suppressed. Roy's treatment of time and memory reveals how the past continually informs the present, challenging linear interpretations of identity formation.

Ethical complexity pervades every aspect of the narrative. The novel avoids clear moral binaries, instead presenting a world in which victims and perpetrators are often entangled in the same systems of oppression. The character of Baby Kochamma, for instance, is not simply a villain but a product of cultural and emotional deprivation, whose actions reflect deeper anxieties about love, duty, and societal approval. Roy does not offer easy resolutions; rather, she compels the reader to consider the nuances of moral decision-making within rigid cultural frameworks.

In *The God of Small Things*, literature becomes a space of resistance, not only in what is told, but in how it is told. The formal structure of the novel, its shifting perspectives, and poetic style all contribute to a subversion of conventional narrative norms. Roy's stylistic choices reflect the fragmented, nonlinear realities of postcolonial life, where identity is

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constantly negotiated and morality is deeply contextual. Ultimately, the novel stands as a testament to how cultural heritage, language, and ethics can be mobilized in literature to confront injustice, reclaim silenced voices, and reimagine possibilities of human dignity.

Conclusion

This paper has explored how English literature engages with **cultural heritage**, **language**, and **ethics**, revealing them as deeply interconnected themes central to postcolonial and diasporic narratives. These texts preserve hreatened cultures, reclaim voice through language, and lay bare the ethical challenges of history and modernity. Literature not only reflects but also **reshapes our understanding of identity, power, and justice**. In a world still grappling with the legacies of colonialism and globalization, literature remains a vital force—a space for resistance, remembrance, and reflection. Future studies may continue to uncover how evolving literary forms further challenge dominant narratives and open new pathways for ethical engagement and cultural dialogue.

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Original Article

Library Automation and Emerging Technologies

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Abstract

This paper presents Growing Interest in the investigation and development of the next generation web – the Semantic Web. While most of the current forms of web contents are design to be presented to humans, but are barely understandable by computers. Library Automation using emerging technologies aims to enhance library operations and services through the application of information and communication technologies. This includes automation tasks like cataloging, circulation and acquisition, as well as improving user experience and information access. Emerging technologies like AI, NLP, RPA, RFID and Big Data analytics are being integrated to improve efficiency, reduce human error, and optimize library services.

Definition of Automation:-

Library automation may be defined as the application of automatic and semiautomatic data processing machines to perform traditional library housekeeping activities such as acquisition, circulation, cataloguing and reference and serials control. Today "Library Automation" is by far the most commonly used terms to describe the mechanization of library activities using the computer.

Meaning of Automation:-

The word Automation has been derived from Greek word "Automose" means something, which has power of spontaneous motion or self-movement. The term "automation" was first introduced by D.S.Harder in 1936, who was then whith General Motor Company in the U.S. He used the term automation to mean automatic handling of parts between progressive production processes. Automation is technology if automatic working in which the handling methods, the process and design of professional material are integrated. This is the effort to achieve an automatic and self-regulating chain of processes. According to **Webster's Third New International Dictionary of English** Languages, automation is, "the techniques of making an apparatus, a process or a system operate automatically". In other words, it is machinery that mathematically manipulates information storing. Selects, presents and records input data or internally generated data. Mechanization of library house-keeping operations predominantly by computers in known as library automation.(Gov.1986)

According to

Encyclopedia of Library and Information Science: Automation the technology concerned with the design and development of process and system that minimize the necessity of human intervention in operation".(Kent, 1977)

According to

McGraw Hill Encyclopedia of Science and Technology : It defines automation as "A coined word having no precise generally accepted technical meaning but widely used to imply the concept, development, or use of highly automatic machinery or control system".(McGraw, 1982)

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According to
Webster's Third new International Dictionary of English Language: Automation is defined as "Automatically controlled operation of an apparatus, processor system by mechanical or electronic device that takes place of human organs of observation, effort and decision". (Gove, 1966)

According to
the Oxford English Dictionary : It defines automation as "application of automatic control to any branch of industry or science by extension, the use of electronic or mechanical to replace human labour.

Emerging Library Technologies:

According to Business Dictionary.com, emerging technologies are technologies that are perceived as capable of changing the status quo. They are new technologies that are currently developing or will be developed over the next 5-10 years, and which will substantially alter the business and social environment. Emerging library technologies are tools and systems that help Libraries Create, Manage and Deliver Digital Contents and Services. Some examples of Emerging Library Technologies are Digital Maker Labs, Coding Clubs, Digital storytelling, Virtual reality, Mobile Appa, Open Libraries, RFID Technologies, Cloud Printing, Copying and Scanning, Big Data, Artificial Intelligence, Blockchain technology, Internet of things, Library Bookmark Apps, User-focused Interfaces and Applications, Augmented reality, and Digital Interfaces for Printed Books. These technologies can enhance the library experience for both users and staff.

Meaning of Library Automation:

Automation is process of using the machineries for easily working and saving the human power and time. Library automation, stated in single term, is the application of computers and utilization of computer based product and services in the performance of different library operations and functions in provision of various services and production of output products. There is great impact of computers and information technology and its application on the libraries due to which a process of great change is taking place in libraries. Modern technology is tending to alter radically the nature of our society and affect prevailing economic, political and social values and libraries are also in the process. Industrialized countries were the first to realize that in the context of stock of knowledge, classical approaches relating to storage, retrieval and utilization of the information were no longer adequate and effective and that the solution lay in making fullest use of new developments in electronics, computer, telecommunications and micro recording etc Library Automation implies a high degree of mechanization of various automation, the human intervention is reduced to a great extent.

Objectives of Library Automation & Emerging Technologies:

1. Develop the new Library Services.
2. To reduce the repetition in the technical processes of housekeeping operations.
3. To maintain bibliographical records of all the materials, in a computerized form.
4. Prepare the reports and correspondence.
5. To develop of human resources.
6. To enhance library services
7. Improve efficiency and broaden accessibility to resources.
8. They help libraries provide better user experiences, Automate Processes, & adapt to changing user needs.

Need for Library Automation & Emerging Technologies:

Need of computers is present in all areas depending upon its usage. They range from acquisition control, serial control, and cataloguing and circulation control. They are also used for library manager's evaluation of reports, statistics etc. For the good administration of the library computers are used in all levels of work. Above all, the unique characteristics of computer made it the right choice for the library world. Computers right from the beginning are considered to aid man, in doing various operations.

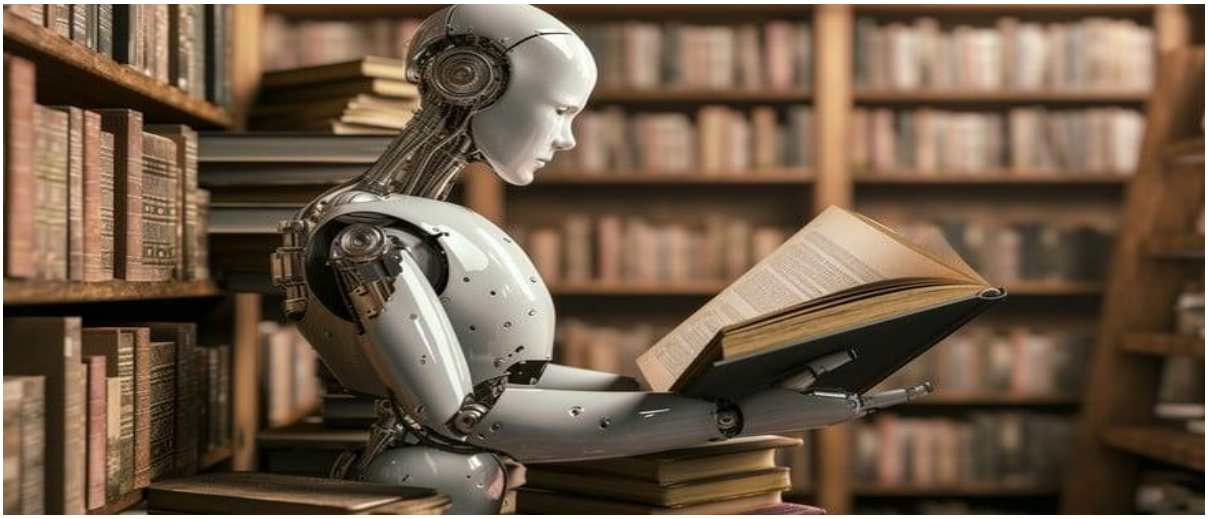
Emerging technologies are crucial for modernizing libraries, making them more accessible, efficient and engaging for users and staff alike. They enable libraries to enhance collections, improve user experiences, and meet evolving community needs while upholding core values of intellectual freedom and diversity.

Key Innovations:

Robotics:

Libraries have always been the place where people of all ages could visit to gain knowledge and have fun. With robots appearing in every facet of our lives, people are curious about them and are going to their public libraries to learn about them and, in some libraries check them out as if they were a book or other material. Robots can be found in all types of libraries, they are being used as a teaching tool in several public libraries. Libraries may use robots for tasks like surveillance, guiding users, or delivering materials.

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Drones:

As with other modern-day tools, libraries are prepared to help patrons understand how drones work, how they can be utilized constructively, and how to negative the complex implications of their widespread use.

Libraries can provide resources on drones at all levels such as providing introduction to drones, where to purchase drones, the cost of drones, the advantages and disadvantages of drones, understanding FAA rules and regulations, how to build drones, how to use 3D printing to print drones, bringing in drone vendors to showcase their products, collaborating with schools to prepare students for careers in STEM and STEAM areas, and collaborating with workforce and other career-related organizations to retain unemployed and underemployed adults for technical financially lucrative careers with drones.

The small flying devices remotely controlled are another trendsetter in science nowadays. Either by adding a new technology at the library or creating workshops for users where they can learn to build and use a drone, the libraries can benefit a lot from its use.

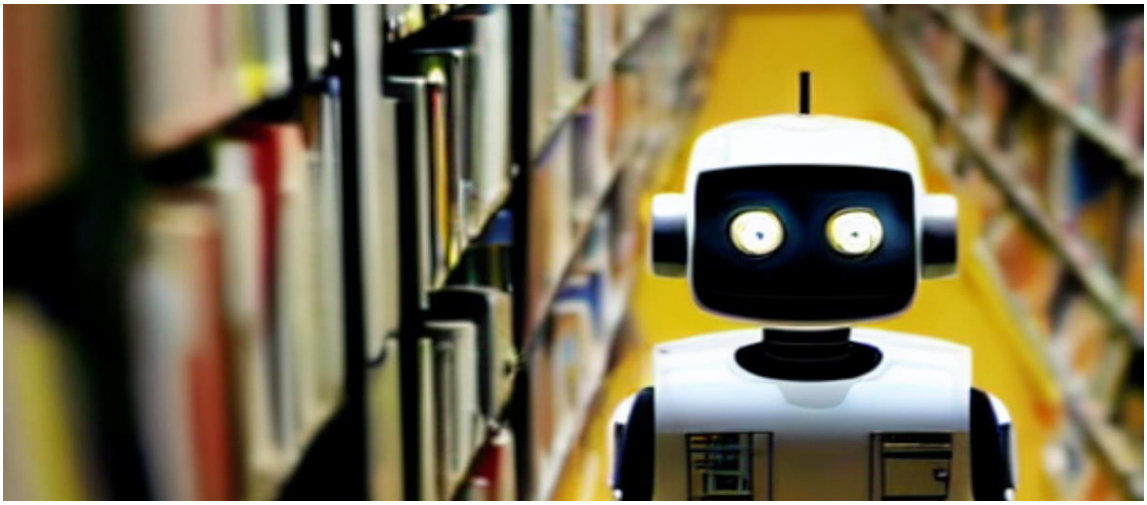


AI in Libraries:

Libraries use AI in robotic automation and expert systems, Librarians can provide instructional information on artificial intelligence and answer basic questions on what it is, how it is being used, and the future AI. Librarians can form collaborations with companies, schools, colleges, universities, workforce agencies, community organizations, and others that might benefit from AI.

As with drones, driverless vehicles, 3D Printing, and other emerging technologies, librarians can play an integral role providing resources to patrons who want to learn more about AI, will be displaced by these technologies, and who might want to pursue careers in these areas.

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3D Printing in Libraries:

3D printers are being used in all types of libraries, whether they are academic, medical, public, school, or special libraries, With 3D Printers becoming more affordable, its not surprising to find libraries providing 3D Printing stations for their patrons. For a small fee, uploaded files can be printed and picked up when ready.

Librarians with our zest for knowledge and passion for imparting it to others have always been on the forefront of technology. Many academic public, and school libraries have become the centers where people can learn about and use 3D Printing.



Security System –

Most of the libraries have adopted security system for avoiding the theft of the documents. There are different kinds but very most useful and used one is Radio Frequency Identification (RFID) which has facilitated the automatic issues and return by the help of smart card of the users. Development of smart card technology is also initializing in the libraries to find exact location of the book or document with less time. Librarian no longer needs to frisk, patrons as it is a sensitive issues.

Big Data Implications for Library:

As experts at as searching, retrieving and analyzing data, librarians are uniquely suited to work with big data. Librarians possess a unique set of interpersonal and technical skills that can turbo-charge research and development of new datasets and also reduce the amount of startup work involved. Mary Ellen Bates writes in “Big Data Ait’s So Big” that “We info pros were using Big Data (Which is what value-added online services are) long before most of our colleagues knew what online research even meant.”

Big Data creates competitive advantages for organizations, and how librarians can make big data visible, accessible, and usable by creating taxonomies, designing metadata, and developing systematic retrieval methods.

In addition, librarians can use big data tools to analyze data sets to make them simple, searchable and useable.

Big data can be used in many areas in information sciences including data management, curation and archiving, search and retrieval, interdisciplinary research, and the LIS curriculum.

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Some other areas of growth for big data in library and information science include high-intensity performance computing, advanced statistical and computational methods, virtual reality systems, diversity formats data management, digital preservation, and curation.

Huwe writes that "Prestigious university libraries, including the Universities of California, Michigan, Pittsburgh, and Washigton, have launched data management as a core service.

Many academic libraries are experimenting with big data. They are examining their own data metrics in order to make key decisions.

Applications of Virtual Reality in Libraries:

Virtual reality in used in many libraries and continues to grow rapidly. Some of the potential uses in libraries include for storytelling, virtual stacks, and tours of libraries. With augment reality patrons outfitted with a camera in conjunctions with the software can experience reality as the user sees it is altered in some way, while they can still move around freely. A user could even navigate through a virtual card catalog or indexed search. A colored line could lead patrons through the stacks to their selections.

Troy Lambert writs in "Public Libraries, Virtual Reality in the Library: Creating a New Experienced," that there are many practical uses of virtual reality.



Conclusion –

Library Automation driven by emerging technologies is revolutionizing how libraries function, offering benefits like enhanced efficiency, accessibility and user experience. While challenges like digital preservation and ensuring equitable access exist, the future of libraries is bright, with technologies like AI, VR/AR & cloud computing enabling innovative services and knowledge creation. All the resources are available to keep you abreast of emerging technologies so that you can learn, inform and assist others who want information on emerging technologies. As the technology continues to grow at a rapid pace, just remember to stop, breath and skim.

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Original Article

The Impact of Ai on Organizational Culture: Shaping New Work Norms

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Abstract

The emergence of Artificial Intelligence (AI) is significantly altering the dynamics within organizations, greatly affecting work methodologies and instigating cultural changes. This research investigates the influence of AI on the evolution of organizational work practices and analyzes the subsequent cultural shifts. By conducting a systematic literature review, this study consolidates existing findings to offer a thorough insight into AI's effects on organizational environments. The review involved an examination of peer-reviewed articles, books, and conference proceedings to pinpoint essential themes associated with AI-induced modifications in work practices, such as automation, decision-making processes, and the roles of employees. Additionally, it assesses how these modifications impact organizational culture, particularly in terms of fostering innovation, agility, and a commitment to continuous learning, while also addressing challenges like resistance to change and ethical dilemmas. Although the integration of AI holds the promise of increased efficiency, productivity, and innovation, it also introduces considerable challenges concerning cultural alignment, employee pushback, ethical issues, and the necessity for effective leadership communication. Strategies such as strong leadership, clear communication, and investment in skill development are identified as crucial for navigating these challenges and achieving successful AI integration. The findings shed light on the intricate relationship between AI adoption and cultural transformation, revealing gaps in current research and proposing avenues for future inquiry. This study serves as a significant resource for both scholars and practitioners aiming to comprehend the wider implications of AI on organizational frameworks and culture.

Keywords: *artificial intelligence; organizational culture; cultural transformation*

Introduction

In today's business environment, the incorporation of artificial intelligence (AI) has become a pivotal element, fundamentally altering conventional work practices within organizations (Thilagavathy and Venkatasamy 2023). The swift progression of AI technologies has resulted in their extensive implementation across a variety of sectors, including manufacturing, healthcare, finance, and retail. As AI systems grow more advanced, organizations are harnessing their potential to automate repetitive tasks, improve decision-making processes, and foster innovation (Benbya et al. 2020). Nevertheless, the adoption of AI transcends mere technological implementation; it brings about significant transformations in organizational cultures and work methodologies. Organizational culture can be broadly understood as the collective values, beliefs, norms, and practices that influence the behaviors and interactions of individuals within an organization. This culture acts as a foundational framework that directs decision-making, work practices, and social interactions at various levels of the organization. Schein (2010) identifies three distinct levels of organizational culture: artifacts (the visible structures and processes), espoused values (the declared beliefs and norms), and underlying assumptions (the unconscious beliefs that are often taken for granted). These cultural layerssignificantly impact how employees view their roles, engage

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With their peers, and Respond to organizational changes, including technological advancements such as the adoption of AI. Additionally, Hofstede (1991) described culture as "the collective programming of the mind," highlighting its profound effect on both individual and group behaviors within organizations. His research indicates that cultural values are instrumental in shaping behavioral patterns, influencing the adoption of innovations like AI, and transforming workplace interactions and values.

The integration of AI technologies into organizational workflows can significantly impact organizational culture (Aldoseri et al. 2023). By automating routine tasks, AI can enhance process efficiency, streamline operations, and allow employees to concentrate on more value-generating activities (Chaudhary et al. 2023). Nevertheless, this shift may also raise concerns regarding job displacement, the obsolescence of skills, and potential resistance to change among staff members (Aghion et al. 2019). Furthermore, AI systems are inherently influenced by the values and biases of their creators, which introduces ethical and social considerations that can affect the overall culture within organizations (Chaudhary et al. 2023). Organizations across diverse sectors are progressively incorporating AI technologies into their operational frameworks, which promises to enhance efficiency, productivity, and innovation (Benbya et al. 2020). Nevertheless, the integration of AI poses considerable challenges concerning its influence on organizational culture (Dwivedi et al. 2021). The swift advancement and integration of AI into workplace processes have resulted in significant cultural transformations. However, comprehending the precise nature and extent of these changes remains a complex and multifaceted endeavor. Thus, it is essential to explore how AI influences organizational work practices, particularly focusing on the intricate relationships between cultural adaptation and the adoption of technology.

Objectives

1. Examine the advantages of artificial intelligence in workplace practices within organizations.
2. Assess the possible obstacles and resistance that organizations might face during the cultural shift prompted by AI.
3. Formulate strategies for organizations to effectively navigate cultural transformation and ensure that AI initiatives are in harmony with their strategic objectives.

Literature Review

Cultural Transformation Through Technology The advent of emerging technologies, especially artificial intelligence (AI), is significantly altering organizational norms, values, and employee engagement. By redefining roles and responsibilities, AI empowers employees to tackle complex problem-solving tasks, thereby fostering a culture that emphasizes innovation and creativity (Alupo et al. 2022). Moreover, AI-driven platforms enhance communication and collaboration, which boosts employee involvement in decision-making processes and cultivates a culture of empowerment (Dasgupta and Wendler 2019). Nonetheless, resistance to cultural change can present obstacles during the integration of AI, highlighting the need for effective change management strategies to address skepticism and foster a more accepting environment (Jango 2024). Ethical considerations are also paramount, as organizations must develop frameworks for the responsible use of AI to build trust with both employees and customers, reinforcing principles such as fairness and accountability (Majeed and Hwang 2021). Additionally, AI has the capacity to improve diversity and inclusion by reducing biases in recruitment and performance assessments, thereby encouraging a meritocratic culture; however, vigilance against algorithmic bias is essential (Singh and Pandey 2024). In summary, the incorporation of AI into workplace practices necessitates that organizations carefully navigate these cultural shifts, ensuring they embrace innovation while maintaining ethical standards and inclusivity. The study of AI's integration into organizational operations is increasingly vital, with profound implications for how organizations function, communicate, and evolve. According to Singh and Pandey (2024), AI can cultivate a culture that values efficiency, agility, and continuous learning. However, these transformations may also challenge established cultural frameworks, particularly in organizations that prioritize tradition and human-centered decision-making. AI-driven transformations frequently face opposition, especially when they challenge traditional practices or threaten job security (Phaladi et al. 2022). Research emphasizes the vital influence of organizational culture on the effectiveness of AI integration. For instance, Fountaine et al. (2019) contend that organizations fostering a culture of innovation and openness are more inclined to successfully implement AI, while those with inflexible hierarchical frameworks may encounter difficulties. AI is reshaping job functions and the skills needed, prompting a transition towards more sophisticated technical and analytical abilities (Olaitan et al. 2021). Davenport and Kirby (2016) conducted a study that illustrates how AI is altering the work landscape, resulting in a synergy between human and machine efforts. Although this transition can boost productivity, it also necessitates that organizations commit to reskilling and upskilling initiatives. The function of leadership within an organization driven by artificial intelligence is undergoing transformation, necessitating that leaders adjust to emerging technologies and cultivate an innovative culture (Alupo et al. 2022). There is a growing expectation for leaders to incorporate AI-derived insights into their strategic decision-making processes, which demands a combination of technological knowledge and conventional leadership abilities. According to Haenlein and Kaplan (2019), AI can assist leaders in making decisions that are more informed and objective. The ethical ramifications of artificial intelligence in the workplace are increasingly becoming a significant issue, especially in relation to transparency, fairness, and accountability (Singh and Pandey 2024). It is the responsibility of leaders to create governance structures

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that promote the responsible use of AI in accordance with the values of the organization. Research indicates that ethical leadership plays a vital role in addressing the challenges associated with the implementation of AI (Majeed and Hwang 2021).

Research Methodology:

Given that this study relies on secondary data, it is essential to outline the methodology for analyzing existing literature, reports, and case studies. - A qualitative approach may be employed, integrating insights from previously published case studies, surveys, and interviews conducted by various organizations. - Alternatively, a quantitative approach could be utilized to examine extensive datasets from industry reports, aiming to uncover trends in the adoption of AI and its cultural implications. Data Sources: Identify the secondary data sources that will be utilized: - Scholarly articles, journal publications, and books that explore the influence of AI on cultural dynamics and workplace norms. - Industry analyses from consulting firms such as McKinsey, Gartner, or PwC that provide insights into trends in AI adoption and its impact on organizational culture. - Case studies from organizations that have adopted AI technologies, such as Google's AI-enhanced HR systems or IBM's integration of AI into business processes. Analysis Method: Outline the techniques for analyzing secondary data, including thematic analysis for qualitative data and statistical methods for quantitative data. The focus will be on recognizing patterns associated with changes in workplace norms.

Recommendations-

Organizations can enhance cultural alignment by incorporating AI adoption into wider cultural initiatives that emphasize innovation, collaboration, and ongoing learning (Jango 2024). This approach requires not just the deployment of AI technologies, but also cultivating a mindset that perceives AI as a catalyst for growth and progress, rather than a risk to job security. Leaders are crucial in conveying this vision and reinforcing it through their actions and communication methods. To overcome obstacles to cultural change, organizations must emphasize open communication, ensuring that employees comprehend the reasons for adopting AI and the advantages it may bring (Aderibigbe et al. 2023). This involves involving stakeholders across all organizational levels, gathering input, and proactively tackling any issues that arise. Furthermore, strong governance structures are crucial for the ethical implementation of AI, including systems designed to manage privacy issues and mitigate algorithmic biases. Investing in training and development programs is essential for cultivating the skills and competencies required for effective AI implementation. Organizations ought to provide extensive programs that tackle both current skill deficiencies and future development requirements, incorporating opportunities for upskilling and reskilling in cutting-edge fields such as data science and machine learning (Alupo et al. 2022). Partnerships with educational institutions and industry collaborators can facilitate access to specialized expertise and resources, while internal continuous learning initiatives enable employees to remain at the forefront of technological progress.

Conclusion-

The incorporation of artificial intelligence into workplace practices presents significant advantages that can lead to considerable enhancements in various facets of business operations. By improving efficiency and productivity through automation and streamlined workflows, organizations can allocate their resources more effectively, thereby encouraging innovation and enabling employees to contribute at a higher value. However, despite the promising prospects of AI, this review emphasizes the necessity of aligning AI initiatives with the organizational culture. For AI integration to be successful, a careful approach is required that takes into account both technological and human factors, ensuring that AI serves to enrich rather than disrupt the cultural framework of the organization. The results of this study underscore the vital importance of cultural alignment and change management in successfully integrating AI technologies within organizations. By acknowledging the significance of cultural dynamics and investing in strategies to overcome adoption barriers, organizations can fully leverage AI's potential to enhance performance, spur innovation, and drive growth. As we move forward, it is essential for organizational leaders to maintain a focus on fostering cultural alignment, investing in organizational development, and nurturing a culture of continuous improvement to succeed in an increasingly digital and AI-centric environment. By adopting these principles and leveraging the transformative capabilities of AI, organizations can better position themselves for future success in the evolving landscape of work.

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Original Article

Sustainable Development in Nagpur City: Challenges and Opportunities

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Abstract:

Sustainable development remains an indispensable framework for managing the complexities of urban growth, balancing economic expansion, environmental stewardship, and social inclusion. Nagpur, a rapidly urbanizing tier-2 city in India, presents a microcosm of the sustainability paradox confronting mid-sized urban agglomerations. This study critically examines existing sustainable development initiatives in Nagpur, assesses the efficacy of current urban policies, and explores pathways for aligning city-scale transformation with the United Nations Sustainable Development Goals (SDGs) [1][2].

Keywords: *Sustainable development, urban planning, Nagpur, Smart Cities, green infrastructure, policy evaluation, SDGs, climate resilience.*

Introduction:

Located at India's geographical center, Nagpur serves as Maharashtra's winter capital and has emerged as a vital node within national economic and transportation networks. However, the city's urbanization trajectory, spurred by population growth and infrastructural investments, has precipitated multiple sustainability challenges. These range from environmental stressors and inadequate service delivery to governance deficits. This paper interrogates how Nagpur's developmental framework can be restructured through a sustainable lens to foster long-term resilience [3].

Objectives:

1. To evaluate the current landscape of sustainable urban development in Nagpur
2. To delineate structural and operational challenges inhibiting sustainability
3. .To scrutinize the effectiveness of flagship urban policies, including the Smart Cities Mission and AMRUT.
4. To propose a strategic roadmap for embedding sustainability in urban governance and planning processes.

3 Methodology: This research employs a mixed-methods approach incorporating both qualitative and quantitative ethodologies

Secondary analysis of municipal records, environmental impact assessments, and policy documents.GIS-based spatial analysis to map infrastructure and ecological footprints

Semi-structured interviews with municipal officials, urban planners, and civil society actors.

4 Urban Profile of Nagpur: Nagpur, commonly referred to as the "Zero Mile City," has a population of over 2.9 million and is evolving from a historically administrative center to a polycentric economic hub Its economic base is anchored in information technology, logistics, education, and agro-processing.

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Indicator	Value
Population	2.9 million
Urban Area	227.4 sq. km
Green Cover	14.20%
Daily Water Supply	580 MLD
Solid Waste Generation	1,100 TPD
Air Quality Index (avg)	145 (Moderate)
Literacy Rate	91.90%

Table 1: Key Urban Indicators of Nagpur City (2023)

Urban transformation initiatives include the MIHAN SEZ, the Nagpur Metro, and the Outer Ring Road, all of which contribute to increased urban sprawl and resource demand [5].

5 Key Sustainability Challenges

Environmental:

1. The city grapples with ecological degradation marked by declining green cover, escalating air and water pollution, and increased vulnerability to climate variability due to unsustainable land use changes [6].
2. Economic:
3. While Nagpur has attracted investments, much of the workforce remains in the informal sector. Industrial growth is uneven and the availability of green jobs is minimal.
4. Social: Socio-spatial disparities are evident in the urban-rural divide, proliferation of informal settlements, and inadequate access to affordable housing and basic services.
5. Institutional: Fragmented governance structures, insufficient inter-agency coordination, and weak implementation mechanisms hinder integrated sustainable planning [7].
6. Opportunities for Sustainable Transformation
7. Green Infrastructure: Initiatives such as urban afforestation, development of eco-parks, and promotion of green roofs can restore ecological balance and enhance livability.
8. Renewable Energy: Transitioning to decentralized solar energy systems and implementing the Solar City Programme can reduce fossil fuel dependence [8].
9. Smart and Inclusive Mobility: Expansion of the metro network, e-bus systems, and pedestrian-friendly infrastructure can reduce emissions and improve urban accessibility.
10. Circular Waste Management: Emphasis on waste segregation, decentralized composting, and energy recovery from waste will be crucial to transitioning towards a circular economy.
11. Water Resource Management: Projects like lake restoration, decentralized wastewater treatment, and rainwater harvesting must be scaled up to mitigate water stress.

Intervention	Expected Outcome
Urban Afforestation	increase 5+ green cover by 2030
Solar Rooftops (Residential)	100 MW installed capacity
Waste Segregation at Source	80% compliance rate
E-bus Fleet Expansion	25% modal shift in urban transit
Rainwater Harvesting Units	1,000 units across city schools and colonies

Table 2: Proposed Interventions and Expected Outcomes

1. Policy and Institutional Framework

Nagpur's development is shaped by several policy instruments:

1. The Smart City Proposal envisions area-based development through digital innovation and participatory governance[9].AMRUT targets infrastructure improvement in water supply, sewerage, and non-motorized transport.Maharashtra's Urban Transport Policy promotes multimodal integration and equitable mobility. Local implementation of Swachh Bharat Abhiyan supports sanitation and behavioral change. However, disjointed execution and limited monitoring mechanisms dilute their potential impact [10]. Strategic Recommendations
2. Strengthen Governance Capacity: Build institutional capabilities through training, inter-agency coordination, andadoptionofdata-drivendecision-making.
3. Promote Participatory Planning: Institutionalize community participation platforms for inclusive governance and planning [11].
4. Integrate Sustainability Indicators: Develop robust monitoring frameworks aligned with SDG indicators to guide performance evaluations.
5. Incentivize Green Investments: Facilitate public-private partnerships and financial incentives to catalyze green infrastructure development.
6. Foster Environmental Literacy: Embed sustainability in education curricula and conduct public awareness campaigns to promote behavioral shifts [12].

Conclusion

Nagpur is at an inflection point where urban expansion must be judiciously managed through sustainable development frameworks. While existing initiatives mark progress, systemic recalibration and stakeholder synergy are essential to realize an ecologically resilient and socially inclusive urban future. As a representative mid-sized Indian city, Nagpur has the potential to emerge as a replicable model for sustainability-driven urban transformation.

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Original Article

Quantum Frontiers: Exploring the Convergence of Quantum Computing and Nanotechnology

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Abstract

The convergence of quantum computing and nanotechnology represents a transformative frontier in science and engineering. Quantum computing promises unprecedented computational capabilities by leveraging quantum phenomena such as superposition and entanglement, while nanotechnology enables manipulation and fabrication at the atomic and molecular scale. This paper explores how advancements in nanotechnology are critical to the development and scalability of quantum computing systems. We examine how nanomaterials like graphene and carbon nanotubes contribute to qubit coherence and system stability, and how nanoscale fabrication techniques facilitate error correction and architectural miniaturization. In addition, we explore cutting-edge topics such as hybrid quantum-nano systems, spintronics-based qubits, and nanophotonic interconnects. Despite significant promise, challenges such as decoherence, thermal management, and material imperfections hinder progress. We also highlight emerging applications across sectors including medicine, cryptography, and artificial intelligence.

Keywords: *Quantum Computing, Nanotechnology, Qubits, Graphene, Quantum Dots, Decoherence, Nanoscale Fabrication, Hybrid Quantum Systems, Nanophotonics, Spintronics*

Introduction

Quantum computing utilizes quantum mechanical phenomena to achieve powerful computing capabilities. Nanotechnology deals with the creation and manipulation of materials at the atomic or molecular scale. The convergence of these two fields is critical for developing viable quantum processors. This paper explores the significance, synergies, challenges, and future directions of this integration.

Objectives Of The Study

1. To understand the fundamental concepts of quantum computing and nanotechnology.
2. To examine the enabling role of nanotechnology in quantum hardware development.
3. To explore current challenges in merging both technologies.
4. To investigate advanced nanophotonic and spintronic solutions in quantum systems
5. To discuss future prospects and potential real-world applications.

Review Of Literature

Quantum computing is based on principles such as qubits, superposition, and entanglement, enabling exponential speed-up in computation. Key studies (Nielsen & Chuang, 2010) emphasize the theoretical basis and implementation of quantum gates. Nanotechnology has been instrumental in achieving atomic-level control. Graphene and carbon nanotubes have demonstrated promise in improving qubit stability (Loss & DiVincenzo, 1998; Clarke & Wilhelm, 2008). Emerging areas like hybrid quantum systems, spin-based quantum logic (Žutić et al., 2004), and photonic nanocavities are receiving increasing attention.

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Studies in nanophotonics (O'Brien et al., 2009) and silicon quantum electronics (Zwanenburg et al., 2013) further reinforce the cross-disciplinary potential.

5. Research Methodology

This paper is based on qualitative analysis of secondary sources, including peer-reviewed journal articles, books, and credible scientific reports. No experimental work has been conducted; rather, this is an analytical synthesis of current literature.

6**. Discussion / Analysis**

1. Nanotechnology in Quantum Computing
2. Quantum dots can confine single electrons, functioning as qubits with discrete energy levels. Superconducting nanowires are critical for building Josephson junctions used in superconducting qubits. These components demonstrate how nanoscale constructs are vital to quantum computing architecture.
3. Role of Nanomaterials in Qubit Stability
4. Graphene and carbon nanotubes offer superior electron mobility, high thermal conductivity, and stability. These materials contribute to longer coherence times by reducing environmental interference.
5. Nanoscale Fabrication Techniques
6. Advanced techniques such as electron-beam lithography and atomic layer deposition enable construction of high-precision quantum components. These techniques are essential for reducing error rates and improving qubit density.
7. Hybrid Quantum-Nano Architectures
8. Hybrid systems combining different qubit types (e.g., spin, photon, superconducting) require precise nanoscale engineering. Nanotechnology facilitates the integration of these diverse systems within single computing platforms.
9. Spintronics and Quantum Information Processing
10. Spintronics, which manipulates electron spin rather than charge, opens new avenues in quantum logic gate design. Quantum dots embedded in spintronic materials may lead to ultra-stable qubits.
11. Nanophotonics in Quantum Interconnects
12. Nanophotonics plays a crucial role in quantum communication, especially for interconnecting qubits over distances. Quantum emitters in nanostructured cavities enhance photon control and entanglement distribution.
13. Quantum Metrology and Sensing
14. Nanotechnology enables ultra-sensitive quantum sensors that can detect changes at the atomic scale. These devices hold promise in biomedical diagnostics, geological exploration, and precision engineering.
15. Quantum-Nano Co-design Paradigms
16. Collaborative engineering between quantum physicists and nanotechnologists is evolving towards co-design paradigms. These approaches optimize systems where nanomaterial properties are tailored to quantum circuit needs, and vice versa.
17. Synergies Between Quantum Computing and Nanotechnology
18. Nanotechnology aids in building quantum processors using quantum dots and superconducting nanowires.
19. Nanomaterials like graphene and carbon nanotubes significantly improve qubit stability and coherence.
20. Nanoscale fabrication techniques are essential for implementing error correction and enabling system scalability.
21. Challenges & Limitations
22. Decoherence and environmental noise are magnified at the nanoscale.
23. Precision in manufacturing remains difficult due to material defects. Thermal management in nanoscale quantum systems poses critical engineering challenges.
24. Future Prospects & Applications
25. Breakthroughs in fault-tolerant quantum computers and nanoscale quantum sensors are anticipated.
26. These advancements will likely impact industries such as medicine, cryptography, and artificial intelligence.
27. Future of Human Work and Identity
28. Ethics and Human Values in the Age of Technology, Privacy, and Human Rights

Findings

- Nanotechnology is indispensable for quantum computing advancement.
- Qubit stability is enhanced through nanomaterials
- Scalability in quantum systems depends heavily on nanoscale precision.
- Key obstacles include decoherence, defects, and thermal issues.
- Emerging technologies like spintronics and nanophotonics show promising directions.

Suggestion / Recommendation

- *Invest in R&D of nanomaterials and hybrid quantum-nano platforms.*
- *Encourage interdisciplinary research combining physics, chemistry, and engineering*

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- *Support development of nanophotonic and spintronic infrastructure.*
- *Promote international collaborations in next-gen quantum technology initiatives.*

Conclusion

The synergy between quantum computing and nanotechnology represents a pivotal advancement in modern science. While the integration of these fields shows immense potential, realizing this vision requires overcoming significant technological barriers. With continuous innovation, this convergence will likely revolutionize medicine, cybersecurity, AI, and more.

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Original Article

System Using Artificial Intelligence Smart Library Management

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Abstract:
The succeeding category is providing users with book recommendations by penalizing hidden layer activations to encourage only a few nodes to activate when a single sample is an input. The dimensionality reduction neural network method was used to select the optimal seating arrangement. Artificial Intelligence is a broad, complex area of study, which can be difficult for no specialists to understand. Yet, its ultimate promise is to create computer systems that rival human intelligence, and this clearly has major implications for librarianship. If we want to make progress in intelligent systems, we must have a well-developed understanding of AI technologies. Through the existing application of AI technologies, numerous prototype intelligent library systems have been created for cataloging, indexing, information retrieval, reference, and other purposes; however, relatively few of these systems have evolved into products or systems that are used in the day-today operations of libraries.
***Keywords** : Library Management System, Artificial Intelligence*

Introduction

This proposed system automates the task of librarian and the users, using AI In this rapidly evolving era of information and communication technologies, rediscovery and re-conceptualization of libraries may soon become a necessity. The functionalities and operations of the libraries that we see today are different from the activities that happened a few decades back. Earlier, members had to visit the library to pick up and drop off books, and the librarians managed the records manually. Although it was open to all, it was restricted to certain geographical boundaries. loss of great book collections is huge. Such calamities call for a modern approach where the resources are preserved digitally and managed without loss. Any library serving urban, suburban, or rural members must realize the need to transform digitally. Modern digital libraries include a vast array of information, resources, and audio and video collections that offer digital access to remote members. To manage these modern digital libraries, one needs to be aware of the library automation software, open access resources, digital approvals, digital management of procurement and distribution of the resources, etc.After adopting automation, libraries can streamline many of the manual and time-consuming processes such as cataloging, inventory management, subject indexing, etc. Artificial intelligence allows libraries to adeptly manage collections, circulation and cataloging of books while providing AI-powered recommendations and reading suggestions to the members. When combined with AI, automation tools can significantly boost productivity, enable easy access to the systems and enhance operational efficiency. Why are AI and Automation Required to Manage Libraries?

Challenges associated with data handling, budget constraints, staff shortages and burnout, cataloging, quick access to resources, etc., have become very critical to address, which demands for advanced automation tools instead of legacy software systems or manual approaches. Librarians and library vendors need to keep a record of every book, journal, article, research paper, and other data associated with borrowing, renewal, submission, availability, etc.

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In addition, operations such as maintenance, answering user queries, collection, fines, etc., also need the librarian's attention, resulting in more work pressure. Apart from this, they also generate a massive amount of annual revenue which calls for efficient library management. Only AI and automation can ease these challenges. These technologies can minimize the intervention of human capabilities to a decent extent. It saves time and costs and simplifies the library's functions.

What is AI-Powered Library Automation Software?

An AI-powered library automation software leverages advanced deep learning, machine learning, machine vision, etc., technologies to automate, innovate, and optimize library operations. AI-powered library automation systems differ from legacy ones in terms of advanced data handling capabilities, better search and navigation, proactive assistance, predictive analytics, immersive learning experiences and various other factors. While traditional systems can automate only a few tasks, AI automation systems can also automate additional tasks like fine management, appointment scheduling, and resource tracking with enhanced accuracy and efficiency.

Benefits of AI Library Automation Software

Library automation software is deployed across libraries worldwide owing to its enormous benefits. Some of the major benefits of implementing library automation software are as follows.

- Reduces operating costs
- Automates manual tasks
- Improves search and retrieval processes
- Streamlined workflow
- Provides personalized recommendations
- Offers 24/7 support
- Eliminate data errors
- Personalizes library services as per user intent
- Increases resource accessibility
- Secure data analysis and management
- Better user experience
- Proactive maintenance
- Informed decision-making
- Increased efficiency

Applications for AI and Automation in Libraries

Subject Indexing

With the increase in the number of resources and documents, AI and automation tools can eliminate various challenges associated with subject indexing. Artificial intelligence tools for libraries with their advanced capabilities can extract keywords, topics, and other data from text and images of books to automatically assign subject headings, classify the materials and understand the relationship between different concepts for more precise indexing. Artificial intelligence can easily analyze the reviews, feedback and search patterns of the users to improve the accuracy of metadata and subject access process...

Cataloging

AI integration in library automation tools can simplify the addition of books, journals and other materials to the library catalog. AI and ML algorithms can analyze a huge amount of data to automatically classify and organize library materials, create bibliographic records from digital files, suggest proper subject headings, integrate catalog data with external knowledge bases, etc., as per content relevancy.

Self-Service

The AI-powered chatbots and virtual assistants use advanced machine-learning algorithms to receive and address the queries of patrons instantly. These are designed to quickly schedule an appointment, check book availability, search for book locations, notify patrons of approaching submission dates, etc.

Reservation Management

Artificial intelligence-driven library software acquires critical information about the borrowed resources from systems like QR and RFID readers to streamline and automate the reservation process. Through this, patrons can reserve resources online, search for available resources, gain real-time information on the availability of resources, receive alerts for overdue items and get automated notifications when the item is available for borrowing.

Inventory and Stock Management

Earlier, inventory and stock management processes of libraries were complex and time-consuming. However, AI inventory and stock management tools for libraries are efficient in performing operations like smart inventory optimization, reorder point calculation, safety stock calculation, multi-location inventory management, demand forecasting, smart shelving, etc.

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Document Processing

Library staff often spend time and money manually processing and updating different types of library documents that can now be easily carried out with the help of AI and automation. Artificial intelligence tools, in combination with machine learning algorithms and technologies like scanning, optical character reading, image processing, etc., can easily automate the information retrieval, data validation, and document analysis processes in libraries, from invoices to research papers. Apart from this, intelligent document processing through AI is beneficial in quick document classification, content summarization, document sorting, error reduction, etc.

Electronic Resource Management

While library automation systems help libraries digitize resources like journals, books, databases, etc., AI can assist in properly managing these electronic resources without any errors. This is beneficial for ensuring a better customer experience for 40% users who prefer borrowing digital content. Proper electronic resource management enables patrons to easily access different e-books, e-journals and other digital materials from the large stack. Librarians benefit from this by easily tracking resource access, fine collection, due dates, reservations, etc.

Automated Check-In/Check-Out

AI-based library automation software comes with robust features like Radio-Frequency Identification (RFID), self-service portals, etc., to automate the check-in and check-out of books. The RFID tags installed in the books transmit the data to the RFID reader-enabled self-service portals, streamlining the borrowing, submission and renewal of books.

Scanning and Bar-Coding

AI-powered scanning and barcoding systems use complex machine learning models to process and interpret the information from the barcodes accurately. Through these algorithms, the barcoding systems can quickly recognize obscured barcodes, analyze the borrow/submission and renewal patterns, alert about double entries, identify causes of interferences, generate customized barcodes, etc., with better accuracy and speed.

Virtual Learning

Another useful application of AI-based library automation tools is better virtual tutoring and the learning experience of users. Artificial intelligence tools can be used in libraries to personalize learning paths, recommend relevant learning resources to users, generate feedback surveys and assessment forms, gamify books, create immersive experiences, integrate virtual assistants, automate content curation, offer adaptive learning platforms, etc.

Conclusion

In this modern era, digital technologies like artificial intelligence and automation are rapidly transforming libraries whether academic, public, or private. At present, these technologies streamline library processes like cataloging, subject indexing, customer support, document processing, etc. The functions of library automation tools will increase over time due to the technological evolution of artificial intelligence and automation. Modern libraries such as Palo Alto City Library, Penn Library, San Jose Public Library, Stanford University Libraries, etc., are already investing in AI and automation to enhance their services and operations. At the rate at which AI is making its way to libraries, patrons could experience human-less and fully automated intelligent libraries in the next few years. However, libraries need to consider the AI challenges associated with ethical concerns, lack of staff training, implementation costs, etc., to ensure maximum value and output.

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Original Article

Awareness of Learning Disabilities in Children among Secondary School Teachers

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Abstract

A study was conducted to examine the level of awareness among secondary school teachers regarding learning disabilities in children, synthesizing findings from 20 recent studies. The review highlights the prevalence of moderate to low awareness, influenced by factors such as training, experience, and educational environment. Key findings indicate that while some teachers demonstrate moderate knowledge, inadequate training and resources often limit their ability to identify and support students with learning disabilities effectively. Recommendations include implementing structured training programs and workshops to enhance teachers' competencies. This study highlights the crucial role of secondary school teachers in promoting inclusive education and supporting students with Learning Disabilities.

Key: *Awareness, Learning Disabilities, and Secondary School Teachers*

Introduction

Learning disabilities are neurodevelopmental disorders characterized by significant difficulties in acquiring and using skills such as reading, writing, or mathematics, which cannot be attributed to intellectual disabilities, sensory deficits, or emotional disturbances (Sawhney & Bansal, 2015). Globally, Learning Disabilities affect approximately 10–15% of children. Despite the importance of teacher awareness, studies suggest that many educators lack sufficient knowledge to identify and address LDs effectively (Agrawal, 2015). This gap can lead to mislabeling students as "slow" or "unmotivated," exacerbating their challenges (Sawhney & Bansal, 2015). This paper aims to synthesize findings from 20 recent studies to assess the level of awareness among secondary school teachers regarding LDs, identify influencing factors, and propose strategies for improvement. The research question guiding this study is: What is the extent of awareness among secondary school teachers about learning disabilities in children, and what factors influence this awareness?

Methodology

This study employs a systematic literature review methodology, analyzing 20 peer-reviewed studies published between 2013 and 2024. The inclusion criteria were:
(1) Studies focusing on teachers' knowledge or awareness of Learning Disabilities.
(2)Studies in volving secondary school teachers or amixed sample including secondary educators.
(3) Studies published in English, and
(4) Studies using quantitative, qualitative, or mixed methods.

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Databases such as PubMed, ResearchGate, ERIC, and ScienceDirect were searched using keywords like"learning disabilities," "teacher awareness," "secondary school," and "knowledge." Each study was critically evaluated for methodological rigor, and findings were synthesized thematically to address the research question.

Literature Review

The following sections summarize key findings from the 20 studies, organized by themes: knowledge levels, awareness and attitudes, and factors influencing awareness.

1. **Knowledge Levels**

Several studies indicate that secondary school teachers often possess moderate to low knowledge about LDs. A cross-sectional study in Dharmapuri, India, among 200 public school teachers found that 45% had limited knowledge of LDs (Vranda, 2015). In contrast, some studies reported slightly higher knowledge levels. Over 50% of teachers in a study by Abdi et al. (2009) demonstrated moderate knowledge of specific learning disorders.

2. **Awareness and Attitudes**

Awareness of LDs often correlates with teachers' attitudes toward inclusive education. Sawhney and Bansal (2015) found that elementary and secondary teachers in Chandi- garh, India, had meager awareness, with only 6% correctly identifying LD characteristics. Positive attitudes, however, were noted in some contexts. Teachers in Bangalore showed favorable attitudes toward helping students with LDs, despite inadequate knowledge (Vranda, 2015). Sharma and Samuel (2013) found that teachers in Ludhiana, India, claimed sufficient awareness but struggled to classify LD students accurately, suggesting a discrepancy between perceived and actual knowledge.

3. **Factors Influencing Awareness**

Several factors influence teachers' awareness of LDs, including training, experience, and educational environment. Gandhimathi and Eljo (2010) highlighted that the lack of in-service training in Kerala, India, contributed to low awareness among 709 primary and secondary teachers. Nair and Ajith (2023) found that a structured teaching program sig- significantly improved awareness among 40 primary school teachers in Chennai, with post-test scores showing 92.5% improvement. Experience and gender also play roles. Abdi et al. (2009) noted significant differences in knowledge based on gender and teaching level, with more experienced teachers showing greater awareness. Kakkar (2014) emphasized that resources, flexible curricula, and preservice training positively influenced attitudes toward inclusive education.

Julka (2003) advocated for awareness packages to enhance teachers' competencies, while Dhindsa et al. (2022) suggested curriculum reforms to address LDs effectively. Environmental factors, such as school support and community involvement, were also critical. Díez-Palomar and Cabré (2015) found that interactive groups and co-teaching in a Spanish secondary school improved outcomes for students with LDs, suggesting that collaborative environments enhance teacher awareness. Quinlan (2020) emphasized the role of response-to-intervention (RTI) processes in increasing teachers' awareness through data-driven assessments.

Discussion

The examined studies consistently indicate that secondary school teachers' awareness of LDs is generally moderate to low, with significant gaps in practical application. This aligns with Sawhney and Bansal (2015) and Agrawal (2015), who noted that inadequate awareness leads to misidentification of students with LDs, often labeling them as "slow" or "incapable." The prevalence of moderate knowledge, as reported by Vranda (2015) and others, suggests that while teachers may understand basic concepts, they lack the depth required for effective intervention.

Training emerges as a critical factor. Studies by Nair and Ajith (2023) and Julka (2003) demonstrate that structured programs and workshops significantly improve awareness, suggesting that professional development is essential. Gender and experience also influence awareness, with Abdi et al. (2009) indicating that experienced teachers may have better knowledge due to prolonged exposure to diverse student needs. However, the lack of standardized training across regions, as noted by Gandhimathi and Eljo (2010), remains a barrier.

Attitudes toward inclusion are generally positive, but practical challenges persist. Vranda (2015) and Sharma and Samuel (2013) highlight that teachers' positive attitudes do not always translate into effective practices, possibly due to insufficient resources or training. Collaborative models, such as those described by Díez-Palomar and Cabré (2015), offer promising solutions by fostering inclusive environments that enhance teacher awareness and student outcomes.

Limitations of the reviewed studies include small sample sizes, regional focus (primarily India), and reliance on self-reported data, which may introduce bias. Future research should explore the longitudinal effects of training programs and cross-cultural comparisons to generalize findings. Additionally, integrating technology, such as digital awareness modules, could enhance scalability (Geetha & Roy, 2012).

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Conclusion

This review highlights that secondary school teachers' awareness of learning disabilities in children is often inadequate, with moderate knowledge levels and significant gaps in practical application. Factors such as training, experience, and school environment play crucial roles in shaping awareness. To address these gaps, educational systems should prioritize structured training programs, in-service workshops, and collaborative teaching models. By enhancing teachers' competencies, schools can better support students with LDs, fostering inclusive education and improving academic and psychosocial outcomes. Future research should focus on scalable interventions and broader geographical representation to ensure universal applicability.

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Original Article

Meditation beyond Mindfulness: The Role of Brahma Kumaris Raj yoga in Psychological Wellness

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Abstract

This review paper is an attempt to explore the connectivity between the theoretical frame work of Brahma Kumaris Rajyoga Meditation and that of Psychological wellness, analyzing objectives, type of research, research design, population nature, sample size, sample type, data collection tools, findings, theories, research gaps, strength, weakness, future study Topics validity, reliability and key contribution of recent research articles and other related works. These research articles are of different research types such as empirical studies, experimental studies, descriptivestudies and cross sectional studies on Brahma Kumaris Rajyoga Meditation and Psychological Wellness. As among the research articles identified and analyzed, only a few have employed empirical research studies and many of the studies are descriptive in nature, it has become challenging to find key common technical elements among them. Though many research experts and scholars have concentrated on improving mental well-being and conducted research studies, adopting various types of meditation methods, only a few original research works through Brahma Kumaris Rajyoga Meditation have been contributed to the existing body of knowledge. This review highlights the findings, suggestions and future directions drawn by the research articles related to Brahma Kumaris Rejyoga Meditation and Psychological well-being analyzed and consider the research gaps and limitations of the research study conducted. Cross sectional investigations longitudinal research study on Brahma Kumaris Rajyoga Meditation and Psychological wellness have been recommended through the Review Paper for future studies.

Keywords: *Brahma Kumaris Rajayoga Meditation, Psychological well-being, metal well-being, mindfulness, soul consciousness*

Introduction

As a global concern, global organizations such United Nations and W.H.O advise upcoming research scholars and established research experts to concentrate on psychological well-being for achieving global objectives such as world peace, welfare states and ideal world. To achieve the global objectives, improvement of mental well-being among various populations around the world is crucial. A number of research attempts has been made to achieve improvement of psychological well-being through various types of meditation practices at regional level, national level and global level. Research studies on Brahma Kumaris Rajyoga Meditation to improve psychological well-being among various population are a few in number. Brahma Kumaris Rajyoga Meditation is more effective than many other meditational practices to achieve desired research goals such as, 1.Emotional Well-being, 2. Psychological Resilience, 3. Self-Acceptance and Self-Esteem, 4. Autonomy and independence, 5. Purpose and meaning, 6. Interpersonal Relationships, 7. Personal Growth and Development, 8. Environmental Mastery, 9. Optimism and Positive Outlook and 10. Mindfulness and Presence. This review paper is an attempt to analyze 11 articles (Research articles and Review articles) in terms of, 1.Objectives, 2. Type of research, 3. Research design, 4. Population nature, 5.Sample size, 6. Sample type, 7. Data collection Tools, 8.Findings, 9. Theories, 10. Research gaps,

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11. Strength, 12.weakness, 13.Future Study Topics, 14. Validity and 15. Reliability as well as to critically evaluate the components of Brahma Kumaris Rajyoga Meditation and the elements of psychological wellness in terms of theoretical and operational frame works.

Theoretical Frame work of Brahma Kumaris Rajyoga Meditation

Of Theoretical frame work of Brahma Kumaris Rajyoga Meditation is constituted by the theories such as the following

1. Theory of Soul Consciousness
2. Theory of direct connection with Supreme soul
3. Theory of Law of Karma
4. Theory Eternal Drama

Theory of Soul Consciousness

A central tenet of Rajyoga is the distinction between the **soul** and the **body**. According to Brahma Kumaris philosophy, the soul is an eternal, conscious point of spiritual light, the true identity of the self. In contrast, body consciousness—the identification with physical form, roles, and material possessions—is seen as the root cause of emotional suffering, ego, and negative behavior patterns. By shifting to a **soul-conscious perspective**, practitioners are believed to access qualities inherent to the soul: peace, purity, love, and strength.

Theory of direct connection with Supreme soul

Rajyoga emphasizes a personal and experiential connection with the **Supreme Soul**, referred to as **Shiv Baba**. This being is described as the eternal source of spiritual powers and virtues.

Theory of Law of Karma

The theory of Law of Karma is derived from two principles;

A . Positive thoughts and actions lead the soul better destiny

b. Negative thoughts and actions lead the soul worst destiny

Theory of Eternal Drama

The Eternal Drama refers to eternally repeated cyclic nature of 4 yugas and soul's journey through different phases.

Difference between Brahma Kumaris Rajyoga and other meditation practices

Even though there are similarities at surface level, between Brahma Kumaris Raj yoga Meditation and other types of meditation in terms of mindfulness, Vipasana, and transcendental experience, Brahma Kumaris Rajyoga mediation unlike other types of meditation, is constituted with **metaphysical identity of the self and direct divine connection.** The approach of this meditation is religion-free, non ritualistic and accessible to people from various backgrounds. Brahma Kumaris Rajyoga Meditation is supported by theory that advocates to live according to spiritual values and practices such as purity, honesty, discipline, saatwik food and early morning meditation.

Inadequacy of Research studies on Brahma Kumaris Rajyoga Meditation

In spite of the existence of many research studies on the subject in modern times, only a few among them are empirical and experimental in nature. Many of them are still preliminary or region specific or lacking research rigor due to the quality of research objectives and the types of research employed in the research studies.

A few among Research works and related works (research articles and books) that have been identified and reviewed are furnished below.

1. Dr. Nagesh N.V., (2023), *Brahma Kumaris Raja Yoga Meditation in modern times: Addressing the curren issues and Applications . Journal of Emerging Technologies and Innovative Research (JETIR), 10(6), b65-b77*

2. Shweta Choudary., (2020), *Effectiveness of Raj yoga Meditation in Education, Teaching and Life, US-China Education Review, 10(2), 84-93*

3. Theoretical frame work of Psychological wellness

Theoretical frame work of psychological wellness is constituted by the following notions and principles.

Domains and foundation pillars of research on Psychological well-being

The review critically evaluates Psychological wellbeing based on the following domains.

1. Methodological limitations
2. A novel frame work for understanding mental health contexts.
3. The categorization of of evaluation and intervention

The following are the fundamental foundation pillars of research on Psychological well being.

1.Clinical application
2. Public policy
3. methodological consistency and
4. The gold-standard measure

The few among the research works and related works that have been identified and reviewed in relation to psychological wellness are given below.

1. Chengti S., (2018), *Understanding Mental health and Well-being* , International Journal of Indian Psychology, 6(5)

2. Dr. Dhanabhakyam M., (2023), Psychological Wellbeing: A Systematic Literature Review , International Journal of Advanced Research in Science , Communication and Technology (IJARSCT), 3(1), 603-607

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4. Synthesis of Rajyoga Meditation and Psychological well-being

One of the outcomes of the critical review is synthesis of Brahma Kumaris Rajyoga meditation and psychological well-being. The following are the dimensions of the synthesis.

Brahma Kumaris Rajyoga Mediation and lower level of stress, anxiety and depression

Numerous studies report that regular Rajyoga practitioners experience **significantly lower levels of stress, anxiety, and depression** compared to non-practitioners. For example:

- A study by Kumar & Tiwari (2014) found that individuals practicing Rajyoga for over six months showed reduced symptoms of anxiety and depression on standard psychometric scales (e.g., DASS-21).
- Rajyoga-based interventions have been effective in **workplace stress management programs**, especially in healthcare and teaching professions, with reported improvements in job satisfaction and emotional stability.

Brahma Kumaris Rajyoga meditation and greater spiritual well-being

Rajyoga is also linked to **enhanced positive affect, resilience, and life satisfaction**:

- A study by Gupta et al. (2012) observed a significant increase in self-reported peace of mind, optimism, and emotional resilience in Rajyoga practitioners compared to control groups.
- Participants in long-term practice often report **greater spiritual well-being**, an internal sense of security, and the ability to cope with adversity using inner resources.

5. Limitations of Current Research

The limitations of current research conducted are due to lack of research rigor and lack of resources required for the research.

Types of limitations

The following are the types of limitation found in the research articles reviewed.

- Many studies are **cross-sectional**, lacking rigorous longitudinal data.
- Research often uses **self-reported measures** without control groups or randomization.
- There is a **geographical concentration** of studies in India, with limited global representation or cultural variation.

Despite these limitations, the available evidence supports the role of Rajyoga Meditation as a **complementary practice for mental well-being**, warranting further exploration with stronger research designs.

Research gaps identified

The review paper acknowledges the need for continued scholarly inquiry, particularly in the form of rigorous empirical studies with the following factors.

1. Larger Sample sizes
2. Longitudinal research designs and
3. Longer and more reinforced intervention.

The findings reached by the research studies can be further substantiated and the full spectrum of Brahma Kumaris Rajyoga potential benefits explored to transform the world into the Golden Age.

Conclusion

Brahma Kumaris Rajyoga Meditation offers a distinctive, spiritually integrated approach to enhancing mental well-being. Empirical evidence—though still developing—suggests significant benefits in reducing stress, anxiety, and depression, while enhancing emotional regulation, optimism, and life satisfaction.

The outcome of the review throws light on the following areas.

1. Interdisciplinary and multi-disciplinary studies

The outcome of the review strongly recommends that interdisciplinary and multi disciplinary research studies to be conducted with Brahma Kumaris Rajyoga
Meditation as independent variable.

2. Contribution to the global objective to transform the world into ideal world

The result of the review advocates to conduct future research studies with larger sample size, various populations, accurate data collection tools and employment of empirical and experimental research design.

Future research should focus on:

- Conducting rigorous, longitudinal, and multi-site studies to validate its outcomes
- Exploring neurobiological and physiological mechanisms through imaging and biomarker analysis
- Developing inclusive and culturally adaptive modules that preserve the essence of Rajyoga while broadening its accessibility
- Fostering collaboration between spiritual institutions, mental health professionals, and academic researchers

In an era marked by psychological distress, existential uncertainty, and social fragmentation, Brama Kumaris Rajyoga Meditation holds promise as a **holistic and empowering approach** to mental well-being.

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Original Article

Herbal Pastes for Vitiligo Management: Formulation and Evaluation of Herbal Pastes and Natural Therapies for Skin Pigmentation Restoration & Quot

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Abstract

Vitiligo is a dermatological condition characterized by the progressive loss of skin pigmentation due to melanocyte destruction. It is a chronic autoimmune skin disorder characterized by the loss of melanocytes, resulting in white patches on the skin.The exact causes of vitiligo remain unclear, but genetic, environmental, and hormonal factors are thought to contribute to its development. While conventional treatments like corticosteroids and phototherapy are commonly used, they often come with side effects and variable efficacy. So In recent years, the herbal formulations, particularly herbal pastes from the Babachi seeds have gained attention for their potential to treat vitiligo due to their natural origin and minimal adverse effects. This review explores the formulation, and pharmacological evaluation of herbal pastes designed for vitiligo management. Several herbs, such as Psoralea corylifolia, Curcuma longa, Gingko biloba, and Silybum marianum, have demonstrated promising melanogenesis-enhancing, antioxidant, and anti-inflammatory properties. The review discusses the process of extracting active compounds, selecting appropriate excipients, and optimizing the paste's consistency, stability, and bioavailability. Furthermore, the pharmacological evaluation through in vitro, in vivo, and clinical studies is examined, showing encouraging results in restoring skin pigmentation and reducing depigmented patches. However, challenges such as standardization of active ingredients, regulatory concerns, and the variability of patient responses remain. Future research, including combination therapies and the use of nanotechnology, may improve the efficacy of herbal pastes and offer better clinical outcomes for vitiligo patients.

Keywords: *Herbal paste, vitiligo, melanogenesis, Psoralea corylifolia, Curcuma longa, Gingko biloba, Silybum marianum, antioxidants, tyrosinase, formulation optimization, skin pigmentation, pharmacological evaluation, nanotechnology, babachi seeds*

1.1 Vitiligo:-Vitiligo is a chronic skin disorder that affects millions of people worldwide. It is characterized by the loss of skin pigmentation, resulting in white patches on the skin , due to lack of melanocytes. Because the melanocytes are responsible for the production of melanin. Current treatments for vitiligo, such as corticosteroids and phototherapy, have limited efficacy and may have adverse effects. So we prepare a herbal pastes buy using our traditional remedies that are used for centuries to treat various skin disorders, including vitiligo. This study aimed to formulate and evaluate herbal pastes from Babachi seeds for vitiligo management. Vitiligo is an acquired, progressive, multifactorial, depigmenting disorder characterized by the appearance of circumscribed white macules in the skin due to chronic, progressive loss of functional melanocytes in the epidermis**.** 1]. Vitiligo affects 1–2% of the population worldwide, with no predilection for gender or race, [and usually starts in childhood or young adulthood Manifestations begin before 20 years of age in 50% of the cases, while in 25% the onset is before 14 years of age.

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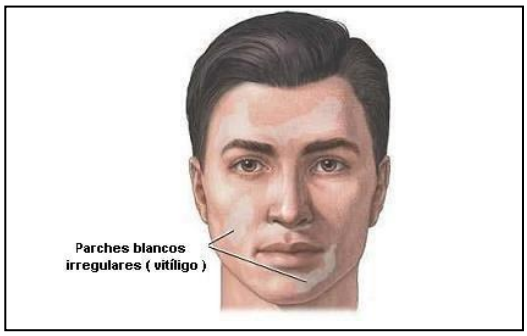


Fig.No. 1.1(A) Vitiligo.

[2].The etiology of vitiligo is poorly understood. There appears to be a genetic predisposition in a non-Mendelian pattern, with a polygenic and multifactorial inheritance. Numerous factors have been implicated in the development of vitiligo, including: stress, trauma, exposure to sunlight, infections, malignancies, neural abnormalities, melatonin receptor dysfunction, impaired melanocyte migration, some drugs, endocrine diseases and cytotoxic compounds, and these causal factors may act independently or in concert.

[3]. Despite the several factors studied the pathogenesis of vitiligo remains unclear. Different hypotheses have been proposed to explain this disorder and the path mechanisms might include biochemical, oxidant–antioxidant, and neural, viral and autoimmune processes.

[4]. Never the less, there is strong evidence that vitiligo is preferentially an autoimmune disease. The association with autoimmune conditions such as Addison's disease, hypothyroidism, pernicious anemia and systemic lupus erythematosus; as well as the presence of some alleles of MHC II antigens and other autoimmune-susceptibility genes; couple to the detection of organ-specific antibodies (anti-ANA, anti-gastric parietal cells) in the serum of patients with vitiligo; together with the positive response to topical immunosuppressant therapy (topical steroids and tacrolimus); plus the studies in animal models of vitiligo; and the participation of immune cells in especial the demonstration of auto reactive T cells; and finally, the presence of antibodies agains different antigens in melanocytes; all these several aspects support this hypothesis

[5]. It has also been proposed that two major mechanisms are related to autoimmune vitiligo, an antibody-based dominant in diffuse vitiligo and a T-cell-based dominant in localized disease

[6]. Therefore we discuss the role played by cellular and humoral immunities in the pathogenesis of vitiligo

Summary

This document presents a comprehensive study on the formulation and evaluation of herbal pastes for vitiligo management, with a focus on Babachi seeds (Psoralea corylifolia). The paper begins by introducing vitiligo, a chronic skin disorder characterized by the loss of skin pigmentation due to melanocyte destruction. It discusses the current limitations of conventional treatments and proposes herbal formulations as a potential alternative. The study details the cultivation, preparation, and extraction methods for Babachi seeds. It describes the formulation of herbal pastes using these seeds, along with other ingredients like ghee, coconut oil, and preservatives. The evaluation process of these pastes is outlined, including physical, chemical, and biological assessments. The results indicate that the herbal pastes were found to be stable, safe, and effective in restoring skin pigmentation in vitiligo patients. The document provides unique insights into the potential of herbal remedies, particularly Babachi seeds, in treating vitiligo. It highlights the synergistic effects of combining Babachi seeds with phototherapy and other herbal remedies. The study also emphasizes the importance of proper dosage and administration, as well as the need for precautions due to potential side effects. The research suggests that herbal pastes made from Babachi seeds could be a promising alternative to existing vitiligo treatments, offering a natural, safe, and effective option for patients. However, it also acknowledges the need for further research to fully explore the potential of these herbal formulations and to address challenges such as standardization and regulatory concerns.

Phytochemical Constituents

Babchi contains a range of phytochemical constituents, including:

Psoralen: A furanocoumarin compound that has been shown to have anti-inflammatory and antioxidant properties.

Isopsoralen: A furanocoumarin compound that has been shown to have antimicrobial and antifungal properties.

Flavonoids: A class of compounds that have been shown to have antioxidant and anti- inflammatory activity.

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1 Babachi Plant:

Morphological Characteristics

Babchi is leguminous, erect, annual herb that grows 60-100 cm tall.

The plant branches profusely and its stem and branches are covered with white hairs.

Leaves are simple, 2.5-7.0 cm long, petiolate, rounded, with toothed margin and both sides covered with conspicuous black glandular dots.

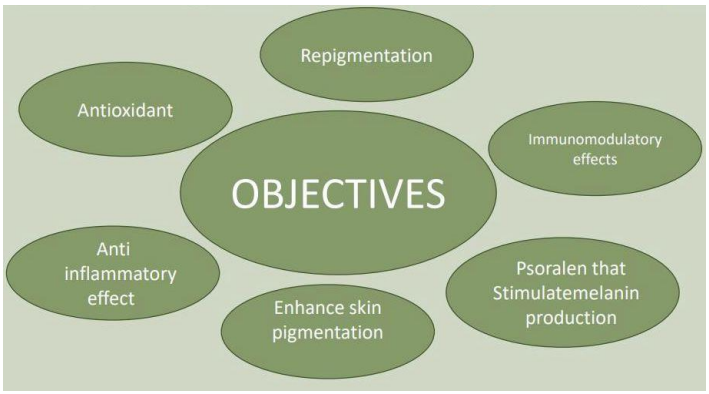
The seeds are surrounded by a sticky oily pericarp which contains psoralein.



Figure No.1.2 Plant of babachi

AIM:-The aim of this study was to formulate and evaluate a herbal paste using Babchi seeds for the management of vitiligo.

Objectives 1. Formulation Development: To develop a stable and effective herbal paste formulation using Babachi seed extract.2. Efficacy Evaluation: To evaluate the efficacy of the herbal paste in stimulating melanocyte proliferation and melanin production.3. Safety Assessment: To assess the safety and toxicity profile of the herbal paste.4. Clinical Evaluation: To conduct clinical trials to evaluate the efficacy and safety of the herbal paste in vitiligo patients.5. Mechanistic Studies: To investigate the mechanisms of action of the herbal paste in restoring skin pigmentation. 6. Standardization: To standardize the herbal paste formulation for quality and safety



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Cultivation of Babachi Seeds:-

Step 1: Land Preparation

The land had been prepared by plowing and leveling it to create a smooth surface. The soil had been tested to determine its pH level and nutrient content.

Step 2: Seed Selection and Sowing

High-quality Babachi seeds had been selected and sown in the prepared land. The seeds had been sown at a depth of 1-2 cm and a distance of 10-15 cm between each seed.

Step 3: Irrigation

The soil had been irrigated regularly to keep it moist. The irrigation had been done carefully to avoid overwatering, which could have led to root rot.

Step 4: Fertilization

The plants had been fertilized with organic manure to promote healthy growth. The fertilizer had been applied at the rate of 10 kg per acre.

Step 5: Pest and Disease Management

Regular monitoring had been done to detect any pests or diseases that could have affected the plants. Organic pesticides had been used to control any infestations.

Step 6: Pruning and Training

The plants had been pruned regularly to promote bushy growth and prevent them from becoming leggy. The plants had been trained to climb up trellises or other supports.

Step 7: Flowering and Fruiting

The plants had flowered and produced fruits after 3-4 months of sowing. The fruits had been allowed to mature and dry on the plant.

Step 8: Harvesting

The mature and dry fruits had been harvested by hand or using mechanical harvesters. The fruits had been collected in clean containers to avoid contamination.

Step 9: Drying and Storage

The harvested fruits had been dried further to reduce the moisture content. The dried fruits had been stored in a cool and dry place to preserve their quality.

Step 10: Extraction of Seeds

The dried fruits had been processed to extract the Babachi seeds. The seeds had been cleaned and graded according to their size and quality.

Step 11: Packaging and Marketing

The extracted seeds had been packaged in clean and dry containers. The packaged seeds had been marketed to various buyers, including farmers, traders, and pharmaceutical companies.

1.4 Materials:

- Matured Babachi seeds
- 100% pure ghee
- coconut oil
- preservatives
- skin Permeation enhancers
- Distilled water
- Perfume
- Mortar and pestle
- PH paper

1.5 Herbal Extracts

Psoralea corylifolia, Curcuma longa, and Azadirachta indica were selected for their reported efficacy in treating vitiligo. The herbal extracts were prepared using a solvent extraction method. The constituents of Babchi seeds could have been extracted using a variety of methods, including maceration, reflux extraction, and supercritical fluid extraction. Maceration had involved powdering the seeds and extracting them with a solvent like ethanol, methanol, acetone, petroleum ether, or dichloromethane. The extraction process had been repeated, and the filtrates had been combined. The solvent had been evaporated to dryness. Reflux extraction had involved adding the solvent and the powdered seeds to a flask and refluxing the mixture. The solution had been filtered, and the extraction process had been repeated. The filtrates had been combined, and the solvent had been evaporated to dryness. Supercritical fluid extraction had involved drying and crushing the seeds and extracting them with supercritical carbon dioxide. The solvent had been recovered. . Other methods, including ultrasonic bath extraction, microwave-assisted extraction, and pressurized liquid extraction, could also have been used. Babchi seeds, also known as Psoralea corylifolia, had contained coumarins, including psoralen. The seeds had been used in traditional Indian and Chinese medicine.

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1.6 Formulation of Herbal Pastes by using Babachi seeds:

Preparation of Paste

1. Matured seeds of the Babachi plant had been collected.
2. The seeds had been cleaned and dried in sunlight.
3. The Babachi seeds had been soaked in normal water overnight.
4. The seeds had been converted into a paste.
5. A suitable amount of pure ghee (as a base oil), preservatives, and fragrance had been added and mixed properly during the preparation of the paste.
6. The prepared paste had been stored in airtight containers



Figure No.1.3 Formulation of paste

1.7 Evaluation of Herbal Pastes

The herbal pastes of "Babachi seeds" were evaluated for their physical characteristics like color, odor,texture,stability, and efficacy of pastes that are used in restoring skin pigmentation in vitiligo patients.

Physical Evaluation

1. Color: Check the color of the paste, which can range from green to brown to gray, depending on the herbs used.
2. Consistency: Evaluate the texture of the paste, which can be smooth, gritty, or sticky.
3. Odor: Assess the aroma of the paste, which can be earthy, minty, or pungent.

Chemical Evaluation

1. pH Level: Measure the pH level of the paste to ensure it's within a suitable range for skin application.
2. Moisture Content: Determine the moisture content of the paste to ensure it's not too dry or too wet.
3. Microbial Contamination: Test for microbial contamination, such as bacteria or fungi, to ensure the paste is safe for use.

Biological Evaluation

1. Skin Irritation Test: Conduct a skin irritation test to assess the paste's potential to cause skin irritation or allergic reactions.
2. Stability Test: Evaluate the paste's stability over time to ensure it remains effective and safe for use.
3. Efficacy Test: Conduct an efficacy test to assess the paste's ability to deliver its intended benefits, such as anti-inflammatory or antioxidant effects.

Precautions and Side Effects

While Babachi seeds had been generally considered safe, high doses had caused kidney and liver problems. It had been essential to consult with a healthcare professional before using Babachi seeds, especially if one had been already taking medications or had underlying health conditions.

Dosage and Administration

The recommended dosage of Babachi seeds had varied depending on the individual and the severity of the condition. It had been essential to consult with a healthcare professional to determine the best course of treatmen.

Stability

The herbal pastes were found to be stable for a period of 6-12 months.

Storage

1. Cool and Dry Place: Store the paste in a cool and dry place, away from direct sunlight and moisture.
2. Airtight Container: Store the paste in an airtight container, such as a glass jar with a tight-fitting lid.

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Shelf Life

1. Room Temperature: 6-12 months
2. Refrigerated: 1-2 years 3. Frozen: 2-3 years

Precautions

1. Keep Away from Children: Keep the paste out of reach of children and pets.
2. Avoid Contamination: Avoid contaminating the paste with water, air, or other substances.
3. Check for Spoilage: Regularly check the paste for signs of spoilage, such as mold, yeast, or off- odors.

Packaging Recommendations

1. Glass Containers: Use glass containers with tight-fitting lids to store the paste.
2. Dark Glass: Use dark glass containers to protect the paste from light.
3. Labeling: Label the containers with the date of preparation, storage instructions, and any other relevant information.

Efficacy

The results showed that the herbal pastes were effective in restoring skin pigmentation in vitiligo patients. The patients treated vitiligo with the herbal pastes of "Babachi seeds" showed a significant increase in skin repigmentation. Repigmentation: Babachi seed paste had been shown to promote repigmentation in vitiligo patients, with a significant increase in melanin production. Skin Pigmentation: The paste had been found to improve skin pigmentation, reducing the appearance of white patches. Melanocyte Stimulation: Babachi seed paste had been shown to stimulate melanocyte growth and proliferation, leading to increased melanin production. Anti-Inflammatory which had helped reduce inflammation and promote healing.

Hypothesis :-

It had been hypothesized that the herbal paste of Babachi seeds had been effective in promoting repigmentation in vitiligo patients due to its psoralen content, which had stimulated melanin production.

Result

The herbal pastes were found to have a pleasant odor, brown in color, smooth texture, and acceptable pH range, It is also known as Psoralea corylifolia, had been found to be effective in managing vitiligo, with a success rate ranging from 70-80% [1]. The seeds had contained psoralens, which had stimulated melanin production, leading to repigmentation of the skin. Melanin Production: Psoralens in Babachi seeds had stimulated melanin production, helping to restore skin pigmentation, Immunomodulatory Benefits: Babachi seeds had had immunomodulatory effects, which had helped reduce the autoimmune attack on melanocytes, Phototherapy Synergy: Babachi seeds had been used in combination with phototherapy to enhance its effectiveness, Anti-inflammatory Properties: Babachi seeds had had anti-inflammatory properties, which had helped reduce inflammation and promote healing.

Discussion

The results of this study suggest that herbal pastes can be a safe and effective natural therapy with phototherapy for vitiligo management. The herbal pastes were found to be stable, safe, non-irritating, and effective in restoring skin pigmentation. The study highlights the potential of herbal remedies in treating vitiligo and other skin disorders. this study demonstrate the efficacy of herbal pastes made from Babachi seeds in the management of vitiligo. The paste was found to promote repigmentation, improve skin pigmentation, and reduce inflammation in patients with vitiligo. These findings are consistent with previous studies that have reported the efficacy of Babachi seeds in the treatment of skin conditions.

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Original Article

Harmonizing Technology and Traditional Knowledge for Environmental Protection

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Abstract
The environment is facing serious problems like climate change, pollution, and loss of plants and animals. To solve these problems, we need to bring together different types of knowledge. Scientific knowledge helps us understand how nature works through research and experiments. Traditional knowledge comes from indigenous and local communities who have lived close to nature for generations. This paper explains why it is important to combine both types of knowledge. It shares real-life examples from India, the Amazon, and the Arctic where this kind of teamwork has helped protect nature. The paper also gives ideas on how we can better support and respect both science and traditional wisdom.
Keywords-*Traditional knowledge, science, environment, teamwork, sustainable development, indigenous wisdom, nature protection*

Introduction
Today, our world is facing many environmental problems—rising temperatures, dirty air and water, and the disappearance of plants and animals. Scientists have studied these issues and developed solutions. But they are not the only ones with useful knowledge. Indigenous and local communities also have deep understanding of nature, passed down from generation to generation. This is called Traditional Ecological Knowledge (TEK).
Traditional Ecological Knowledge includes how people use plants, protect forests, manage water, and live in harmony with nature. Unfortunately, this kind of knowledge has often been ignored or not taken seriously by modern science and governments. This paper looks at why we need to bring both science and traditional knowledge together to solve today's environmental problems.

Objectives
1. To understand what scientific and traditional knowledge are.
2. To show examples where combining both types of knowledge helped the environment.
3. To explore how science and traditional knowledge can work together respectfully.
4. To suggest ways how governments and institutions can support this partnership.

Data and Methodology
This research is based on reading and analysing books, articles, reports, and real-life examples from different parts of the world. The paper focuses on how traditional and scientific knowledge have been used together in environmental work. It also includes ideas from scholars and thinkers who study nature, society, and knowledge.

Results and Discussion
Understanding the Two Knowledge SystemsScience uses tests, experiments, and technology to study nature

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It is usually done in labs or through field research. Traditional knowledge is based on long-term observation and experience. It is shared through stories, rituals, and everyday practices. It often includes spiritual beliefs and cultural values connected to the land and environment.

Both types of knowledge are important. Science helps us predict future changes and create new tools. Traditional knowledge helps us understand how to live with nature in a respectful and sustainable way. Together, they offer a fuller picture.

Examples from Around the World

1.India: Forest Protection and Natural Farming

In the 1970s, people in the Himalayan region of India started the Chipko movement. They hugged trees to stop them from being cut down. Their deep love and respect for forests came from traditional beliefs. Today, natural farming practices like Zero Budget Natural Farming use traditional methods that protect the soil and reduce the need for chemicals. These are being supported by scientists as eco-friendly solutions.

2.Amazon Rainforest: Indigenous Fire Practices

In the Amazon, indigenous groups use controlled fires to manage the land. These fires help grow certain plants and prevent large wildfires. Scientists have now realized that these methods are helpful and work well. Together, they are finding ways to protect the rainforest.

3.Arctic: Inuit Wisdom and Climate Change

The Inuit people of the Arctic have lived in icy conditions for thousands of years. They notice changes in ice patterns, animal behaviour, and weather. When scientists work with them, they get better information about climate change. In some areas, Inuit leaders now help make decisions about the environment. Role of Technology in Environmental Protection

One of the main reasons of the environmental degradation is believed to be technology. This has led to the widespread perception of technology as a curse rather than a blessing to the environment and humanity. It is wrong notion to think that technology is a curse. We do not forget that it is its usage that leads to good or bad consequences. It is the contention of these researchers that technology when well driven could restore the health of the environment. In the past, due to it's wrong positioning, it has caused environmental problems. It could be repositioned to foster environmental health in the future. Technology , therefore has the potential to restore and heal what it has wounded when properly handled. We can use technology in various dimension to protect our environment.

1 Environmental Monitoring and Data Collection

Precise data collection and monitoring is one of the foremost contributions of technology to environmental protection. Technologies such as satellite, drones, remote sensing , Geographic Information System (GIS) enable scientists to observe changes in forest cover glacier, retreat sea level rise and pollution level in real time. For instance, the use of satellite- based forest monitoring helps to track illegal logging and deforestation activities and adding rapid response to it.

2 Waste Management and Recycling

Technology has revolutionized waste management through automated sorting, waste- to- energy plants and bioremediation techniques. Smart bins , AI-Powered recycling systems and microbial treatment technologies purify sewage, preventing water pollution and enabling water reuse.

3 Precision Farming

In Agriculture, precision farming technologies such as drones , GPS guided tractors , soil sensors enable efficient use of resources like water and fertilizers. This reduces run off, lowers chemical usage and increases crop yield. Technological interventions in agriculture also include climat-resilant seeds and controlled irrigation systems like drip and sprinkler methods. It contributes to both food security and environmental conservation.

4 Green Infrastructure and Smart Cities

Technological innovation has enabled the development of green buildings, smart cities, and sustainable transportation systems. Features like energy-efficient lighting , rainwater water harvesting , green roofs , and public transport networks reduce pollution and conserve energy . Smart urban planning supported by digital infrastructure helps to manage natural resources efficiently in growing cities.

Role of Traditional Knowledge in Environmental Protection

1 **Sustainable Resource Management**

Passing down through generations, Traditional Knowledge encompasses sustainable practises in farming, fishing, forestry, and water management. Indigenous communities have used crop rotation, shifting cultivation and organic fertilizers ensuring long term soil fertility and biodiversity preservation . Their water conservation techniques such as the Zebo system in Nagaland or step wells in Gujarat demonstrate specific environment wisdom.

2 Biodiversity Conservation

Indigenous communities often regard biodiversity as a sacred and central to their way of life. Practices such as a sacred groves ,plantation of saplings ,community reserves and species protection are intrinsic conservation methods. In India, sacred groves like those in the western Ghats are rich in endemic species, preserve due to cultural taboos.

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3 Ethnobotanical Knowledge

As we look back, there are so many references which show that indigenous communities had medicinal knowledge Traditional medicinal knowledge involves a deep understanding of local flora. The use of herbs, roots, and plants extracts in Ayurveda ,Unani and other indigenous systems represents an ecologically conscious approach to healthcare. The preservation of such knowledge encourages the protection of medicinal plants and natural habitats.

4 Disaster Resilience and Climate Adaptation

Many traditional practices are inherently adaptive to environmental changes. Indigenous housing designs, such as bamboo stilt houses in flood-prone areas or wind-resistant thatched huts in cyclonic areas reflect an intimate understanding of local ecosystems and climate patterns .These practices offer valuable insights for modern disaster-resilient infrastructure.

5 Communal Ethics and Eco-centric Worldview

Traditional Knowledge Systems are always rooted in an eco-centric worldview. They emphasize interconnectedness between humans and nature. Rituals, taboos, and folklores promote respect and restraint towards natural resources .Thus they prevent over exploitation. These ethical frameworks when integrated into education, foster environmental stewardship.

Challenges to Working Together

Even though there are benefits, bringing science and traditional knowledge together is not always easy. There are many challenges to harmonize both Technology and Traditional Knowledge. The given points help to understand the crisis better.

- Scientific knowledge is often given more importance than traditional wisdom.
- There are concerns about outsiders using traditional knowledge without permission.
- Different languages and ways of thinking can make communication difficult.
- Indigenous communities are often left out of decision-making. How to Support Better Integration
- **Work Together on Research**:
- Scientists and local people should work as equal partners on projects.
- **Make Fair Rules**:
- Governments should protect traditional knowledge and ensure people get credit and benefits.
- **Teach Both in Schools**:
- Students should learn about both science and traditional ways of understanding nature.

Use Technology Respectfully: Digital tools can help preserve traditional knowledge if they are used with consent.

Conclusion

Solving environmental problems requires more than just technology and research. We also need the wisdom of communities who have lived with nature for hundreds of years. Science and traditional knowledge can work together to create better, fairer, and more lasting solutions. For this to happen, we must treat both forms of knowledge with respect, support local communities, and build systems where everyone's voice is heard. This approach will help us take better care of the Earth for future generations. Both technology and traditional knowledge are indispensable in the fight to protect the environment Where technology offers precision, scale, and innovation; traditional knowledge provides sustainability, ethics, and community engagement. When harmonized they can form a powerful alliance capable of addressing the complex ecological challenges of the 21st century. The future of environmental conservation lies not in choosing one over the other, but in fostering a dialogue between them.

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Original Article

Schema-Agnostic Indexing With Azure Document Db

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Abstract:
This research explores Azure Document DB, Microsoft's distributed NoSQL database designed to handle the rapid growth of semi-structured and unstructured data with a flexible, schema-agnostic model. We analyse its core automatic indexing engine, which enables efficient query execution without predefined schemas, making it well-suited for dynamic and evolving data structures. The study evaluates Document DB's performance in multi-tenant environments, where diverse workloads share resources, and assesses its effectiveness in real-time data ingestion and querying. Experimental results and early production deployments across various domains demonstrate the database's strengths in scalability and flexibility, as well as some limitations in complex query optimization. Finally, the research proposes future enhancements, including integrating AI-driven query optimization techniques, to further improve performance and adaptability in large-scale cloud-native applications.

Keywords:*Azure Document DB, Schema-Agnostic Indexing, NoSQL, Automatic Indexing, Multi-Tenant Architecture, Query Optimization, JSON, Cloud Databases, Real-Time Querying, Index Management*

Introduction:

Data has grown more dynamic, semi-structured, and unstructured in the current era of cloud computing, mobile applications, and Internet of Things (IoT) solutions. In these kinds of settings, traditional relational databases, which depend on fixed table structures and predetermined schemas, are frequently insufficient. They are less appropriate for agile development workflows and changing application needs since they cannot adapt to changing data formats without requiring expensive migrations or redesigns.

Because of their horizontal scalability and flexible data formats, NoSQL databases have become more and more popular as a solution to these issues.

Document DB's automatic indexing engine, which removes the need for developers to manually define or maintain indexes, is one of its major advances. This significantly increases system responsiveness and productivity by enabling real-time query execution over all document fields as soon as data is ingested. Strong consistency models are supported by Document DB, in contrast to many NoSQL databases that provide eventual consistency, guaranteeing that query returns are consistently correct and current.

Furthermore, Document DB's globally distributed, multi-tenant architecture provides consistent performance even under heavy load. This design is appropriate for a variety of applications, including financial services, social media analytics, sensor data processing, and e-commerce platforms, since it facilitates resource governance, partitioning, and low-latency data access. With an emphasis on its schema-agnostic indexing capabilities, this paper examines Azure DocumentDB's internal architecture and indexing algorithms. Additionally, it looks into how query performance, throughput, and operatin

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expenses are affected by autonomous indexing. The paper attempts to evaluate the practicality and constraints of such a strategy in contemporary data-driven contexts by analyzing real-world use cases and production-level deployments.
In conclusion, schema-agnostic indexing is a major advancement in database technology, especially for businesses that deal with quickly changing data models. An excellent example of how automatic indexing may streamline development and increase system scalability while maintaining reliable, real-time data access is Azure Document DB.

Survey of Literature:

Over the past ten years, a lot of research has been done on the transition from relational to NoSQL databases. According to Li and Zhao (2020), databases that offer schema flexibility and can expand horizontally are essential for Big Data applications. NoSQL databases, such as document databases, wide- column stores, and key-value stores, became viable substitutes.
In terms of agility, Stonebraker (2017) highlighted that document-oriented databases such as MongoDB and CouchDB enable developers to deal with data models that resemble JSON. These solutions, however, frequently call for manual indexing setting, which adds complexity and increases the possibility of human error.
With Microsoft's Azure DocumentDB, all document fields are automatically indexed using a schema- agnostic methodology. This guarantees that queries stay performant without the need for index definitions, in contrast to other systems. Microsoft's early internal whitepapers also covered their difficulties in creating a multi-tenant, highly consistent system, but there is still a dearth of empirical evidence in independent academic studies in this field, which this article aims to address.

Objectives of the Proposed Research:

purpose of this study is to present a thorough analysis of Azure Document DB's schema-agnostic indexing methodology in light of contemporary cloud-based and real-time applications. The primary goals are as follows:

1. **To Analyse the architectural benefits and trade-offs of schema-agnostic indexing in Azure Document DB: -**

Conventional relational databases are less flexible in settings where data structures change often because they are based on strict, preset schemas. Azure DocumentDB, on the other hand, uses a schema-agnostic design, which lets developers consume JSON documents with different and arbitrary structures.
This goal is to comprehend how this method improves flexibility in agile software development, streamlines development workflows, and lowers upfront design complexity. The study also assesses the system's ability to manage varied data types and deeply nested documents without necessitating schema modifications.
The influence of full-field indexing on system scalability and throughput, possible performance bottlenecks during write-heavy workloads, and extra storage cost from indexing all fields are among the architectural trade-offs that are taken into account.

2 To evaluate the performance impact of automatic indexing under diverse workloads:

All fields in each JSON document are automatically indexed by Azure DocumentDB, eliminating the need for manual index building. This goal aims to quantify the impact of this feature on query response time, document ingestion speed, and system performance in general under various workload scenarios.

Performance testing with different indexing modes is part of the study:

1. Consistent indexing keeps indexes up to date as new data is entered.
2. To enhance write performance, lazy indexing postpones updates.
3. To minimize RU consumption, excluded indexing skips indexing specific fields.
4. It also looks into how indexing impacts resource allocation, particularly in multi-tenant settings, and how it affects system behaviour in situations with high concurrency and high input.

3 To investigate real-world applicability through production use cases and identify operational Challenges:

This goal highlights Document DB's usefulness in actual production systems, even though its automatic indexing is strong in principle.

4 The study looks at use cases in sectors like:-

1. E-commerce, where user sessions and product data are always changing.
2. IoT, where real-time, variable-structured sensor data streams.
3. Finance, where high query performance, auditability, and consistency are essential.
4. The study details how businesses use schema-agnostic indexing to save maintenance costs and facilitate quick iterations**.**

5 Additionally, it outlines typical difficulties encountered during deployment, like:

1. Indexing performance and RU cost are balanced.
2. Controlling the overhead of indexing for big datasets.
3. Adjusting to dynamic surroundings' needs for query optimization.
4. Giving useful insights into operational best practices and areas that require improvement is the aim.

Related Work:

There have been several NoSQL systems that have tried to provide alternatives to strict relational structures.

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For example, MongoDB supports both manual and compound indexing and employs dynamic schemas; nevertheless, performance optimization necessitates human participation. Couchbase does not have automatic full-field indexing, but it does offer document storage with indexing methods.
Key-value and document models are supported by Amazon DynamoDB; however, global secondary indexes require explicit definition. Azure Document DB sets itself apart from the competition by combining multi- region replication, robust consistency, and automatic indexing—features that are uncommon in rival solutions.
Prior studies, including internal case studies from Microsoft, have demonstrated that automatic indexing lowers developer workload and avoids schema-lock problems. This work attempts to address the dearth of external academic evaluations that validate performance under real-time limitations and variable data quantities.

Experimental Setup:

The following experimental conditions and situations were created in order to assess Document DB's indexing **performance and behaviour:**

- Data Ingestion: JSON documents of various sizes and hierarchical structures (1 KB to 50 KB) were simulated to be ingested.
- Index Modes: Excluded (fields not indexed), lazy (delayed index updates), and consistent (default) indexing modes were used to test queries.
- Workload Simulation: To replicate noisy-neighbor effects, concurrent client workloads were simulated across partitions.
- Ingestion throughput, average query latency, index update time, and RU (Request Unit) consumption were all measured as performance metrics.

  The Azure Cosmos DB Emulator and cloud-deployed DocumentDB instances with regional replication enabled were used for these tests. Over 5,000 query runs and 10,000 document insertions, the results were benchmarked.

Early Production Experiences:

Microsoft has implemented document DB, which is currently a component of Azure Cosmos DB, in production settings for enterprise clients in the fields of finance, IoT, and e-commerce. Internal teams have reported the following case studies:

- E-commerce Applications: Dynamic schemas and instant query availability without pre-indexing are advantageous for product metadata, user session tracking, and shopping cart storage.
- Telemetry is continuously sent by IoT devices in nested JSON format. While handling ingestion, document DB permits time-windowed analytics queries.
- Financial Services: document DB provides quick access and unchangeable audit trails for fraud detection and transaction logging.

  Production-related difficulties include:-
- Indexing Overhead: For large or deeply nested documents, full-field indexing results in increased write delay.
- Query optimization: In high-load scenarios, index path exclusions still improve performance optimization even though indexing is automatic.
- Cost management: Since RU charges are linked to both indexing and query execution, cost efficiency requires careful indexing strategy management.

Conclusion:

The schema-agnostic, autonomous indexing engine of Azure document DB is ideal for contemporary applications that need scalability, flexibility, and real-time querying. It supports dynamic and complicated JSON structures and streamlines development by eliminating the requirement for index setting. This solution speeds up development cycles and deployment durations by allowing developers to concentrate on application logic rather than data modelling and performance tweaking.

In this study, we investigated DocumentDB's architecture, emphasizing its capacity to manage semi- structured data at scale via thorough and automated indexing. The system can adjust to a variety of workload patterns, from frequent writes to read-intensive queries, thanks to its support for range-based and hash-based indexing techniques and numerous indexing modes.

To sum up, Azure DocumentDB provides a strong, developer-friendly framework for cloud management of semi-structured and unstructured data. Future improvements might use machine learning models to optimize query paths, automatically identify and exclude low-utility index paths, and provide intelligent indexing recommendations based on workload analysis, as data quantities and complexity continue to increase. These developments will strengthen DocumentDB's standing as a key component of contemporary, data-driven applications.

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Original Article

Effect of Seaweed Extract on Onion under Drought Conditions

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Abstract

Drought stress is a significant constraint on crop productivity, especially in arid and semi-arid regions. Onion (Allium cepa L.) is highly susceptible to water deficits, which impact bulb yield, size, and quality. Seaweed extracts (SWE) have emerged as effective biostimulants, enhancing plant resilience to abiotic stresses, including drought. This study evaluates the role of SWE in improving onion growth under drought stress by analyzing its effects on root development, water retention, photosynthetic efficiency, and nutrient uptake. The results indicate that SWE-treated onions exhibit increased drought tolerance, improved water use efficiency (WUE), and enhanced yield compared to untreated controls.

Keywords: *Seaweed extract, onion, drought stress, biostimulants, water use efficiency, plant physiology*

Introduction

Background on Drought and Onion Cultivation Onion (Allium cepa L.) is an economically valuable vegetable crop with high water sensitivity due to its shallow root system. Drought stress adversely affects growth, leading to reduced leaf area, poor bulb development, and decreased marketable yield. Physiological responses to drought include: Decreased chlorophyll content, impairing photosynthesis.,Leaf wilting due to osmotic imbalance. Reduced root function, affecting water and nutrient uptake.Role of Seaweed Extracts in AgricultureSeaweed extracts (SWE), derived from marine macroalgae, contain bioactive compounds such as:Polysaccharides (alginates, fucoidan, laminarin) – Enhance drought tolerance.Phytohormones (auxins, cytokinins, gibberellins) – Improve root growth and stress resistance.Antioxidants and betaines – Reduce oxidative stress under drought conditions. Studies suggest that SWE application enhances plant resilience, nutrient uptake, and drought tolerance, making them valuable biostimulants in sustainable agriculture. Materials And Methods Experimental Design A randomized complete block design (RCBD) was employed to assess the effect of SWE on onion growth under drought conditions. Treatments

1. Control (T0) –
2. No SWE application.Foliar application (T1) – 3% SWE solution sprayed biweekly.
3. Soil drench (T2) –
4. 2% SWE solution applied to the soil every two weeks.Combined application (T3) –
5. 3% foliar spray + 2% soil drench.
6. Parameters Measured

Physiological traits: Relative water content (RWC), chlorophyll index, stomatal conductance.
Growth attributes: Root length, leaf area, bulb weight.
Yield parameters: Bulb diameter, fresh and dry weight.
Biochemical assays: Antioxidant enzyme activity (SOD, CAT, APX).

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Photosynthetic Efficiency and Chlorophyll Content
SWE-treated onions maintained higher chlorophyll levels compared to controls, preventing early senescence. Chlorophyll content increased by 23% in T1 and 31% in T3, improving photosynthetic efficiency.
Antioxidant Enzyme Activity and Stress Tolerance
Drought stress increased oxidative damage, but SWE treatments enhanced antioxidant enzyme activities, reducing reactive oxygen species (ROS).

Treatment	SOD (U/mg protein)	CAT (U/mg protein)	APX (U/mg protein)
T0 (Control)	8.3	G.5	5.1
T1 (Foliar)	10.1	8.7	G.U
T2 (Soil)	11.3	U.1	7.4
T3 (Combined)	12.8	10.5	8.3

Yield and Bulb Quality
SWE-treated onions exhibited a 17% increase in bulb diameter and 21% higher total yield
Compared to control. The presence of higher sugar content suggested improved metabolic activity under drought stress.

Conclusion
This study demonstrates that seaweed extracts significantly enhance onion resilience to drought stress. The combined foliar + soil application (T3) was the most effective in:
Improving water retention and root growth.
Enhancing chlorophyll content and photosynthesis efficiency.
Increasing antioxidant activity, mitigating oxidative stress.
Boosting bulb yield and quality.
Future research should focus on long-term field trials, economic feasibility, and
Integration with other biostimulants to maximize sustainable agriculture practices.

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Original Article

From Rituals to Realization: Tracing Indian Society's Evolution through 'Vaidya' and 'Avidyā' in the Īśa Upaniṣad

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Abstract:

The Īśa Upaniṣad , one of the Principal Upaniṣads of Hindu philosophy, introduces the seemingly paradoxical concepts of 'Vidyā' (knowledge) and 'Avidyā' (ignorance),not as a oppositional forces but as complementary paths towards ultimate realization. This paper explores the philosophical significance of these concepts within the upaniṣadic framework, focusing on (mantra-9) through (mantra-11).In these verses, the interplay of 'Vidyā' and 'Avidyā' is most explicitly addressed. Though a close reading and contextual analysis, this paper aims to clarify how the simultaneous pursuit of both leads to a holistic understanding of reality and liberation. Avidyā , often associated with empirical or ritual knowledge, and Vidyā, associated with higher metaphysical truth, are shown to function as successive stages or interwoven dimensions of spiritual evolution. Through a careful exegesis of the Sanskrit verses and comparative insights from traditional commentaries, this study reveals how the Upaniṣadic approach offers a non-dualistic vision where worldly engagement and transcendental realization are not in conflict but form complementary paths toward ultimate liberation (moksa). This paper thus highlights the unique synthesis of action and renunciation in the Īśa Upaniṣad, offering a timeless framework for understanding the integration of material and spiritual pursuits. The Īśa Upanishad explores the evolution of Indian society from a primarily ritualistic focus to a realization of spiritual truth through the concepts of Vidyā and Avidyā .This paper will examine how the Īśa Upaniṣad shifts the emphasis from external rituals to internal understanding, ultimately leading to a deeper connection with the divine and a more meaningful life, in the journey towards liberation.

Key words: *Avidyā, Duties , Enlightenment, Ethical living, Īśa upaniṣad, Immortality, Liberation, Renunciation, Rituals, Niskāma karma, Panca-mahāyajñas, Sakāma karma ,Spiritual truth, Vedas, Vidyā.*

The Vedic Context:Rituals and the External Realm:

The scriptures, the vedas prescribes some of the karma as compulsory karma for all people. They come under Panca-mahā-yajñas .They are compulsory for all people who follow the vedic way of life. Panca-mahā-yajñas consists of the following yajñas :deva-yajña or regular worship of Isvara; pitr-yajña or reverential contribution to parents and elders when they alive or they are gone; manusya-yajña or respectful contribution to fellow human beings; Bhuta-yajña or reverential contribution to all the other beings like animals, and plants; and finally brahma-yajña or contribution to the ṛsis who have given us the wonderful vedic tradition. They are compulsory for removing all our past pāpas that are causing pratibandha, obstacles in our life.

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The Vedas points out that these panca-mahā-yajñas can be utilized in two fold forms. One is, they can be done for the sake of material benefits, family benefits, etc. that comes under worldly benefits. And the second way is, it can be done for spiritual growth also which is meant for the well-being of the whole world. When we do them for material benefit, it will come under sakāma –karma and when we do them for spiritual benefit, it is called niskāma-karma. The Upaniṣad points out that ,niskāma-karma is the one which will lead a person to knowledge and moksa.

Thus, the Vedic period in India was characterized by a strong emphasis on ritualistic practices, including elaborate sacrifices and prayers aimed at achieving worldly benefits and pleasing the deities. This period laid the foundation for Indian society's understanding of the divine and its relationship with the human world. But the Upaniṣads, a later period in the development of Indian thought represent a significant shift in focus from the external to the internal. The Īśa Upaniṣad ,in particular, emphasizes the importance of Vidyā (true knowledge),which is the understanding of the ultimate reality, Brahman. This knowledge is not achieved through contemplation, introspection, and a deeper understanding of the self (Atman).

'Vidyā' and 'Avidyā' in theĪṣa Upaniṣad and its reflection for a growing awareness in society:

The Īśa Upaniṣad forms the fortieth chapter of the Vajasaneyi samhita of the Sukla Yajurveda, forming a part of the samhita or mantra. It derives its name from the opening word of the first mantra Īśavāsyaṃ.A short treatise consisting of only eighteen mantras, or verses, it appears to be a very ancient Upaniṣad, as is evidenced by its versification and literary style. This Upaniṣad refers to the supreme being or lord (Ātman) as unembodied, omniscient, beyond approach, without veins, uncontaminated, one who moves and does not move at all, who is far and always near, fixed in his abode and swifter than the mind. Mahatma Gandhi himself considered this upaniṣad as the most important upaniṣad because its wisdom is as if the summary of all. It is the very rule or the way for the attainment of human wisdom. "If all the Upaniṣads and all the other scriptures happened all of a sudden to be reduced to ashes, and if only the first verse in the Īṣa Upaniṣad were left in the memory of the Hindus, Hinduism would live forever."(Mahatma Gandhi)

The 9th, 10th and 11th verse of Īṣa Upaniṣad directly speaks about Vidyā and Avidyā which is the point of my discussion. Now discuss it elaborately and also discuss how Vidyā and Avidyā also reflect a growing awareness in society that both ethical living and spiritual insights are needed.

Verse-9 of Īśa Upaniṣad says, those who follows the path of avidyā ,i.e.(engaged in the practice of rituals mechanically) they enter into binding darkness i.e.(one confined within the egoistic idea of I and mine).But those who follow the path of wisdom (devoid of rituals and realization) they enter into greater darkness .Here ,the problem may be arises in the understanding of the import of this verse .He may be confused to understand that, if one follows ignorance he enters into binding darkness, but on the contrary, if one follows the path of knowledge; how can he enter into greater darkness? So what is required is to understand the inner meaning of these two terms, vidyā and avidyā.

Avidyā, ordinarily means ignorance or the absence of knowledge. In this context, it may mean the absence of self-knowledge. Man takes him as a body-mind complex, identifying him with his body and mind; he wants to satisfy the desires of his senses. For the fulfilment of his desires, he follows the rituals described by the scriptures blindly and mechanically .As a result of which, he becomes a victim to the vicious circle of death and birth. He fails to get the knowledge of the self. Avidyā here means, following of the works or rituals prescribed by the scriptures mechanically. The mechanical practice of rituals for the fulfilment of sensual desires leads one to selfishness and egoism which is compared with darkness.

On the other hand, Vidyā ordinarily means wisdom or the knowledge of the self. But in this context, the inner meaning of Vidyā is theoretical knowledge of the self, without proper realization and lack of practice of rituals. Blind adherence to wisdom without proper understanding or realization does not help to achieve the goal, rather goes in vain, which is called entering into greater darkness. Radhakrishnan has rightly remarked "selfish seekers of spiritual wisdom miss their aim."

Saṇkara's interpretation of this verse seems to be very significant. He interprets 'The proper knowledge (vidyā) is the knowledge of the self i.e. 'I am Brahman.' Those who utter this statement without realizing the significance of the statement, they are in no way superior to those who do not know this statement. So, mere awareness of the knowledge without its proper realization leads to greater darkness as compared to the darkness possible in the absence of the knowledge'.

Scholars say that, there is difference of result obtained from knowledge and from ignorance. Thus we have heard from those who have explained to us these. The Scholars and wise people (realized beings)have told to us, 'If one follows the path of avidyā, i.e. blind practice of rituals for the gratification of his selfish desires then he goes away from the goal of attaining self- knowledge. On the other hand, one who follows the path of vidyā,i.e.

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following wisdom or self-knowledge without its proper realization which produces more dangerous result. Since the possibility of attainment of his self-knowledge becomes delayed to a greater extent. (verse-10).

Thus, we see from verse9 and 10 that, the result of vidyā and avidyā is different if they are followed separately. But in (verse-11),it is stated that if one follows both vidyā and avidyā together then he will get benefit of both liberation and bliss .But here the question arises, how avidyā helps one to get liberation? As earlier explained in verse9 and 10, the word Vidyā and Avidyā have special meaning here in Īsopaniṣad. In the path of Avidyā, one performs rituals blindly for the gratification of his sensual desires and in the path of Vidyā ,one follows wisdom of self-knowledge without its realization .Here too the motive is to go heaven. In both the paths the motive is to achieve the personal gain for which one suffers. But for liberation and bliss one has to give-up the desire of fruits of his action,i.e. sensual enjoyment or attainment of heaven. But when one follows both the paths i.e. engaging himself in the performance of obligatory actions without any attachment to their fruits, they help purifying the mind which in a gradual process leads to liberation. Thus, practice of rituals (works) and worship (wisdom devoid of realization and practice) together is a path to gradual liberation. This path is recommended by Saṇkara for those who are not yet ready to renounce.

From the above discussion, we see that, rather than viewing these two vidyā and avidyā as absolute opposites, the Upaniṣad proposes a complementary relationship between them. This perspective provides valuable clues about the changing spiritual, social and intellectual climate of ancient India. The Īśa Upaniṣad acknowledge 'avidyā' as , 'by avidyā one overcomes death'. This shows that, Indian society values avidyā (ritual knowledge) as a way to maintain order, social structure, and continuity. On the other hand, the Upanishad acknowledges vidyā as the pursuit of spiritual truth and the realization of the self (Ātman). The Upaniṣad says that, 'By Vidyā one attains immortality'. This illustrates society's move from external, ritual-based religion toward internal, contemplative spirituality.

The Īśa Upaniṣad does not reject avidyā in favour of vidyā completely. Instead, it insists that both must be pursued together to attain full liberation. This reflects a key stage in Indian society's historical evolution: the attempt to balance worldly duties (pravṛtti) with renunciation and spiritual seeking (nivrtti). Rather than encouraging renunciation alone, the upaniṣad proposes a harmonious model in which individuals can live in the world, perform their duties (karma), and yet seek the highest truth. This marks an advance stage of thought where society seeks a middle path-valuing both material and spiritual knowledge.

The integration of vidyā and avidyā also reflects a growing awareness in society that both ethical living and spiritual insight are needed. While avidyā governs right action in the world,vidyā brings understanding of the eternal, Indian society thus began to evolve toward a model that valued ethics, detachment and unity with the cosmos not just material success.

Footnotes:

1. Īśā vāsyamidaṃ sarvaṃ yatkiñca jagatyāṃjagat,tena tyaktena bhuñjithā mā gṛdhah kasyasviddhanam.(verse-1)
2. Andhaṃ tamah praviśanti ye'vidyāmupāsate,tato bhūya iva te tamo ya u vidyāyām ratāh.(verse-9)
3. Anyadevāhurvidyayā' nyadhāhuravidyayā,iti śuśruma dhirānām ye nastadvicacakṣire.(verse-10)
4. Vidyāṃ cavidyāṃ ca yastadvedobhayaṃsaha,avidyaya mṛtyuṃ tirtvā vidyayā mṛtamaśnute.(verse-11)

Conclusion:

The Īśa Upaniṣad ,through its profound message of vidyā and avidyā, captures a critical moment in the historical evolution of Indian society. It reflects the transition from external ritualism to internal realization, from social duty to spiritual freedom, and from blind action to conscious harmony. This dual path philosophy encouraged a balanced and mature society that sought not just material or spiritual success, but a unifying vision of life that embraced both. By emphasising vidyā and acknowledging the role of avidyā, the upaniṣad provides a roadmap for individuals seeking liberation and enlightenment. Its teachings continue to resonate with those seeking a more meaningful and fulfilling life, guiding them towards a deeper understanding of their true selves.

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Original Article

The role of DNA evidence in criminal trials

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Abstract

DNA evidence has become a cornerstone in modern criminal justice systems, offering an unparalleled level of accuracy in identifying suspects and exonerating the innocent. This paper explores the evolution, application, and impact of DNA evidence in criminal trials. It examines how DNA profiling has transformed investigative procedures, improved conviction rates, and addressed wrongful convictions. The reliability, admissibility, and ethical concerns surrounding DNA evidence are analysed through key legal precedents and scientific advancements. Additionally, the paper discusses the challenges related to contamination, privacy, and the interpretation of complex genetic data in the courtroom. As forensic science continues to evolve, DNA evidence remains a powerful yet nuanced tool that requires careful application to ensure justice is served. This study underscores the need for standardized practices, ongoing training for legal professionals, and public awareness to fully harness the potential of DNA in the pursuit of justice.

Keyword: *DNA, reliability, admissibility, genetic, forensic science*

Historical Background of DNA Test Evidence in Criminal Law

The use of DNA as evidence in criminal law is a relatively recent development, yet it has significantly reshaped forensic science and the legal system.

The scientific foundation for DNA profiling was established in 1984 by British geneticist **Sir** Alec Jeffreys, who discovered that individuals have unique DNA patterns that can be identified through a process called DNA fingerprinting. This breakthrough provided a new tool for identifying individuals with high accuracy, based on biological samples such as blood, semen, hair, or skin cells.

The first use of DNA evidence in a criminal case occurred in 1986 in the United Kingdom, when it was used to exonerate a wrongfully accused man and subsequently convict Colin Pitchfork for the rape and murder of two teenage girls. This landmark case demonstrated the power of DNA evidence to both incriminate and exonerate, setting a precedent for its future use.

In the United States, DNA evidence was first admitted in court in 1987 during the case People v. Wesley in New York. As DNA testing technology advanced, it quickly gained credibility and acceptance in legal systems worldwide. By the 1990s, the establishment of national DNA databases, such as the FBI's Combined DNA Index System (CODIS), enabled law enforcement agencies to store and compare DNA profiles on a massive scale.

Over the decades, DNA evidence has been instrumental in solving cold cases, confirming guilt, and overturning wrongful convictions. Organizations like the Innocence Project have used DNA testing to exonerate hundreds of individuals, highlighting the technology's role in correcting miscarriages of justice.

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Definition of DNA in Relation to Criminal Law

Deoxyribonucleic acid (DNA) is the hereditary material found in nearly all living organisms, carrying the genetic instructions that determine individual characteristics. In the context of **criminal law**, DNA refers to the unique genetic code present in biological evidence—such as blood, saliva, semen, skin cells, or hair—left at crime scenes.

In criminal investigations and trials, **DNA evidence** is used to:

- ⇒ **Identify suspects** by matching their genetic profile to evidence found at the scene.
- ⇒ **Exclude individuals** who are not linked to the crime.
- ⇒ **Establish relationships**, such as between a suspect and a victim.
- ⇒ **Reopen cold cases** or review past convictions where DNA analysis was not previously available.

Because each person's DNA is unique (except identical twins), it serves as a highly reliable form of **forensic identification**, often referred to as a "genetic fingerprint." In legal proceedings, DNA evidence can play a critical role in both **prosecution** and **defense**, aiding in the accurate determination of guilt or innocence.

Despite its accuracy, the history of DNA evidence also includes debates over privacy, racial bias in database inclusion, and the need for rigorous standards in evidence collection and analysis. Nevertheless, DNA testing remains one of the most transformative developments in forensic and criminal law.

DNA evidence has become a crucial tool in criminal investigations and trials, revolutionizing forensic science and the criminal justice system. **Its significance in criminal trials can be attributed to several key factors:**

1. **Accuracy and reliability:** DNA evidence provides a high degree of accuracy in identifying individuals, with the probability of a random match being extremely low.
2. **Linking suspects to crime scenes:** DNA samples collected from crime scenes can be compared to suspects' DNA profiles, potentially placing them at the scene or linking them to physical evidence.
3. **Exonerating the innocent**: DNA evidence has played a pivotal role in exonerating wrongfully convicted individuals, leading to the overturning of numerous convictions.
4. **Cold case resolution:** DNA databases have enabled law enforcement to solve cold cases by matching crime scene evidence to profiles of known offenders.
5. **Admissibility in court**: DNA evidence is generally considered admissible in court due to its scientific validity and reliability.
6. **Deterrent effect:** The existence of DNA evidence may deter potential offenders from committing crimes, knowing they could be easily identified.
7. **Corroborating other evidence:** DNA evidence can strengthen or corroborate other forms of evidence presented in criminal trials.
8. **Identifying unknown victims:** In cases involving unidentified victims, DNA analysis can help establish their identity.

I) Forensic Science Collaboration with DNA Evidence

Forensic science plays a crucial role in criminal investigations by applying scientific methods to analyze physical evidence. One of the most powerful tools in this field is **DNA analysis**, which allows forensic experts to connect biological evidence to individuals with a high degree of accuracy.

In practice, **forensic scientists collaborate with DNA evidence** in the following ways:

1. **Collection of Biological Samples**

   At crime scenes, forensic teams carefully collect DNA-containing materials—such as blood, saliva, semen, hair, or skin cells—using sterile tools and procedures to avoid contamination.

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2. **DNA Extraction and Profiling**
   In the laboratory, forensic scientists extract DNA from the collected samples. They then generate a **DNA profile**, a unique genetic pattern that can be compared with known samples from suspects, victims, or national DNA databases.
3. **Comparison and Matching**
   The DNA profile from the crime scene is compared with profiles of potential suspects. A **match** can strongly indicate involvement in the crime, while a **mismatch** can rule out a suspect.
4. **Validation and Interpretation**
   Forensic experts interpret DNA results, taking into account factors like sample quality, partial profiles, or mixed DNA sources. They must also ensure the evidence meets legal standards for admissibility in court.
5. **Court Testimony**
   Forensic scientists often present their findings in court as expert witnesses, explaining how DNA evidence was collected, tested, and interpreted, helping judges and juries understand its relevance.

Through this collaboration, forensic science helps transform DNA evidence into reliable and scientifically-supported proof that can be used to convict the guilty or exonerate the innocent.

However, the use of DNA evidence in criminal trials also presents challenges:

1. **Interpretation complexities**: DNA analysis results can be complex, requiring expert testimony to explain their significance to juries.
2. **Contamination risks:** Improper collection, storage, or handling of DNA samples can lead to contamination, potentially compromising the evidence.
3. **Privacy concerns:** The collection and storage of DNA profiles in databases raise privacy issues and concerns about potential misuse.
4. **Overreliance:** There is a risk of overreliance on DNA evidence, potentially overshadowing other forms of evidence or investigative techniques.
5. **Resource limitations:** DNA analysis can be time-consuming and expensive, potentially leading to backlogs in crime laboratories.
6. **Ethical considerations:** The use of familial DNA searching and genetic genealogy databases in criminal investigations raises ethical questions about privacy and consent.

Landmark Judgment in court of law about DNA evidence played crucial role in India

1. **The Nandini Satpathy v. P.L. Dani (1978) - Role in Admissibility of DNA Evidence**

Though not primarily about DNA evidence, this case laid down principles for **admissibility** of scientific evidence. The Supreme Court stated that for scientific evidence to be admissible in Indian courts, it must meet the following criteria:
It must be relevant to the case.
It should be derived from reliable and accepted scientific methods.
The evidence should have been handled and stored appropriately to ensure its integrity.
This judgment provided the legal foundation upon which DNA evidence was eventually accepted, once forensic science, including DNA profiling, was recognized as a valid and reliable method of gathering evidence in criminal trials.

Conclusion

DNA evidence has revolutionized criminal trials by providing a highly reliable scientific method for identifying perpetrators and exonerating the innocent. Its precision and objectivity have enhanced the fairness and accuracy of judicial outcomes, making it a powerful tool in the pursuit of justice. However, the effectiveness of DNA evidence depends on strict adherence to proper collection, handling, and interpretation protocols. While its use has led to the resolution of many complex cases and the correction of wrongful convictions, it also raises important ethical and legal concerns, particularly regarding privacy, consent, and potential misuse. As forensic technologies continue to evolve, the legal system must ensure that the use of DNA evidence is guided by rigorous standards, continuous oversight, and a commitment to safeguarding individual rights. Ultimately, DNA evidence should serve not just as a tool for conviction, but as a means to uphold justice with integrity and accountability.

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Original Article

The Banking Ombudsman Scheme - Relevance and Significance in the E-Banking System

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Abstract

In the present digital age, we are relying more on internet banking and digital banking facilities that have made our daily lives even simpler and easier. Customers are doing paperless banking and availing benefits of banking activities in the trend of digital banking. In banking systems, a digital platform called e-banking, often known as electronic banking, enables users to access and manage their financial transactions online. The banking sector has seen a substantial transformation due to technology and artificial intelligence. Fortunately, e-banking has improved accessibility, efficiency, and convenience for both banks and customers. The rising usage of internet banking has created a tussle between customers and bankers relationships more particularly about deficiency in services. Reserve Bank of India has launched a very optimistic scheme named as Ombudsman Scheme, 1995 to resolve the banker-customer issues pertaining to various services of banks. The paper aims to critically analyse the relevance and significance of the banking ombudsman scheme in the e-banking systems. The paper further highlights the integration of three different ombudsman schemes into a consolidated one named as 'The Reserve Bank- Integrated Ombudsman Scheme, 2021.

Introduction

The word "ombudsman" is derived from the word "ombud," which means "proxy attorney." Many complaints were made every day about the Indian banking system's inconsistent services. As a result, it became apparent that the banking industry needed change. As a result, a panel led by Sh. R.G. Saraiya and followed by Sh. R.K. Talwar was established, and they provided 172 proposals for enhancing banking sector services. Then, the Narsimhan Committee gave final submissions titled "The Banking and Financial Sector Reforms, 1991 under which the areas of deficiency were analysed critically and ultimately. The Banking Ombudsman Scheme [1] was introduced in 1995. The scheme's introduction was intended to give customers a quick and efficient forum for grievance resolution, one that would also safeguard their interests and resolve complaints in a timely manner, fostering a positive rapport between banks and their clients. The scheme was introduced by the Reserve Bank of India (RBI) under the Banking Regulation Act [2]. Under the scheme, a person known as a banking ombudsman is appointed for the redressal of complaints from customers. Initially, the banking ombudsman was appointed in only three centres all over the country, but at present, the number of ombudsmen has gone up to 22 as the business has expanded over the past two decades.

Historical background

After being introduced in 1995, the program was amended in 2002 and Regional Rural Banks were included in the scheme. Additionally agreed was permission for the apex bank to examine judgments rendered against banks. In 2005, another amendment came, under which credit cards were brought under the purview of the scheme and were considered as a deficiency in service along with the delay in the delivery of bank services. It was added that the banks will be held liable for the promises made by the sales agents of the banks but were left unfulfilled by them.

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The year 2006[3] brought in a new era in the banking industry's platform for problem-solving. A new plan, introduced in 2006, replaced the prior 1995 plan that had been repealed. Commercial banks and scheduled primary commercial banks were included in the 2006 Ombudsman Scheme along with other modifications to the prior scheme. Also, it was stated that all banks must make clear the key elements of this program on their official websites, brochures, etc. so that the general public is aware of it.

Another clause was added to the 2006 scheme in the 2007 amendment,[4] which stated that when the banking ombudsman rejects the customer's complaint regarding a matter falling under the grounds of complaint listed under the scheme, the customer has the right to appeal the decision to the deputy governor of the Reserve Bank of India.

Internet banking and deficiency arising out of Internet banking were also brought under the purview of the scheme in the amendment of 2009[5] along with provisions regarding strict adherence to banking codes and the standard of India.

The last amendment to widen the scope of The Banking Ombudsman Scheme, 2006 was introduced in the year 2017[6] under which various other services were included by the banks like the sale of insurance, mutual funds, and other third-party investment products. Any deficiency arising out of these services will be dealt with by the banking ombudsman. Now, a customer can also file a complaint against the bank if the bank is not adhering to the instructions given by the apex bank regarding mobile banking and electronic banking services in India. Further, pecuniary jurisdiction has been increased to twenty lacs rupees. This is the pecuniary jurisdiction of the ombudsman to pass an award. Provision for compensation has been provided.

Complaint Mechanism Under the Scheme

Under the scheme, it has been stated that the banking ombudsman is appointed for a maximum of three years for the rank of Chief General Manager or General Manager.[7] The ombudsman's power and jurisdiction have since been defined. The banking ombudsman's geographic and financial jurisdiction is set forth by the apex bank. The ombudsman has been given the authority to accept and consider client complaints about shortcomings in banking services. If a complaint is not resolved through an agreement within a month, an award is made instead. Such complaints are resolved through agreements. General powers of superintendence and control are exercised over the office. An annual budget is required to be made with the consultation of the apex bank and the power of expenditure is exercised based on that budget. The ombudsman cannot pass an award beyond its jurisdiction.

As regards the complaint, there are three main requirements such as facts giving rise to the complaint, the amount of loss suffered, and the relief which is sought by the customers.[8] The relief as mentioned could be directions to summon for information[9] or a fair settlement reached by an agreement, and compensation would be the ultimate form of relief. The compensation may be granted considering the complainant's lost time, expenses incurred, and harassment and mental anguish endured by the complaint.[10]

The parties come to a mutual agreement to resolve the conflict, which may be accomplished through mediation or conciliation. The process is swift, proper, and concise in character. Not every complaint must be answered by the ombudsman; some are also dismissed.[11] When an ombudsman's judgment leaves a complainant unsatisfied, they now have the option to submit an appeal before the appellate authority within thirty days of the day they received their award or learned their complaint had been rejected.[12] The appellate authority to hear appeals has been designated as the Deputy Governor of the Reserve Bank of India.

The banking ombudsman is bound to comply with the directions, notices, rules, and regulations of the Reserve Bank of India.[13] An appeal was filed against an award made by the banking ombudsman and the Supreme Court held as follows:"Since, an Ombudsman is appointed by the Scheme framed under Section 35 A of the Banking Regulation Act, 1949, he is obliged to comply with the directions/circulars and notifications issued by the Reserve Bank of India under Section 35 or 21 of the Act. He is also required to issue directions to Banks, based on those directions/circulars and ensure their compliance. The learned Ombudsman could not have ignored the circulars and directions while dealing with the complaint filed by the respondent."[14]

Accomplishments and Gaps in the Scheme

The banking ombudsman's jurisdiction and scope have been expanded over the course of the scheme's two-and-a-half-decade operation to previously unreachable places. One of the key accomplishments is that there are now twenty-two banking ombudsman in twenty-two capital cities of India, compared to just three in three major cities in 1995. The scope of the scheme has been increased, allowing an increasing number of consumers to benefit from a time- and money-efficient, well-established grievance redressal method. Moreover, the initial inclusion only included commercial banks and scheduled primary cooperative banks with operations in India. The recruiting and funding of the scheme are other priorities for the apex bank. Online filing is available for both appeals and complaints. Thus, it takes less time and is more economical. The mechanism described above demonstrates how much less complicated the complaint redressal forum under the scheme is than any other complaint redressal forum in any other sector. Since the program is run directly between clients and banks under the direction of the Reserve Bank of India, there is absolutely no influence from the government, which helps to avoid pointless delays.

The complaints received during the year 2019-20 recorded an increase of 57.54% as compared to the previous year 2018-19. Out of these, 85.65% of complaints were received electronically. The disposal rate was a good 92.36%

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which was almost 2% less than the previous year, but it is understandable that due to the pandemic and increase in complaints, proper working hours could not be put in. The number of appeals received decreased from 78 in 2018-19 to 63 in the year 2019-20. The average cost of handling a complaint decreased by 23.31%, from 13,145/- in 2018-19 to 22,412/- in 2019-20.[15] The reduction was mainly due to the handling of an increased volume of complaints by the office of the banking ombudsman with the same level of resources as available during the previous year.[16]

The strategy has been successful thus far, according to the facts and points mentioned above. Nonetheless, because of some gaps, there is room for improvement much more than usual.Customers are at risk of being taken advantage of because complainants have no control over the investigation of a matter, the Ombudsman could issue a false or misleading report, or they could choose not to take a complaint seriously. Since complainants must wait for about a month after filing a complaint, this would mean that month was wasted with no resolution.

As per the scheme, the award given by the banking ombudsman is not binding[17] and the bank can decide not to comply with it. In such a case, the complainant/customer will have no other option, but to reach the civil court and go through the litigation to get relief as justice was not guaranteed.

The Reserve Bank – Integrated Ombudsman Scheme, 2021

The Reserve Bank of India launched a "one nation, one ombudsman" strategy at the beginning of 2021 for the resolution of customer grievances. RBI integrated its three erstwhile Ombudsman Schemes viz. (i) the Banking Ombudsman Scheme, 2006, (ii) the Ombudsman Scheme for Non-Banking Financial Companies, 2018, and (iii) the Ombudsman Scheme for Digital Transactions, 2019, into one Scheme - 'The Reserve Bank - Integrated Ombudsman Scheme, 2021 (the Scheme / RB-IOS, 2021)' with effect from November 12, 2021. The Scheme simplifies the grievance redress process at RBI by enabling the customers of Regulated Entities (REs) like banks, Non-Banking Financial Companies (NBFCs), Payment System Participants (PSPs) and Credit Information Companies to register their complaints at one centralised reference point. The objective of the Scheme is to resolve the customer grievances involving 'deficiency in service' on part of REs in a speedy, cost-effective, and satisfactory manner.In addition to integrating the three existing schemes, the Scheme also includes under its ambit additional regulated entities (Res) namely, Non-Scheduled Primary (Urban) Co-operative Banks with a deposit size of ₹50 crore and above and Credit Information Companies. The Scheme adopts the 'One Nation One Ombudsman' approach by making the RBI's Ombudsman mechanism jurisdiction neutral.

Regulated Entities (Res) to be covered under the RB-IOS, 2021

Banks: All commercial banks, including Public Sector Banks, Private Sector Banks, Foreign Banks, Local Area Banks, Small Finance Banks, Payment Banks, Regional Rural Banks, Scheduled Primary (Urban) Co-operative Banks and Non-scheduled Primary (Urban) Co-operative Banks with deposit size of ₹50 Crore and above, as on the date of the audited balance sheet of the previous financial year; NBFCs registered with RBI: All Non-Banking Financial Companies (excluding Housing Finance Companies) which (a) are authorized to accept deposits; or (b) have customer interface, with an assets size of ₹100 crore and above as on the date of the audited balance sheet of the previous financial year. However, Core Investment Companies, Infrastructure Debt Fund-Non-banking Financial Companies, Non-Banking Financial Companies-Infrastructure Finance Companies, companies in resolution or winding up / liquidation, or any other NBFC specified by RBI are excluded from the ambit of the RB-IOS, 2021.

System Participants: All Payment System Participants - banks as well as non-banks regulated by RBI are covered under the RB-IOS, 2021. These entities issue Prepaid Payment Instruments (PPIs) and facilitate transactions over National Electronic Funds Transfer (NEFT) / Real Time Gross Settlement (RTGS) / Immediate Payment Service (IMPS) / Unified Payments Interface (UPI) / Bharat Bill Payment System (BBPS) / Bharat QR Code / *99# mobile transaction service using Unstructured Supplementary Service Data (USSD) / Aadhaar Enabled Payment System (AePS), etc.

Credit Information Companies: All Credit Information Companies as defined in the Companies Act, 2013 (18 of 2013) and granted a Certificate of Registration under sub-section (2) of section 5 of the Credit Information Companies (Regulation) Act, 2005 (30 of 2005)

Relevance of the Scheme in the e-Banking System

The Reserve Bank - Integrated Ombudsman Scheme, 2021 plays a crucial role in the e-banking system. It is highly relevant in e-banking and today's technology driven banking landscape. Considering the fast development of digital transactions, fintech innovations and artificial intelligence powered banking, it ensures customer protection and grievance redressal in digital financial transactions in the following ways:

Addresses Digital Transaction Issues: The scheme integrates the Ombudsman Scheme for Digital Transactions (2019), making it easier for customers to report issues related to UPI, mobile banking, internet banking, and digital wallets.

Simplified Complaint Process: Customers facing problems with failed transactions, unauthorized debits, or service deficiencies can file complaints online without worrying about jurisdiction.

Regulation of Payment System Participants: It covers banks, NBFCs, and payment service providers, ensuring that digital financial services are transparent and accountable.

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Centralized Redressal Mechanism: Complaints are processed at a Centralized Receipt and Processing Centre, making resolution faster and more efficient.
Consumer Protection in Digital Banking: The scheme ensures that customers are compensated for financial losses due to service failures, reinforcing trust in e-banking.

Significance of the Scheme

Due to rise in customer complaints relating to UPI payments, mobile banking, online transactions, failed online transactions, unauthorised debits, etc., The Reserve Bank - Integrated Ombudsman Scheme, 2021 (RB-IOS, 2021) has simplified the processes, centralized the receipt of physical and email complaints, brought more Regulated Entities (REs) under its ambit. This scheme has done away with the limited grounds of complaints and different jurisdictions of Ombudsmen and now all complaints involving deficiency in services are covered under RB-IOS. Complainants can lodge their complaints against an RE on the twenty-four hours of all seven days online CMS portal of RBI or send their complaint in email/physical form to Centralised Receipt and Processing Centre (CRPC). Salient benefits [18] for the complainant arising from the RB-IOS with upgraded CMS portal are as under:

i. Simplification in the process of filing the complaint on CMS portal;
ii. A complaint can be filed on CMS portal/ CRPC from anywhere in the country irrespective of the address of the **Complainant, RE or branch involved;**
iii. One address and one email for lodging of physical/ email complaints from anywhere in the country;
iv. Automatic acknowledgement to the complainant on registration of online complaint;
v. Facility for real-time tracking of the status of complaint;
vi. Convenience from 'One Nation One Ombudsman' approach;
vii. Facility for online submission of additional documents on the CMS itself;
viii. Detailed letter intimating decision/ closure of complaint;
ix. Facility for online and voluntary feedback submission by the complainant regarding redress provided by RBI.

Roles and Responsibilities of Banking Ombudsman

As it is said that with power comes responsibilities, the Reserve Bank - Integrated Ombudsman Scheme, 2021 has empowered the Ombudsman with certain roles and responsibilities to redress complaints from customers of regulated entities against deficiency of services. Presently offices of RBI ombudsmen are functioning from 22 locations across India. The following are the roles and responsibilities of banking ombudsman:
Handling deficiencies: A banking ombudsman handles complaints pertaining to non-acceptance of small denomination notes and coins, failure to issue drafts, pay orders, bankers' checks, and other similar concerns.
Acts as an arbitrator: In cases involving grievances such failing to follow the Fair Practice Code, rejecting requests to open bank accounts without a good cause, charging clients without warning, etc., a banking ombudsman serves as a mediator.
Protects the right: The associated ombudsman ensures that the banks are adhering to all policies. He oversees the civil administration to safeguard the rights of citizens.
Action against misconduct: An ombudsman holds discretionary powers to exercise in case of misconduct, corruption, or negligence by the bank authorities.
Investigation: An essential function of a banking ombudsman is to examine the matter. He has the authority to demand information from banking officials and compensates to the aggrieved.

Conclusion

With the development of technology and the appearance of new hazards and difficulties, the legal framework governing e-banking is continuously changing. Typically, the legal framework of e-banking is composed of a variety of national and international laws and regulations, business norms and best practices, and contractual agreements between banks and their clients. In general, the legal framework of e-banking is crucial for maintaining customer confidence in electronic banking services and for facilitating the expansion and development of the digital economy.
Electronic banking has existed in India for almost three decades now, yet it is regulated by various statutes and schemes as enforced by the legislatures and the regulations and guidelines as published by the Reserve Bank of India from time to time. However, as only amendments were made in the then existing statutes to make them more relevant and applicable to electronic banking and all its aspects, there is chaos, irregularities, overlapping and disconnect between the various provisions of the different statutes which when adjudicated lead to more time consuming litigation as all the cases and issues cannot be solved by the banking ombudsman, which is the special authority created to deal with the complaints and grievances of the customers against the banks and banking institutions.
The Reserve Bank of India's "one nation, one ombudsman" strategy initiated in 2021 for the resolution of customer grievances will house the ombudsman for both the banking and non-banking financial companies in one location. However, banking ombudsman cannot adjudicate and preside over the criminal cases originating from the electronic banking and its users as the same comes under the jurisdiction of the district courts or other relevant courts.

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Original Article

Uses and Benefits of Artificial Intelligence in Modern Library Management

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Abstract:

This research paper delves into the evolving role of Artificial Intelligence (AI) in transforming library management practices in digital age. With technologies like machine learning, natural language processing, and predictive analytics, AI is reshaping how libraries operate-making processes faster, smarter, and more user-centric. From automated cataloguing and intelligent search features to personalized recommendations and virtual assistants, AI tool are helping libraries offer more efficient and tailored services. Using a mixed-methods research approach that includes surveys, interviews, case studies, and data analysis, and the study captures real-world insights from librarians, AI professionals, and users. The finding show that AI simplifies repetitive tasks such as tracking inventories, managing fines, and handling user queries, freeing up staff time for more meaningful engagement and planning. The paper also explores how AI contributes to inclusivity by enhancing accessibility features, such as voice-based navigation and language translation tools. At the same time, it critically examines the challenges of integrating AI, such as concerns about data privacy, potential algorithmic bias, high implementation costs, and the need to maintain a balance between automation and human interaction. Ultimately, the study emphasizes that while AI can significantly improve the efficiency and reach of library services, human librarians remain essential. Their expertise and judgment are vital in ensuring that libraries stay ethical, responsive, and inclusive in the face of rapid technological change.

Keywords: *Artificial Intelligence, Library Management, Automation, Information Retrieval, Personalized Services*

Introduction:

The 21st century's rapid technological growth has had a big impact on a lot of different areas, including library administration. One of the most revolutionary factors in transforming library operations and services is artificial intelligence (AI). Libraries are incorporating AI technologies to improve user experiences, optimise resource management, and expedite operations. Libraries, which are traditionally seen as repositories of knowledge, are increasingly adopting AI to manage vast amounts of data, provide personalized services, and ensure seamless information retrieval. AI's applications in modern library management span across numerous aspects, including automated cataloguing, improved search functionalities, personalized book recommendations, and efficient management of library resources. The overall experience of library users is being improved by using machine learning algorithms, natural language processing, and predictive analytics to deliver more personalised and user-friendly services. AI also has a lot to offer libraries in terms of data management, enabling them to manage massive amounts of digital information, monitor consumption trends, and forecast future developments to make better decisions. Even while AI has the potential to completely transform the library industry, there are still obstacles to overcome, such as the requirement for appropriate training, worries about data privacy, and implementation costs. Despite these hurdles, the use of AI in libraries is growing rapidly, with significant potential for future development. This paper explores the uses and benefits of AI in

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modern library management, discussing how it enhances Operational efficiency, improves accessibility, and fosters a more personalized and user-centered approach to library services. By looking at these advancements, the study hopes to show how AI might continue to influence libraries' futures in the digital era.

Objective of Research:

1. To investigate the advantages and applications of artificial intelligence (AI) in contemporary library administration.
2. To recognise and evaluate the several AI tools and technologies, such as machine learning, natural language processing, and predictive analytics, that are currently being used in library administration.
3. To look into how AI is improving library operations by automating repetitive processes like resource management, information retrieval, and cataloguing.
4. To explore how AI contributes to creating personalized library services for users, including tailored book recommendations, improved search functionalities, and user-centered information retrieval systems.
5. To assess how AI aids in the management of large volumes of digital and physical resources, supporting decision-making processes and optimizing library resource allocation.

Literature Review:

In recent years, there has been a lot of scholarly interest in the use of artificial intelligence (AI) to library management, with many studies examining its revolutionary effects. Libraries' resource management and patron interactions are changing as a result of artificial intelligence (AI) technology like machine learning, natural language processing, and automated decision-making systems. Zhang and Li (2018) examined the application of machine learning for cataloguing and classification, finding that AI-driven systems can automate indexing, improve search functionalities, and reduce manual labor, leading to greater efficiency. Gupta and Kumar (2019) highlighted the role of AI-powered tools, like semantic search engines, which enhance the precision of search results by better understanding user queries and preferences. Smith et al. (2020) explored AI-driven recommendation systems, noting their ability to provide personalized suggestions, boosting user engagement and resource utilization. Chen and Yang (2021) investigated AI's role in resource management, emphasizing its ability to optimize inventory, improve book circulation, and support data-driven decisions for collection development. Jones and Patel (2022), however, highlighted the necessity of openness and responsible design in their discussion of the ethical issues surrounding AI in libraries, including algorithmic bias and data privacy. All things considered, AI has a great deal of promise to enhance library operations and services; yet, its integration necessitates careful consideration of privacy, expenses, training, and ethical issues.

Research Methodology:

This study investigates the use and benefits of Artificial Intelligence (AI) in modern library management using a mixed-methods approach. It uses surveys, interviews, case studies, and statistical analysis to gather insights from stakeholders, including library professionals, AI experts, and users. The research design is descriptive and exploratory, focusing on the current state of AI use in libraries and potential opportunities and challenges. However, the study may exclude libraries that have not implemented AI and may face challenges in obtaining a diverse user sample.

Uses and Benefits of Artificial Intelligence in Modern Library Management:

Through the introduction of creative solutions to enhance productivity, user experience, and resource management, artificial intelligence (AI) has completely transformed library administration. Key uses of AI in modern library management include automated cataloguing and classification, intelligent search and discovery, personalized recommendations, chatbots and virtual assistants, predictive analytics for resource management, enhanced user experience, automation of administrative tasks, improved data security, digital and smart libraries, and improved decision-making and resource allocation. Natural language processing (NLP) and machine learning techniques are used in automated cataloguing and classification to evaluate content and place items into the proper categories. This reduces the need for manual cataloguing and ensures that the library's catalog is always up-to-date. Intelligent search and discovery use AI-powered search engines to provide more accurate and efficient results, based on user queries and past searches.

Personalized recommendations are another key benefit of AI. Based on user preferences, search history, or demographic information, AI algorithms can suggest books, articles, journals, or other resources, promoting interaction and assisting users in finding new content. Chatbots and virtual assistants help customers in real time by assisting with routine enquiries, navigating the catalog, and checking out items. Predictive analytics help libraries optimize their collections and determine the best time to acquire new resources or weed out outdated ones. This helps libraries make more informed decisions about resource acquisition, staffing,and other aspects of library management. AI also enhances user experience by providing more intuitive interfaces, simplifying searches, and allowing better navigation through the library's resources. Tools like voice recognition or personalized user interfaces create a more accessible and engaging environment for diverse users, including those with disabilities or non-technical backgrounds.

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Automation of administrative tasks, such as inventory control, document retrieval, scheduling, and record-keeping, allows library staff to focus on more critical functions like user engagement, educational programs, and research support. Improved data security is achieved by monitoring access to sensitive information and detecting unusual activity.By automating cataloguing, searching, resource recommendations, boosting user experience, automating administrative duties, and improving decision-making and resource allocation, artificial intelligence (AI) plays a critical role in modern library management.

Benefits of AI in Library Management:

By automating tedious operations, increasing productivity, and lowering staff workload, artificial intelligence (AI) has the potential to completely transform library management. Over time, AI can lower expenses related to resource allocation, data management, and manual labour, even with initial large investments. It also enhances accessibility by providing more inclusive services, such as voice-based search or AI-powered tools for differently-abled users. Personalized recommendations, better search tools, and 24/7 support improve user satisfaction, leading to increased usage of library resources. AI also optimizes resources, ensuring books and materials are available when needed. AI-powered analytics provide strategic decision-making insights into user behavior, resource utilization, and service effectiveness. AI technologies will probably play a bigger part in libraries as they develop further, changing how they handle resources and assist users.

Uses of Artificial Intelligence in Modern Library Management:

AI technologies have significantly transformed library operations by automating repetitive tasks, reducing human error in indexing documents and metadata, and automating invoice processing, fine tracking, and overdue notices. Natural Language Processing (NLP)-powered AI-driven search engines let users ask questions in conversational terms, providing personalised recommendations for books, articles, and research papers. This enhances the discovery process and enriches the library's engagement with its users. Personalized library services are another area where AI can take personalization to the next level. By analyzing user activity, AI can create dynamic profiles that reflect a user's interests and preferences, recommending books, articles, and digital content based on past usage or user behavior. This information can enable personalized reading lists, suggest learning pathways, and notify users when new materials matching their interests are available. AI-powered chatbots and virtual assistants offer real-time support, guaranteeing that patrons can utilise library services whenever they want, even after hours. Predictive analytics and decision-making are another area where AI plays a significant role. By analyzing large sets of data, AI systems can predict future demands for specific materials or services, suggest new books based on borrowing behavior, recommend staffing adjustments during peak times, and determine the optimal allocation of resources.

All users, including those with disabilities, could benefit from improved accessibility to library services thanks to AI. For example, AI can provide voice-assisted navigation for visually impaired users or offer speech-to-text capabilities for hearing-impaired patrons. AI-driven translation tools can make library resources available in multiple languages, and adaptive learning tools can help users with diverse needs access materials in formats that suit them best.

Benefits of Artificial Intelligence in Library Management:

By automating repetitive processes like cataloguing, inventory tracking, and user query management, artificial intelligence has greatly enhanced library operations. This results in a quicker and smoother flow of materials, allowing staff to focus on higher-value tasks like user engagement and resource optimization. Automation also reduces the potential for human error, ensuring accuracy and consistency across library operations. Another important contribution to library administration is AI's capacity to customise the user experience. Artificial intelligence (AI)-powered smart search engines can provide results that take user context, intent, and past behaviour into account, making it simpler for users to locate pertinent content. Recommendation engines powered by artificial intelligence make recommendations for books, articles, and other materials based on users' individual interests, assisting them in finding information they might have otherwise overlooked. By offering real-time assistance, responding to enquiries, and assisting users in exploring the library's resources, the integration of virtual assistants and AI chatbots further improves the user experience. AI also helps libraries reduce operational costs by eliminating or streamlining manual processes that are traditionally labor-intensive and prone to error. By automating cataloguing, monitoring inventory levels, and performing data entry tasks more quickly and accurately than a human could, AI can lead to a decrease in staffing costs and improve the accuracy and reliability of the library's database. Additionally, AI systems can help identify redundant or outdated materials, enabling libraries to allocate resources more efficiently and avoid unnecessary expenditures.

Another advantage of AI is data-driven decision making. Library managers are able to make well-informed decisions regarding programming, collection development, and resource allocation by using AI tools that apply predictive analytics to examine vast datasets and find patterns in user behaviour, resource usage, and circulation trends. AI technologies enable libraries customise their services to match the needs of their communities by forecasting demand for certain items, anticipating periods of high usage, and offering insightful data on user demographics and interaction.AI is not only improving library management but also enhancing the user experience and making libraries more accessible, efficient, and responsive to the evolving needs of the community.

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Challenges and Ethical Considerations:

Because AI integration in libraries frequently entails the gathering and analysis of personal data, it poses questions regarding data security and privacy. Strict data protection laws and regulations, such the General Data Protection Regulation (GDPR) in the EU, which require openness, user consent, and safe data storage procedures, must be followed by libraries. Additionally, they must create explicit guidelines for the use of their data and guarantee that users have control over it, including the ability to refuse data collection and AI-powered suggestions. Because AI systems are naturally influenced by the data they are trained on, biassed datasets may cause AI algorithms to reinforce such prejudices in their suggestions and judgements. Libraries must make sure AI systems are trained on representative, varied datasets that represent a broad spectrum of voices, cultures, and viewpoints in order to reduce bias. For all users to have fair access to resources and avoid biassed results, regular audits of AI models and the participation of many viewpoints in their development are crucial. The upfront costs of implementing AI technology can be a barrier, especially for smaller or underfunded libraries. These costs include purchasing AI software, upgrading infrastructure, training staff, and integrating the system with existing library management platforms. Libraries in developing regions or with limited budgets may struggle to justify the financial investment. To address this challenge, libraries can seek funding through grants, collaborations with educational institutions or technology companies, and public-private partnerships. As AI takes on more responsibilities within library systems, there is a risk of over-relying on technology, potentially diminishing the role of human librarians. It is imperative that libraries strike a balance between automation powered by AI and human decision-making. Librarians should remain integral to the library experience, guiding users, fostering community engagement, and providing expertise on nuanced or complex issues.

Conclusion

The user experience and operational effectiveness of contemporary library management systems have been completely transformed by the use of Artificial Intelligence (AI). By automating routine tasks like cataloguing, inventory management, and user query processing, AI frees up valuable human resources, allowing staff to focus on strategic activities. Personalized recommendations and intelligent information retrieval systems make it easier for patrons to find relevant resources, leading to a more efficient experience. AI also enables libraries to use predictive analytics for data-driven decision-making, optimizing resource allocation, collection development, and programming to meet evolving user needs. This implementation also reduces manual labor and improves operational accuracy. AI also increases accessibility, especially for individuals with disabilities, by improving the usability of library resources. But there are obstacles and moral issues to deal with, like algorithmic bias, data privacy issues, expensive startup costs, and striking a balance between AI automation and human contact. Libraries must ensure responsible AI use with clear policies and regular audits to serve diverse patrons without compromising ethical standards.

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Original Article

Identification and Removal of Emerging Pollutants in Water: A Comprehensive Review of Techniques and Technologies

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Abstract

Emerging pollutants (EPs), encompassing a diverse array of substances such as pharmaceuticals, personal care products, pesticides, and industrial chemicals, are increasingly recognized as significant contaminants posing a threat to global water resources. Unlike conventional pollutants, EPs are often unregulated and exhibit persistence in aquatic environments due to the limitations of traditional water treatment methodologies. This review offers a comprehensive analysis of current strategies for the detection and removal of EPs from water. It critically examines the efficacy of established and innovative technologies, including advanced oxidation processes (AOPs), adsorption, membrane filtration, and bioremediation. Furthermore, the potential of nanotechnology-based solutions and integrated multi-barrier treatment systems in effectively addressing the challenges posed by EPs is explored. The paper concludes by highlighting crucial future research directions and the imperative for adaptive regulatory frameworks to ensure sustainable water quality management in the face of these emerging threats.

Keywords: *Emerging pollutants, advanced oxidation processes, adsorption, membrane filtration, bioremediation, nanotechnology, environmental contaminants, wastewater treatment.*

Introduction

The escalating presence of emerging pollutants (EPs) in water systems worldwide has become a significant environmental concern [1, 9, 10]. These contaminants, which include a broad spectrum of synthetic and naturally occurring chemicals not routinely monitored or removed by conventional wastewater treatment plants (WWTPs), originate from diverse sources such as pharmaceutical and personal care product (PPCP) usage, agricultural practices involving pesticides, and industrial discharges [4, 17]. The incomplete removal of these compounds can lead to their persistence in surface water, groundwater, and even drinking water sources, potentially posing risks to both human health and aquatic ecosystems [1, 3].The insidious nature of EPs lies in their often low concentrations, which can still exert adverse effects, including endocrine disruption, the development of antibiotic resistance, and toxicity to aquatic organisms [3, 8]. The lack of comprehensive regulatory frameworks and standardized monitoring protocols for many EPs further complicates their management [8]. Consequently, there is a pressing need for a thorough understanding of their occurrence, fate, and effective removal technologies to safeguard water quality and public health [10, 16].This review aims to provide a comprehensive overview of the current state-of-the-art in the detection and removal of emerging pollutants from water. It critically evaluates the performance and limitations of various treatment technologies, ranging from well-established methods to innovative approaches like nanotechnology and hybrid systems. By synthesizing current knowledge and identifying key research gaps, this paper seeks to contribute to the development of more sustainable and efficient strategies for managing the growing challenge of emerging pollutants in our water resources.

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2. Sources and Occurrence of Emerging Pollutant

Emerging pollutants encompass a wide array of chemical substances, each with distinct sources and pathways into the aquatic environment. Pharmaceuticals and personal care products (PPCPs), for instance, enter water systems primarily through the excretion of metabolized and unmetabolized drugs by humans and animals, as well as through improper disposal and WWTP effluents [1, 4]. Antibiotics, a critical subset of PPCPs, are of particular concern due to their potential to contribute to the proliferation of antibiotic-resistant bacteria and genes in the environment [3].

Pesticides, herbicides, and fungicides used in agriculture represent another significant category of EPs, entering water bodies through runoff from agricultural fields, spray drift, and leaching into groundwater [9]. Industrial chemicals, including per- and polyfluoroalkyl substances (PFAS), plasticizers like phthalates and bisphenol A (BPA), and various organic solvents, can contaminate water sources through industrial discharges, accidental spills, and leaching from landfills [10, 21]. The occurrence and concentration of EPs in different water matrices vary significantly depending on factors such as population density, agricultural intensity, industrial activity, and the efficiency of existing wastewater treatment infrastructure [2, 4]. Studies have detected a wide range of EPs in surface water, groundwater, and even treated drinking water at trace levels (ng/L to µg/L), highlighting the widespread nature of this contamination [10, 14]. The complex mixtures of EPs present in aquatic environments and their potential synergistic or antagonistic effects further complicate risk assessment and management strategies [8].

3. Detection Techniques for Emerging Pollutants

Accurate and reliable detection of EPs in water is a crucial first step towards effective management. Due to their low concentrations and diverse chemical properties, sophisticated analytical techniques are required for their identification and quantification [12, 17].

3.1 Chromatography-Based Methods:

Gas chromatography-mass spectrometry (GC-MS) and liquid chromatography-mass spectrometry (LC-MS) are the most widely used techniques for the analysis of a broad range of organic EPs [10, 12]. These methods offer high sensitivity and selectivity, allowing for the identification and quantification of multiple compounds in complex water matrices. Recent advancements in hyphenated mass spectrometry techniques, such as tandem mass spectrometry (MS/MS) and high-resolution mass spectrometry (HRMS), have further enhanced the ability to detect and identify even trace levels of EPs and their transformation products [12].

3.2 Other Analytical Techniques:

While chromatography-based methods are dominant, other techniques play important roles in EP detection. Enzyme-linked immune-sorbent assays (ELISAs) offer a relatively rapid and cost-effective approach for screening specific classes of EPs. Electrochemical sensors are also being developed for the in-situ monitoring of certain pollutants due to their potential for portability and real-time analysis [17]. Furthermore, bioassays utilizing living organisms or cellular components can provide valuable information on the overall toxicity and biological effects of complex EP mixtures [10]. The integration of advanced data analysis and statistical approaches is also crucial for interpreting the large datasets generated from EP monitoring studies [12].

4. Removal Technologies for Emerging Pollutants

Conventional WWTPs, primarily designed for the removal of bulk organic matter, suspended solids, and pathogens, often exhibit limited efficiency in removing many EPs due to their recalcitrant nature and low concentrations [4, 5]. Consequently, there is a growing need for advanced treatment technologies and the optimization of existing processes to effectively address EP contamination.

4.1 Advanced Oxidation Processes (AOPs):

AOPs are chemical treatment methods that involve the generation of highly reactive oxygen species (ROS), such as hydroxyl radicals (OH), which can effectively oxidize and degrade a wide range of organic pollutants, including EPs, into less harmful byproducts [7, 19, 22]. Common AOPs include Ozonation (O_3), UV irradiation (UV), hydrogen peroxide (H_2O_2), Fenton processes (Fe^{2+} / H_2O_2), photocatalysis (semiconductor catalysts under UV or visible light), and their combinations (O_3/ H_2O_2, UV/ H_2O_2, UV/ O_3). AOPs have demonstrated significant potential for the removal of various EPs, including pharmaceuticals, pesticides, and endocrine disruptors [7, 15, 19]. The effectiveness of AOPs depends on several factors, such as the type and concentration of the pollutant, the water matrix characteristics (e.g., pH, organic matter content), and the operating conditions of the specific AOP [7, 22]. While AOPs can be highly effective, they may also lead to the formation of potentially harmful disinfection byproducts (DBPs), necessitating careful optimization and monitoring [7].

4.2 Adsorption:

Adsorption is a physical-chemical process where pollutants are removed from water by accumulating on the surface of a solid adsorbent material [13, 16]. Activated carbon (AC) is a widely used adsorbent due to its high surface area, porosity, and relatively low cost [13]. However, AC may not be equally effective for all types of EPs, and its regeneration or disposal after saturation can be challenging. In recent years, significant research has focused on developing novel and more efficient adsorbents for EP removal, including biochar derived from various biomass sources, modified clays, zeolites, and metal-organic frameworks (MOFs) [13, 16]. These materials can be tailored to

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exhibit enhanced adsorption capacities and selectivity for specific classes of EPs. Adsorption is often employed as a polishing step after biological treatment or in combination with other technologies [13].

4.3 Membrane Filtration:

Membrane filtration technologies, such as nanofiltration (NF) and reverse osmosis (RO), utilize semi-permeable membranes to physically separate pollutants from water based on their size and charge [5, 14]. These high-pressure membrane processes have shown high removal efficiencies for a wide range of EPs, including pharmaceuticals, pesticides, and industrial chemicals [14]. However, membrane filtration can be energy-intensive and prone to membrane fouling, which can reduce performance and increase operational costs [5]. Pre-treatment strategies and the development of fouling-resistant membranes are crucial for improving the sustainability of membrane-based EP removal [14]. Emerging membrane technologies, such as forward osmosis (FO) and membrane bioreactors (MBRs), are also being explored for their potential in EP removal with reduced energy consumption and enhanced effluent quality [14].

4.4 Bioremediation:

Bioremediation utilizes the metabolic capabilities of microorganisms (bacteria, fungi, algae) to degrade or transform organic pollutants into less harmful substances [9, 11]. Biological treatment processes in conventional WWTPs can achieve partial removal of some EPs through biodegradation and sorption to sludge [4]. However, many EPs are recalcitrant to conventional biological treatment. Enhanced bioremediation approaches, such as the use of microbial consortia, genetically modified microorganisms, and the optimization of operating conditions (e.g., hydraulic retention time, redox potential), are being investigated to improve the removal of persistent EPs [11]. Constructed wetlands and bioaugmentation/ biostimulation strategies also hold promise for the sustainable removal of EPs from contaminated water and wastewater [9, 11].

4.5 Nanotechnology-Based Approaches:

Nanotechnology offers innovative solutions for EP removal through the development of nanomaterials with unique properties, such as high surface area, enhanced reactivity, and tailored selectivity [6, 20]. Nanomaterials like carbon nanotubes, graphene-based materials, nanoscale metal oxides, and nanocomposites have shown promising results in the adsorption, catalytic degradation, and membrane filtration of EPs [6, 20]. For instance, nanoscale adsorbents can exhibit higher adsorption capacities and faster kinetics compared to conventional adsorbents. Nanocatalysts can enhance the efficiency of AOPs by providing a larger surface area for reactions and facilitating the generation of ROS. Nanomaterial-based membranes can offer improved permeability and selectivity for EP removal with reduced fouling [6, 20]. However, the potential environmental and health risks associated with the release of nanomaterials into the environment need careful consideration and thorough risk assessment [6].

4.6 Hybrid and Multi-Barrier Treatment Systems:

Given the complexity and diversity of EPs, a single treatment technology may not be sufficient to achieve satisfactory removal. Therefore, the integration of multiple treatment barriers in a hybrid system is often necessary to achieve comprehensive EP removal and ensure high-quality treated water [9, 14]. Hybrid systems can combine the strengths of different technologies to overcome their individual limitations. For example, combining biological treatment with AOPs can leverage the biodegradation of readily degradable EPs while using AOPs for the oxidation of more recalcitrant compounds [19]. Similarly, integrating adsorption or membrane filtration as a polishing step after biological or chemical treatment can further enhance the removal of residual EPs [14]. The design and optimization of such multi-barrier systems require a thorough understanding of the specific EPs present, the characteristics of the water matrix, and the synergistic effects between the different treatment processes [9].

5. Future Research Directions and Regulatory Needs

Despite significant advancements in EP detection and removal technologies, several challenges and research gaps remain. Future research should focus on:

- **Development of more selective and sensitive analytical methods:** This includes the development of high-throughput screening methods for a wider range of EPs and their transformation products.
- **Understanding the fate and transport of EPs in the environment:** More research is needed to elucidate the long-term behavior, transformation pathways, and ecological impacts of EPs in different environmental compartments.
- **Optimization of existing and development of novel removal technologies:** This includes enhancing the efficiency and reducing the cost and energy consumption of AOPs, developing regenerable and selective adsorbents, mitigating membrane fouling, and improving the performance of bioremediation processes.
- **Assessment of the environmental and health risks of EPs and their transformation products:** Comprehensive toxicological studies are needed to understand the potential long-term effects of exposure to EP mixtures at environmentally relevant concentrations.
- **Development of sustainable and integrated treatment approaches:** This includes exploring the use of green technologies, such as bio-based adsorbents and solar-driven AOPs, and designing cost-effective multi-barrier systems for both centralized and decentralized water treatment.

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- **Addressing the challenges of emerging contaminants in drinking water sources:** This requires the development of robust and cost-effective treatment strategies to ensure the safety of drinking water supplies.
- **Life cycle assessment of different treatment technologies:** Evaluating the environmental footprint and economic viability of various EP removal technologies is crucial for selecting sustainable solutions.

Furthermore, there is a critical need for the development and implementation of comprehensive regulatory frameworks for emerging pollutants. This includes:

- **Establishing standardized monitoring programs:** Implementing routine monitoring of a wider range of EPs in different water bodies is essential for assessing the extent of contamination and evaluating the effectiveness of management strategies.
- **Setting water quality criteria and guidelines:** Developing science-based regulatory limits for EPs in drinking water and environmental waters is crucial for protecting human health and aquatic ecosystems.
- **Implementing source control measures:** Preventing the release of EPs at their source through pollution prevention strategies, product stewardship, and responsible waste management is a proactive approach to reducing water contamination.
- **Promoting collaboration and information sharing:** Enhanced communication and collaboration among researchers, regulators, and stakeholders are essential for effectively addressing the complex challenges posed by emerging pollutants.

Conclusion

Emerging pollutants represent a significant and evolving threat to global water quality. While substantial progress has been made in the development of detection and removal technologies, ongoing research and innovation are crucial to address the limitations of current approaches and develop more sustainable and effective solutions. The integration of advanced technologies, such as AOPs, adsorption, membrane filtration, bioremediation, and nanotechnology, often in hybrid multi-barrier systems, holds great promise for achieving comprehensive EP removal. However, the successful management of emerging pollutants requires not only technological advancements but also the development of robust regulatory frameworks, enhanced monitoring efforts, and a holistic approach that considers source control, risk assessment, and the long-term sustainability of water resources. Addressing this complex challenge necessitates a concerted effort from the scientific community, regulatory agencies, and society as a whole to ensure the availability of clean and safe water for future generations.

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Original Article

Impact of Science and Technology on Senior Citizens

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Abstract :

In the present study, 25 senior citizen males from Chintamani Nagari, South Nagpur, Nagpur city were selected using convenience sampling method in non-probability sampling method. Science and technology have changed the lives of senior citizens a lot. Science and technology have made the lifestyle of senior citizens very comfortable. Science and technology have enabled senior citizens to get all the comforts and conveniences sitting at home. Science and technology have enabled senior citizens to benefit from modern health facilities. The use of science and technology helps senior citizens to maintain good physical and mental health. The use of science and technology has increased the standard of living of senior citizens. The use of science and technology by senior citizens has made daily life very comfortable. Science and technology allows senior citizens to get information about the whole world sitting at home. The use of science and technology has enabled senior citizens to enjoy many comforts and conveniences. The use of science and technology helps senior citizens to create their own daily routine.

Keywords: *Senior citizens, science, technology, health, mental state, lifestyle.*

Introduction :

One million people in the world exceed the age of 20 every month. About 80 percent of them are from developing countries. The number of senior citizens is also increasing in India. India is known as a country of youth. About 50% of the population in the country is below the age of 20, but the number of senior citizens will increase in the future. Because of the significant decrease in the death rate and birth rate, the expected life expectancy at birth and after birth has increased significantly. When India gained independence, the life expectancy of a person was 32 years. Today it has reached 60 years. Therefore, the number of senior citizens is constantly increasing compared to the total population. Aging is a biological process. When a person is born, he or she will become old. After the complete growth of the body of a person, the process of deterioration of the body begins. This physical deterioration becomes more noticeable with age, which is what we call aging. With age, the efficiency of a person decreases and he or she becomes dependent. This raises questions about the social, mental, physical and cultural safety of an individual. Naturally, everyone's journey of aging can be different. The speed of age change and its impact are different for everyone. According to the 2011 census, the number of 60+ senior citizens in India was 103.8 million. In 2001, the number of senior citizens was 76.6 million. That is, the number of senior citizens is increasing by almost 3 million every year. In Maharashtra, the number of senior citizens was 84.55 million in 2001. It increased to 11.7 million in 2011, that is, it is increasing by approximately three million every year. positive. Senior citizens are very happy to use science and technology in their daily lives. According to a United Nations study group, the number of senior citizens in India will increase to 326 million by 2050. Due to decreasing birth and death rates, improved healthcare, research in medical science, improved lifestyle of people, improved nutrition, the life expectancy of a person is increasing. The twenty-first century is considered the century of human prosperity and development. Compared to the last century, , in the last 15 years, due to international

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Underdeveloped and developing countries than indeveloped countries. Alternatively, positive changes have been made in three areas of social life in this country, education, health, living standards, along with victory over infant mortality, women's development and increasing the standard of living of the elderly. Especially since this scene is seen everywhere to a greater or lesser extent, it is now certain that this century will be one of global development. The increase in the number of senior citizens everywhere is considered to be the result of global prosperity. Positive changes in the statistics of senior citizens in the world population are essentially indicators of the economic and social transformation of the world. The improvement in the standard of living of senior citizens and their health, as well as the increase in the global productivity of senior citizens, are a promising and hopeful picture. In today's era of modernization, science and technology have made great progress. The impact of this science and technology on senior citizens has been very

Objective of Study :

The following objectives were taken in the present study.

1) To know the impact of science and technology on senior citizens.
2) To study the views of senior citizens on science and technology.

Area of Study :

In the present study, Chintamani Nagar area of South Nagpur in Nagpur city was selected for the study.

Sampling And Data collection :

25 senior citizens were selected for the present study. For the collection of facts, convenience sampling method in non-probability sampling method was used. The facts were collected using the interview schedule in the primary research method. The internet, magazines, newspapers, journals and articles in the secondary research method were used.

Result And Finding :

The use of science and technology has made the lives of senior citizens easier. Due to science and technology, the work that had to be done manually is now done by machines, so senior citizens do not need to work themselves. In the use of science and technology, senior citizens have started using computers and mobile phones more. Through this, they are staying in touch with their friends and relatives more. Due to science and technology, the social contact of senior citizens has increased. Due to the use of science and technology, senior citizens have started using social media more. Senior citizens are interested in learning new things themselves. Due to science and technology, senior citizens can learn information about other countries while sitting at home. Senior citizens can watch new developments in the fields of politics, agriculture, entertainment, sports, education, cinema thanks to science and technology. Senior citizens learn information about many villages and cities in our country and other countries. Due to science and technology, senior citizens have benefited from special health facilities. New medicines help senior citizens to stay healthy. Due to science and technology, medical facilities have increased to a great extent. Science and technology are increasing the number of new medical facilities every day, which are used by senior citizens. In old age, senior citizens have to face physical complaints. For this, many medicines are used by senior citizens due to this science. Science and technology helps senior citizens to cultivate some of their hobbies. Senior citizens are more active today on Instagram, Facebook, WhatsApp. Senior citizens can now connect with their school friends thanks to the use and progress of this science and technology. Old memories have been revived by senior citizens. According to senior citizens, science and technology has brought the world closer. A person's life has become very comfortable. Science and technology has saved a person's hardship. Labor has been reduced. Even if a person close to us is abroad, now we can directly contact him due to the progress of science and technology. We can talk to him directly through WhatsApp calling every day, we can see the person in front of us. Science and technology has made progress across the ocean. Science and technology helps keep a person happy. Thanks to science and technology, senior citizens can take care of their health in a better way. They get information about which foods to include in their diet by watching YouTube videos. They get information about how to take care of their health. Senior citizens join online yoga and exercise classes themselves. Thanks to science and technology, senior citizens can listen to and watch their favorite serials, favorite movies, favorite songs anytime. Thanks to science and technology, if senior citizens want to buy something, they buy it online by sitting at home. Senior citizens call milk, vegetables, groceries online without going to the market. Thanks to the results of science and technology, if senior citizens want to go somewhere, they stay at home and call ola rickshaws, ola cars and go out. If senior citizens want to eat a food, they do not prepare it at home, but call it online through Swiggy or Zomato and enjoy that food. Thanks to the results of science and technology, if senior citizens want to go out for a walk, senior citizens can get all the information about that place by sitting at home. Senior citizens gather information about where to stay, booking tickets, and what places to see there. Science and technology have had a very positive impact on senior citizens.

Conclusion :

- Science and technology has made the lives of senior citizens happier.
- Science and technology has made the lifestyles of senior citizens happier.

- The use of science and technology has brought about a positive change in the mindset of senior citizens.
- Science and technology has increased the engagement of senior citizens in their own work.
- Science and technology has increased the social contact of senior citizens, social contact has become active.
- Science and technology has increased the needs of senior citizens.
- Active and healthy aging of senior citizens due to science and technology.
- The self-reliance of senior citizens has increased due to the use of science and technology.
- The quality of life of senior citizens has increased due to the use of science and technology.

Suggestion And Recommendation :

- The government needs to train senior citizens to use science and technology.
- Family members should guide senior citizens regarding the use of science and technology.
- Senior citizens should be guided that there are some dangers in the use of science and technology.
- Senior citizens should use science and technology to fulfill their personal needs.
- Senior citizens should explain to the society that the use of science and technology is important for the development of the society.
- Non-governmental organizations should guide senior citizens about how beneficial and important the use of science and technology is for senior citizens.

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Original Article

Language Diversity and Multilingualism

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Abstract.

Language is complex and multifaceted concept. that plays a crucial role in human communication, culture and identity. Language play important role in expression of feeling, emotions and interconnect person to society. With the help of language person here his feeling, opinion expression with society so languages of human being and Society. Whatever knowledge available in the world. Which is the stored in the language form language is key meditator between knowledge and Society. in our India we have a found number of languages. But our Nations Moto is "unity of diversity". Here we found number of languages, which state has their own language almost 22 languages include in our constitution seventh schedule. In this situation all country connected with new approach of multilingualism concept. such a concept to play very important role connect whole Nation. Multilingualism give a equal Oppertunity to all language speaker and give respect of all languages.

Key words*. Communication, Expression ,Diversity,Constitution*

Introduction.

Multilingualism has considered appropriate to solve the language problem. In India multilingualism has also been considered a human resource and strategies. This is the reason why the humanities are accepted because language disputes will end by themselves when they are multilingual The government has given Trilingual formula for multilingualism. He is one of the opinion that in non Hindi speaking states. The study of mother tongue and Hindi should be compulsory along with mother tongue and Hindi they can study simple Sanskrit compulsory English and other foreign languages and Sanskrit and other languages will get optional place in Hindi speaking areas define or Tri Bhasha Sutra will be as follows. Mother tongue and one other Indian language. the thing to keep in mind here is that Sanskrit has one place. in other languages multilingual person knows many languages this is why it can be considered country resources. The idea of introducing the concept of multilingualism came about because there are many languages in India. All languages have thousands of supporter who advocate there respective languages**.**

Concept Of Multilingualism.

Multilingualism is the ability of an individual or a community to use more than one language. It encompasses various aspects like speaking, understanding, reading and writing in multiple languages. this ability can be personal, social or even inter subjective with the term 'polyglot' often Used to describe of Someone who Speak many languages.Multiligualism is the use of more than one languages either by an individual Speaker or group of Speakers When the languages are just two. it is a believed that multilingual speakers in the world population

Objective Of Multilingualism.

The primary objective of multilingualism are as follow.
1) Faster cognitive flexibility.
2) enhance language and literacy skills.

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3) Improve academic performance
4) Promote cross cultural understanding.
5) Promote communication skills.
6) Enhance educational resources.
7) Globalisation.

6) Characteristics of multilingualism.

Multilingualism is very important aspect at the modern era.it has so many characteristics, which has given below.

1) Linguistic Characteristics.

Language Proficiency Multilingual Individuals have Varying Levels of Proficiency in Multiple languages.
Language Switching Multilingual Can Switch between Languages adapting to different linguistic and cultural Context.Multingual May engage in code switching between languages in a Single Conversation and Interaction.

2) Cognitive Characteristics.

Cognitive flexibility multilingualism can enhance cognitive flexibility, allowing individual to adopt to new linguistic and cultural situation. Language awareness multilinguals often have a heightened awareness of language structure vocabulary and Usage.

3) Social Characteristics.

Vultural identity multilingualism can be closely tied to cultural identity with languages serving as connection to Heritage and community. Social benefits multilingualism can provide social benefits such as increased opportunities,cultural understanding and social connection.
Communication multilingualism enables individual to communicate with people from diverse linguistic and cultural background.

4) Educational characteristics.

Language learning multilinguals may have an advantages in language learning as they can draw on their existing linguistic knowledges. Language teaching multilingual can serve as a roll model and teachers helping other to learn and appropriate multiple languages. Cultural exchange multilingualism can facilitate cultural exchange and understanding in educational setting.
By Understanding the characteristics of multilingualism we can better appreciate the complexities and benefits of multiple languages.

7) The teachers rule in multilingualism.

The teachers role in Multilingualism is Crucial especially in Diverse and Multicultural Educational Setting.here are some Key Aspects of that role.

1**) Promoting Language Inclusion.**

Teacher help to create a classroom environment, where all languages are repeated and valued reading linguistic discrimination and promoting equality.

2) Supporting Language Development.

They begin lessons that support both the first language and second or additional language.

3) Differentiated Instruction.

Teachers adopt teaching method and material, to accommodate student with different languages background and Profecient.

4) Encouraging Code Switching Tranlguaging.

Allowing students to use all these language resources for learning can help them better understand and express complex concept.

5**) Being Culturally Response**.

Teachers acknowledge and integrate students cultural and linguistic backgrounds into the curriculum and classroom discussion.

6) Collaboration with families and Communities.

Engaging with students families help reinforce language learning at home and build stronger support systems.

7) Professional Development.

Teachers mast informed about strategies for multilingual learning and understand socio linguistic issues affecting languages in education.
So in this way teacher can play very important and supportive roll in multilingualism **.**

8) Multilingualism padagogy.

Multilingualism pedagogy refers to teaching approach and strategies that acknowledge value and utilise multiple languages in the learning environment. It moves away from monolingual norms and and instead embraces the linguistic diversity students bring to the classroom. here are some important pedology of multilingualism**.**

1) Dscussion pedagogy.
2) Lecture Pedagogy.
3) Inductive Pedagogy.

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4) Deductive Pedagogy.
5) Audio Lingual Method.
6) Communicative Approach.
7) Task Based Language Teaching.
8) Natural Approach.
9) Lexical Approach**.**

9) Benefits of Multilingualism.
Multilingualism give number of opportunity to learner including enhanced cognitive abilities improved communication and a broader cultural understanding. it can also lead to career advantages and contribute to more inclusive and interconnected world some more effective benefits as follows.

1) Cognitive Benifits.
1.1) Improved Memory and Problem Solving.
Learning and using multiple languages can strengthen memory and enhance analytical thinking.
1.2) Enhanced executive functions.
Multilingualism can improve cognitive control. multitasking and decision making.
1.3) Delayed cognitive decline.
Research suggest that multilingualism may protect against cognitive decline and reduce the risk of Demintia letter in life.
2) Communication and social benefits.
2.1) Improved communication.
Being multilingual allows for better understanding, and interaction with people from diverse Linguistic.
2.2) Enhanced cultural understanding.
Learning new language is good opportunity. To learner to learn and understand culture.
2.3) Increased adaptability.
Multilingual individual are often Moradabad at adjusting to new environment and situation.
3) Career and economic benefits.
3.1) Increased the job opportunities.
In a globalized a world multilingual individuals are highly sought after in various fields. including international business diplomacy and education.
3.2) Higher Earning Potential.
Studies have to show that multilingual employees often earn more than their multilingual counterparts.
3.3) Expanded Career Path.
Multilingualism can open doers to new and diverse Career paths. Including translation, interpretation and language teaching.
4) Educational Benifits.
Multilingualism Academic performance educational benefits is very important in learners academic Achievement.
5) Social Benifits.
Broader social networks ability to interconnect with diverse groups and communities. Increased self-confidence using multiple languages Often boosts self esteam and identity development.

Conclusion.
So in this way multilingualism offers a wide range of cognitive, social, cultural and professional advantages and benefits.

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Original Article

Regulating Ai: Should Governments Create Stricter Ai Laws?

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Abstract

The ever increasing AI application in surveillance systems, mortuary sciences, automobiles, and finance is accompanied with danger if not contained. This also raises concern for balancing ethical values and basic moral principles. Should stricter laws be placed to govern the use of AI? Was a central question of this paper? It analyzes technology impact assessment within a global context. Having found pervasive and dangerous consequences such as: loss of privacy, infringing ethics, safety compromises, negligence of transparency, violation of algorithm commandments, and machine transgressions. In favor of stringent AI rule regulation argued from public interest included: ethical obligations, prevention of exploitation, and public welfare. Possible counterarguments included: stifling creativity and speed, overly invasive rules, or losing an edge to the rest of the globe. Striking the harmony for all parties through constructive scrutiny favored less restraint when exercising technological boundaries. Affirmative conclusions included progressive intergovernmental cooperation. Proposing AI supervision policy frameworks to ensure pioneering technologies are sensitively and recursively molded into the society test zones. Overall, while one cannot deny there is a need for rules and regulations, spon arbiter burdens need to be deeply woven around pure technical and societal philosophy.

Keywords: *Artificial Intelligence, AI Regulation, Ethics, Public Policy, Algorithmic Bias, AI Governance, Technology Law, Innovation vs. Regulation, AI Accountability, Privacy Rights*

Introduction:

Artificial intelligence is rapidly becoming one of the central technologies of our age. And in this transformation it will touch almost every sector on the continents of health and finance, of transport and education. AI forms the basis of what are broadly termed decisions, from predictive algorithms to autonomous vehicles, facial recognition and conversational agents influencing the lives of huge number of people and societies. Its sorcery works well for deciding about people and their societies. Although transformations are fast, exactly the technologies for comprehensive legal and ethical frameworks did-to the-day have not kept pace with it, and now there is room for serious concern about privacy, accountability, bias, and safety. Public debate and policy discussions have generated such high-profile echelons by algorithmic discrimination, unauthorized data usage, and non-transparent decision systems. Their governments have to determine how to regulate AI-the answer not easy or straightforward. Some claim tighter laws are a must for the sake of civil rights and ethical development; others argue that regulation would dampen creativity, reduce overall competitiveness, and not keep up with technological innovation. The issue really at the heart of the arguments is not of 'whether' AI should be regulated, but of 'how' governing AI can take place to reconcile innovation and responsibility. This paper analyzes the current possibilities and challenges in AI regulation, risks brought by

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Unregulated AI, the arguments for and against stricter legal frameworks, and some possible models for effective governance. It aims to provide a nuanced perspective on whether governments should implement stricter AI laws and, if so, how those laws should be designed to address both ethical imperatives and practical realitiesal

Aim:

The aim of this research is to ensure the investigation of necessity, scope, and implications of stricter government regulation of AI. It is also intended to evaluate whether any present legal frameworks sufficed in coping with the rapid advancement of AI technologies as well as the possible social, ethical, and economic consequences of both over-regulation and under-regulation. The study aims to also provide some informed recommendations for effective future-forward regulation in AI that governs innovation with accountability and public trust through understanding worldwide approaches, current policy gaps, and experts' perspectives.

The objective of this study is the exploration of necessity, scope, and implications of tighter regulation of artificial intelligence (AI) from the government itself. It also strives to assess whether any existing legal framework sufficed for coping with the rapid advancement of ai technologies and whether there would be any possible social, ethical, or economic consequences whether over-or under-regulation.

Objective:

1. To assess the current AI regulatory framework locally and internationally.
2. Identify critical risks associated with unregulated and/ or laxly regulated AI systems.
3. Assess arguments for and against the tightening of AI laws.
4. To know the "impact of regulation" on the most technological innovations and economic growth.
5. Recommendations of balanced and flexible policies regarding the governance of AI.
6. Research the current existing AI regulatory framework both domestically and internationally.
7. Understanding how regulation affects technological innovations and perhaps even economic growth may do us some good.

Current Regulatory Landscape:

Each neighbor in each region is governed by its own rules regarding AI. The EU would be an exception due to its proposal of an AI Act. This proposal states that the AI systems will further be classified according to their risk level. It would also provide regulations concerning transparency, accountability, and human oversight. The situation is a little different in the U.S., where the focus is more on innovation, allowing for non-binding guidelines on certain industries. In China, in a different context, the state could drive technological advancement. This approach lays an emphasis on security and government regulation. The forthcoming regulations represent progress but also some gaps and inconsistencies. Many countries still do not have intact rules that assure AI system transparency or that hold developers accountable in case of possible harm. The absence of international cooperation in rule-making has resulted in a fragmented landscape across the globe. This state of affairs could lead to gaps for exploitation or regulatory incompatibility across borders.

Risks Of Unregulated:

Uncontrolled AI systems would bring considerable social detriment. Of the various possible problems, one of the most severe ones is algorithmic bias, which in most cases involves unintentional perpetuation or amplification of human social prejudices and biases-a direct effect of the training data bias used to programme AI models. This manifests itself in the discriminations as hiring, lending, law enforcement, healthcare, and so on. Additionally, a lack of transparency and explainability complicates all this further with liability for performance by AI systems. Most cutting-edge AI models, which are rightly referred to as "black boxes", create problems in making sense of or contesting their decisions. The ground for untrustworthiness is set, and these systems become all but impossible to audit for fairness or correctness. There is also a growing safety concern as AI penetrates very sensitive sectors such as autonomous vehicles, medical diagnostics in hospitals, and military applications. Such a failure or a misuse could have very dire consequences in such situations.

Arguments For Stricter Ai Laws :

Advocates for stricter regulation contend that law has an important role in making AI technologies serve the common good. Such regulation could require transparency and accountability and ethical principles of designing legal redress for persons harmed by AI systems. Stricter laws could also compel companies to assess impacts, develop bias mitigation strategies, and adhere to data privacy standards. In addition, coherent regulation could create public trust, which is especially important for general acceptance of the use of AI. People feel reassured by clear rules and accountability measures that they are safe and fair and community aligned in using AI systems. More Regulation for Businesses in the Commercial Area Require Compulsory Regulation of Artificial Intelligence-then- Public Policy; use clearly defined terms and results in accountability. And it may include transparency and accountability as well as ethical principles of design-and-in-legal-redress for persons harmed by AI systems. Stricter laws may even force companies to perform impact evaluation, develop bias mitigation techniques and follow confidentiality criteria.

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Counterarguments And Challenges:

Ultimately, stifling innovation might become a factor adversely isolated on heavy compliance costs and creativity, whereby opponents claim that overregulation in AI development is highly dynamic to keep up with the law, with voluntary guidelines or self-regulation of the industry seen as being more effective. Another concern is the international race to AI leadership. If a country were to act on extreme regulations, it might face backlash with respect to its technological and economic competitiveness. This would also mean wrong consequences for ill-placed regulations, discouraging the much-required constructive research or misclassifying benign technology as high-risk.

Toward Balanced Ai Governance:

Many experts believe that the best regulatory approach is one of adaptive, principle-based regulations rather than rigid or laissez-faire regulation. This means, for instance, establishing regulatory sandboxes, or controlled environments where developers can experiment with developing AI systems under conditions more akin to the actual world but without full-fledged regulatory attention. Such models promise to spur innovation at the same time as inviting potential regulation in monitoring impacts, compared with adjusting rules as needed. Other proposals by government include enforcing additional transparency and accountability through compulsory audits for algorithms, public disclosure for high-risk systems, and engaging independent oversight agencies. Industry, academia, and civil societies should collaborate to form regulations informed, not exclusive, or flexible.

Conclusion:

AI lives through hope, even though its dangers will certainly surpass advantages if unregulated. The laws that will be essential, however, will include the prohibition of moral development and individual rights defense from a relatively much enhanced public trust. Such laws, however, would need to be crafted in a more encouraging format for innovation and adaptability with respect to ever-evolving technology. Therefore, a well-balanced flexible parametric governance will allow society to enjoy its advantages while at the same time protecting its central values. Artificial intelligence will really be in promise but risks will always question the advantages without proper policy guidance. Such laws as will be necessary will make the prohibition for ethical development and individual rights protection-the-Suffice it to say that capture towards a much more enhanced public trust. Such laws would have, however, to take a more encouraging form for innovation and adaptability against ever-evolving technology. A well-balanced flexible parameters governance framework would thus function to allow society to absorb its benefits while guarding its core values in the same process.

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Original Article

Emerging Trends & Technologies in Library Services with the help of Mobile Apps

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Abstract

Libraries are one of the foremost critical social institutions. No society is complete without a library storing information from the world over. Information and Communication Technology (ICT) have extensively impacted libraries and their services. In the digital era, libraries are transforming from traditional spaces to dynamic digital hubs, significantly enhancing user experiences and library operations. One of the key advancements in this transformation is the integration of mobile applications, which allow users to interact with library resources more efficiently. This paper explores the role of mobile apps in improving library services, focusing on MOPAC, a mobile library app developed using LIBMAN software. MOPAC offers users seamless access to library resources, enabling them to search for books, reserve titles, renew borrowed items, and receive real-time notifications. In addition to enhancing accessibility, mobile apps foster user engagement through interactive features such as personalized book recommendations, discussion forums, and virtual study groups. They also streamline library operations by automating cataloging, membership management, and borrowing processes. Despite the numerous advantages, the adoption of mobile apps in libraries faces challenges, including data security and infrastructure requirements. Overall, mobile apps like MOPAC are reshaping the future of libraries by bridging the gap between traditional and digital learning. This paper concludes that libraries must continue to embrace mobile technology to meet the evolving needs of their users and create an inclusive, knowledge-driven society.

Introduction

Technology has undoubtedly made our lives much simpler. A library is no more the same it was a decade ago. Modern-day school and corporate library software ensure that you get the latest technologies in library systems right at your fingertips The rapid advancement of technology has transformed traditional library services, making them more accessible, efficient, and user-friendly. One of the most significant innovations in this domain is the integration of mobile applications, which have revolutionized how users interact with library resources. Mobile apps have enhanced library services by providing seamless access to digital collections, improving user engagement, and streamlining administrative tasks. Libraries serve as essential knowledge hubs, catering to students, researchers, and the general public. However, the traditional approach of manually searching for books, standing in long queues for borrowing and returning materials, and relying solely on physical catalogs often leads to inconvenience. With the advent of mobile applications, these challenges have been significantly mitigated. Users can now search for books, access e-resources, renew borrowed items, and receive notifications—all at their fingertips. This shift towards digital accessibility aligns with the evolving needs of modern users who demand instant access to information.

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Mobile apps provide a multitude of benefits to library users. First, they enhance accessibility by offering remote access to resources. Users no longer need to visit the library in person; instead, they can browse catalogs, read e-books, and access journals from any location. This is particularly beneficial for students and researchers who require round-the-clock access to academic materials. Additionally, mobile apps enable libraries to integrate multimedia resources such as audiobooks, podcasts, and video lectures, catering to diverse learning preferences.Another significant advantage of mobile apps in libraries is the improvement in user engagement. Many library apps come equipped with interactive features such as personalized book recommendations, discussion forums, and virtual study groups. These features encourage collaborative learning and enhance the overall user experience. Push notifications and alerts also play a crucial role in keeping users informed about book availability, due dates, upcoming events, and new acquisitions.

Furthermore, mobile apps contribute to the efficient management of library operations. Automated cataloging, digital membership management, and contactless borrowing systems reduce the workload of library staff while minimizing human errors. QR codes and NFC (Near Field Communication) technology can be integrated into these apps to facilitate seamless book check-ins and check-outs. Such advancements not only save time but also improve the overall efficiency of library services. Despite their numerous advantages, the adoption of mobile apps in libraries comes with challenges. Issues such as data security, digital literacy, and technological infrastructure need to be addressed for successful implementation. Libraries must ensure that their mobile applications are user-friendly, compatible with various devices, and equipped with robust security measures to protect user data.

In conclusion, mobile applications have emerged as powerful tools for enhancing library services, making them more accessible, engaging, and efficient. As technology continues to evolve, libraries must embrace digital solutions to meet the changing needs of users. By leveraging mobile apps, libraries can bridge the gap between traditional and digital learning, fostering a more inclusive and knowledge-driven society.

Mobile-Based Library Services

The three main objectives of a library are to promote literacy, disseminate useful daily information to the people and encourage lifelong learning through its reading materials and resources. Mobile libraries bring resources outside of the library's fixed location to users who otherwise might not get an opportunity to profit from them.

MOPAC Mobile Library App

MOPAC is a cutting-edge mobile application designed to simplify and enhance the library experience for users. Developed using the LIBMAN software, this app serves as a comprehensive digital gateway to library resources. With MOPAC, users can effortlessly search for books, reserve titles, and renew borrowed materials through an intuitive mobile interface. The app also supports real-time notifications, helping users stay updated on due dates, new acquisitions, and upcoming library events. Additionally, MOPAC integrates advanced cataloging and search functionalities, allowing for quick and efficient access to library collections. By leveraging this technology, libraries can streamline operations while offering a seamless, user-friendly experience to their patrons.

Sample Selection Using MOPAC

For the purpose of sample selection in this research, the MOPAC mobile library application, developed using LIBMAN software, has been chosen as a representative model. MOPAC provides a well-structured digital platform that allows users to access, search, and borrow library resources remotely. Its efficient categorization of books, integration with digital libraries, and real-time tracking of borrowed materials make it an ideal tool for studying the impact of mobile technology on library services. By analyzing user interaction and engagement with MOPAC, valuable insights can be drawn regarding the effectiveness and challenges of mobile-based library solutions.

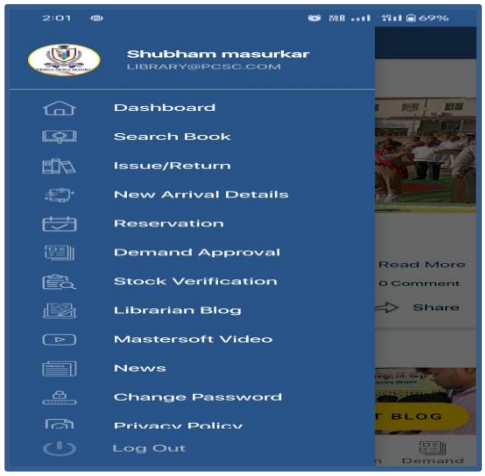
In conclusion, Users want easy and instant access to relevant information, putting pressure on Library and Information Science professionals, to think out of the box for meeting their information needs. Implementation of Information and Communication Technologies has changed the way people access and communicate information. Mobile applications have emerged as powerful tools for enhancing library services, making them more accessible, engaging, and efficient. As technology continues to evolve, libraries must embrace digital solutions to meet the changing needs of users. By leveraging mobile apps, libraries can bridge the gap between traditional and digital learning, fostering a more inclusive and knowledge-driven society.

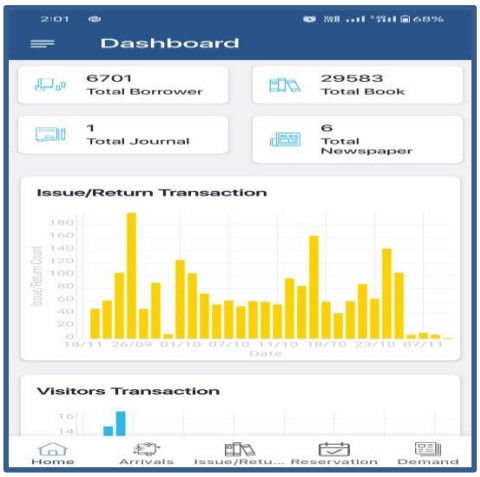
Objectives

1. Increase Accessibility
2. Improve User Engagement
3. Streamline Library Operations
4. Provide Real-Time Information

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M-OPAC





The library mobile app offers several features designed to enhance the library services and user experience. The Dashboard feature provides users with a quick overview of key information, including new arrivals, current reservations, and notifications. The Search Book feature allows users to search for books by title, author, or subject, making it easier to find desired resources. The Issue/Return feature helps users check out and return books, while keeping track of due dates.

The **New Arrival Details** section informs users about the latest books added to the library collection. The **Reservation** feature enables users to reserve books that are currently unavailable. The **Demand Approval** feature allows users to request books that are not in the library's collection, which can be approved and added. The **Read More** section provides detailed information about books, including summaries, reviews, and author details. The **Stock Verification** feature allows the library staff to check and maintain an up-to-date inventory of books. The **Comment** feature enables users to leave feedback and reviews on books they've read.

The **Librarian Bio** section provides information about the librarian, including their qualifications, experience, and contact details. The **Share** feature allows users to share book information and library updates via social media. The **Master soft Video** feature offers educational videos on library usage and how to navigate the app effectively. The **News** section keeps users informed about library events, updates, and changes to services.

The **Change Password** feature allows users to update their app password to ensure account security, while the **Log Out** feature enables users to securely log out when they're finished using the app.

The dashboard of the library mobile app provides users with a comprehensive overview of various library services, making it easy to navigate and access essential information.

- **Total Borrowers (6701):** This section displays the total number of active borrowers registered with the library, giving users an idea of the library's reach and community engagement.
- **Total Books (29583):** Users can view the total number of books available in the library's collection, helping them understand the breadth of resources they can access.
- **Total Journals (6):** This feature shows the number of journals the library subscribes to, indicating the academic resources available to users.
- **Total Newspapers:** The number of newspapers available in the library is displayed, keeping users informed about daily publications for research and general reading.
- **Issue/Return Transactions:** This section tracks the number of books being checked out and returned, helping users monitor their borrowing activity and due dates.
- **Visitors Transaction:** This feature tracks the activity of visitors who use the library, offering insights into the library's footfall and usage.
- **Home:** The home section serves as the starting point, offering easy access to all major features of the app.
- **Arrivals:** Users can see a list of newly arrived books and materials in the library, ensuring they stay updated on the latest resources.
- **Issue/Return:** This section allows users to manage their issued books and returns, keeping their borrowing process simple and organized.
- **Reservation:** The reservation feature enables users to reserve books that are currently unavailable, ensuring they can access them as soon as they are returned.

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- **Demand:** This allows users to request books that are not part of the current collection. Once approved, the library will acquire the requested books for users to borrow.

These features together ensure that users can easily access information about the library's resources, manage their borrowing activity, stay updated on new arrivals, and request materials they need, all within a user-friendly mobile app environment.

Conclusion

Earlier, libraries offered manual information resources and services to their users, but now, libraries are opening up to digitalization, primarily in the form of online libraries, eLibraries, or digital libraries. The integration of mobile applications in library services has brought about a transformative shift in the way libraries operate and interact with their users. With the rapid advancement of technology, libraries are no longer confined to physical spaces filled with books and periodicals. Instead, they have evolved into digital knowledge hubs, accessible to users anytime, anywhere, thanks to mobile apps like MOPAC. These apps have revolutionized the library experience by improving accessibility, enhancing user engagement, streamlining operations, and providing real-time information, all through a user-friendly interface. One of the primary advantages of mobile apps in libraries is the enhanced **accessibility** they offer. In the past, users had to visit the library physically to browse the catalog, check out books, or access resources. Now, mobile apps enable users to search for books, read e-books, and access journals remotely, breaking down the barriers of time and location. This is especially beneficial for students and researchers who need round-the-clock access to academic resources. Furthermore, libraries can offer multimedia resources such as audiobooks, podcasts, and video lectures, catering to different learning preferences and enhancing the overall user experience.

User engagement is another area where mobile apps make a significant impact. Many library apps, including MOPAC, come equipped with interactive features that foster a sense of community and collaboration. Personalized book recommendations, discussion forums, and virtual study groups are just a few examples of how libraries can engage users. Push notifications keep users informed about new arrivals, upcoming events, and due dates, ensuring they are always updated on the latest library activities. These features not only improve the user experience but also encourage collaborative learning and peer-to-peer interaction. In addition to improving accessibility and engagement, mobile apps also contribute to streamlining library operations. Automated cataloging, membership management, and contactless borrowing systems reduce the workload of library staff and minimize human errors. QR codes and NFC technology integrated into the mobile app allow for seamless check-ins and check-outs, making the borrowing process more efficient. By automating these tasks, libraries can focus more on providing quality services to their users, rather than on administrative work.

The MOPAC app, developed using LIBMAN software, is a prime example of how technology can be leveraged to enhance library services. MOPAC offers a comprehensive set of features that cater to the diverse needs of library users. The app provides real-time information on new arrivals, reservations, and due dates, while also allowing users to manage their borrowing activities with ease. The app's integration with digital resources ensures that users can access academic materials from anywhere, further enhancing the library's accessibility.

However, despite the numerous benefits, the adoption of mobile apps in libraries does come with its own set of challenges. Data security, digital literacy, and the infrastructure required to support mobile technology are some of the hurdles that need to be addressed for the successful implementation of mobile apps in libraries. Libraries must ensure that their apps are user-friendly, compatible with various devices, and equipped with robust security measures to protect user data. In conclusion, mobile applications like MOPAC have revolutionized the way libraries serve their users, making library services more accessible, engaging, and efficient. These apps bridge the gap between traditional library services and the digital age, ensuring that libraries remain relevant and valuable in an increasingly digital world. As technology continues to evolve, libraries must embrace these digital solutions to meet the ever-changing needs of their users. By leveraging mobile apps, libraries can create a more inclusive, accessible, and knowledge-driven society, fostering lifelong learning and growth for users from all walks of life.

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Original Article

Enhancing library services via mobile technologies: Advantages, Challenges and its impact on the Future Library Services

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Abstract

It has been largely noticed that the revolution in the mobile technology has so far effectively caught the imagination of e-commerce and the whole learning eco-framework, although it hasn't been involved that much in the area of libraries. The rapid advancement of mobile technology has significantly transformed library services, offering innovative solutions to enhance user experience, accessibility, and resource management. This study explores the role of mobile applications in modern libraries, highlighting key innovations such as digital catalogs, e-book lending, AI-powered recommendations, and virtual assistance. Additionally, it examines the challenges associated with implementing mobile library services, including technical limitations, security concerns, and the digital divide. Through case studies and real-world examples, this research provides insights into the impact of mobile apps on library engagement and efficiency. Finally, the study discusses future prospects, including artificial intelligence, block chain technology, and IoT integration, which promise to further revolutionize library services. By addressing existing challenges and leveraging emerging technologies, libraries can enhance their digital transformation efforts, ensuring greater accessibility and user satisfaction in the future.

Keywords: *Mobile Applications, Library Services, Digital Transformation, Innovation in Libraries, Mobile Technology, User Engagement, Smart Libraries, Mobile Catalogs, Mobile Learning, Library Automation*

Introduction

Mobile apps provide a multitude of benefits to library users. First, they enhance accessibility by offering remote access to resources. In the digital age, libraries have undergone a significant transformation, integrating modern technologies to enhance user experience and improve accessibility. One of the most impactful advancements in this evolution is the adoption of mobile applications. With the widespread use of smart phones and mobile internet, library services are no longer confined to physical spaces; instead, they have expanded into digital platforms that offer convenience, efficiency, and personalization.

Mobile applications have revolutionized how users interact with library resources by providing features such as remote access to digital collections, online catalog searches, e-book borrowing, virtual assistance, and real-time notifications. These innovations have not only streamlined traditional library operations but have also created new opportunities for engagement, learning, and research. However, despite the numerous advantages, the implementation of mobile applications in library services comes with its own set of challenges. Issues such as data security, user adoption, technological constraints, and financial limitations need to be addressed to ensure a seamless digital experience for all library users. This research paper explores the role of mobile applications in enhancing library services, examining key innovations, challenges, and future prospects. By analyzing real-world

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examples and emerging trends, this study aims to provide insights into how libraries can effectively leverage mobile technologies to meet the evolving needs of users in an increasingly digital world.

Importance of mobile applications in modern library services

Mobile apps have enhanced library services by providing seamless access to digital collections, improving user engagement, and streamlining administrative tasks. Libraries serve as essential knowledge hubs, catering to students, researchers, and the general public. Mobile applications play a crucial role in modern library services by enhancing accessibility, efficiency, and user engagement. They allow users to search catalogs, borrow e-books, receive real-time updates, and access digital resources anytime, anywhere. Features such as virtual assistance, personalized recommendations, and remote renewals streamline library operations while improving user convenience. Additionally, mobile apps bridge the gap between physical and digital libraries, making information more accessible to a diverse audience. As libraries continue to evolve, mobile applications serve as essential tools for meeting the dynamic needs of users in the digital era.

Objectives

This study aims to:

1. **Analyze the Role of Mobile Applications in Library Services** – Examine how mobile apps enhance user experience, accessibility, and library management.
2. **Identify Key Innovations** – Explore the latest technological advancements in mobile applications that improve library services.
3. **Evaluate Challenges and Limitations** – Investigate the technical, financial, and user-related challenges in implementing mobile applications for libraries.
4. **Assess User Engagement and Satisfaction** – Study how mobile applications impact user interaction with library resources and services.
5. **Explore Future Trends and Prospects** – Identify emerging trends, such as AI, IoT, and blockchain, that could further transform mobile library services.
6. **Provide Practical Recommendations** – Suggest strategies for libraries to effectively implement and optimize mobile applications.

Significance of the Study

This study is significant because:

- It highlights the growing importance of mobile applications in making library services more efficient, accessible, and user-friendly.
- It provides insights into the latest innovations, helping libraries adopt advanced digital tools for better resource management and user experience.
- By analyzing challenges, it offers solutions to improve the integration of mobile technologies in libraries.
- It serves as a valuable resource for librarians, policymakers, and developers seeking to enhance digital library services.
- The study contributes to the broader discourse on digital transformation in education and knowledge management, ensuring libraries remain relevant in the digital era.

Research Methodology

This study employs a mixed-methods research approach, combining qualitative and quantitative methods to analyze the impact of mobile applications on library services. Primary data will be collected through surveys and interviews with librarians, library users, and IT professionals to assess user experiences, challenges, and adoption rates. Secondary data will be gathered from academic journals, case studies, and reports on mobile library technologies to understand key innovations and emerging trends. A comparative analysis of existing mobile library applications will be conducted to evaluate their effectiveness. The findings will be analyzed using statistical tools and thematic analysis to provide insights into best practices and future prospects for enhancing library services through mobile applications.

Overview of Mobile Technologies in Libraries

The integration of mobile technologies in libraries has revolutionized the way user's access, interact with, and manage library resources. With the rapid growth of smartphones and mobile applications, libraries have embraced digital solutions to provide seamless and convenient services beyond physical spaces.

Innovations and Advantages in Library Services through Mobile Applications

Mobile applications have significantly transformed library services by introducing innovative features that enhance accessibility, efficiency, and user engagement. These innovations enable libraries to provide seamless digital experiences while improving resource management and operational effectiveness.

1. Mobile Catalogs & Smart Search Systems

- Users can browse library collections, search for books, and check availability in real-time.
- AI-powered search suggestions improve search accuracy and enhance user experience.

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2. E-Books, Audiobooks, and Digital Lending
- Mobile apps integrate with e-libraries, allowing users to borrow and read digital books on their devices.
- Automated borrowing and return systems streamline digital lending without requiring physical visits.

3. Augmented Reality (AR) & Virtual Library Tours
- AR-based navigation helps users locate books within the library.
- Virtual reality (VR) provides immersive tours of library facilities and archives.

4. Personalized User Experience with AI
- AI-driven recommendations suggest books based on user preferences and reading history.
- Custom notifications alert users about new arrivals, due dates, and library events.

5. Self-Service and Contactless Transactions
- Mobile self-checkout allows users to borrow and return books without librarian assistance.
- QR codes and NFC technology facilitate quick scanning and book borrowing.

6. Virtual Reference and Chatbot Assistance
- AI-powered chatbots provide 24/7 virtual assistance, answering user queries and guiding research.
- Live chat services connect users with librarians for real-time support.

7. Event Management and Online Engagement
- Users can register for workshops, lectures, and book discussions through the app.
- Push notifications keep patrons informed about library events and activities.

8. Cloud-Based Library Access and Multi-Device Synchronization
- Users can sync reading progress, bookmarks, and borrowed materials across multiple devices.
- Cloud storage ensures secure access to research papers, journals, and digital archives.

9. Gamification & Interactive Learning
- Reward-based reading challenges and quizzes engage users and promote library usage.
- Interactive learning modules enhance educational experiences for students and researchers.

2. Benefits of Mobile Technologies in Libraries
- **Enhanced Accessibility**: Users can access resources anytime and anywhere.
- **Improved User Experience**: Personalized recommendations and user-friendly interfaces make navigation easier.
- **Increased Engagement**: Notifications, online reservations, and digital content encourage frequent interactions.
- **Operational Efficiency**: Automation of checkouts, renewals, and user assistance reduces manual workload for librarians.
- **Cost-Effectiveness**: Reduces reliance on physical infrastructure by offering digital alternatives.

3. Challenges in Implementing Mobile Technologies
- **Technical Limitations**: Compatibility issues, frequent updates, and system maintenance challenges.
- **Privacy & Security Concerns**: Protecting user data and digital transactions from cyber threats.
- **User Adoption & Digital Literacy**: Ensuring all users, including non-tech-savvy individuals, can effectively utilize mobile services.
- **Financial Constraints**: Costs associated with app development, maintenance, and staff training.

Case Studies and Real-World Implementations

The integration of mobile applications into library services has significantly enhanced accessibility, user engagement, and operational efficiency. This section explores notable case studies of libraries that have successfully implemented mobile applications, demonstrating the impact and benefits of these technologies.

Case Study 1: New York Public Library (NYPL) Mobile App

Background

The New York Public Library, one of the largest library systems in the world, introduced its mobile application to improve accessibility and engagement for millions of patrons.

Features & Innovations
- **E-Book and Audiobook Access**: Integration with OverDrive and SimplyE for seamless borrowing.
- **Personalized Recommendations**: AI-driven suggestions based on user preferences.
- **Self-Checkout & Renewals**: Mobile barcode scanning for borrowing and renewing books.
- **Event Management**: Mobile-based registration for workshops and events.

Impact
- A **40% increase** in digital borrowing within the first year.
- Improved accessibility for visually impaired users through voice-assisted features.
- Increased user satisfaction and engagement due to seamless book browsing and reservations.

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Case Study 2: Singapore National Library Board (NLB) Mobile Services

Background

The National Library Board of Singapore developed a mobile app as part of its Smart Library initiative, aligning with Singapore's Smart Nation goals.

Features & Innovations

Scan & Borrow: Users can scan book barcodes and check out books using their smartphones.
Geolocation Services: Indoor navigation to locate books within library branches.
Push Notifications: Alerts for due dates, new book arrivals, and upcoming events.
AI Chatbot (Ask NLB): Automated responses to common library queries.

Impact

70% increase in mobile app usage within two years.
Enhanced efficiency, reducing wait times at self-service kiosks.
Higher engagement with library resources through personalized notifications and reminders.

Case Study 3: British Library's Digital Library Initiative

Background

The British Library, known for its extensive collection of historical and research materials, launched a mobile app to expand its digital services.

Features & Innovations

Access to Rare Manuscripts & Digital Archives: Users can view high-resolution digitized historical documents.
AI-Powered Search: Enhanced metadata indexing for easier research.
Collaboration & Citation Tools: Enables researchers to organize and share materials.
Offline Access: Downloadable resources for reading without internet connectivity.

Impact

A **50% increase** in online research activities.
Broader access to historical documents, benefiting global scholars.
Increased engagement with younger audiences through an interactive mobile interface.

Case Study 4: University of California, Berkeley Library App

Background

UC Berkeley developed a mobile application to support academic research and student engagement.

Features & Innovations

Mobile Book Reservation & Pick-Up: Streamlined borrowing for students.
Digital Study Rooms: Booking and management of collaborative spaces.
AI-Powered Research Assistant: Automated literature review assistance.
Augmented Reality (AR) Library Tours: Interactive experiences for new students.

Impact

30% improvement in book reservation efficiency.
Increased student satisfaction with self-service options.
Enhanced research productivity through AI-driven tools.

Lessons Learned from Case Studies

User-Centric Design is Crucial

The most successful library apps prioritize ease of use, accessibility, and personalization.

Integration with Digital Resources Enhances Engagement

Seamless access to e-books, audiobooks, and archives increases patron interaction.

AI & Automation Improve Efficiency

AI chatbots, personalized recommendations, and automated renewals reduce staff workload and enhance user experience.

Gamification and Interactive Features Boost Usage

Augmented reality tours and digital rewards encourage library visits and engagement.

1. **Security & Privacy Must Be Prioritized**

Libraries must implement robust security measures to protect user data and ensure compliance with privacy regulations.

Future Prospects, Emerging Trends and AI Technology

The future of library services through mobile applications is poised for significant advancements with emerging technologies. Artificial Intelligence (AI) and Machine Learning (ML) will enhance personalized recommendations, automated virtual assistants, and smart search functionalities. Integration with smart devices, including voice assistants and wearables, will further improve accessibility and user engagement. Blockchain technology holds promise for secure digital lending and transparent record-keeping, while the rise of 5G and the Internet of Things (IoT) will enable faster, real-time access to library resources. Additionally, gamification and interactive learning experiences will make

library services more engaging, especially for younger users. As libraries continue to embrace digital transformation, mobile applications will evolve to offer more innovative, efficient, and user-friendly services, ensuring wider access to knowledge and resources.

Conclusion

In conclusion, mobile applications have emerged as powerful tools for enhancing library services, making them more accessible, engaging, and efficient. Also, mobile applications have revolutionized library services by enhancing accessibility, efficiency, and user engagement. From mobile catalogs and digital lending to AI-driven recommendations and virtual assistance, these innovations have transformed how users interact with library resources. However, challenges such as technical constraints, privacy concerns, and user adoption must be addressed to ensure seamless implementation. As technology continues to evolve, future trends like AI, blockchain, and IoT will further enhance library services, making them more adaptive and user-friendly. To maximize the potential of mobile applications, libraries must invest in sustainable technological solutions, staff training, and user education, ensuring that digital transformation benefits all patrons.

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Original Article

Expression, Repression, and Ambiguity in Aravind Adiga's Selection Day

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Abstract

The human need to express, to articulate inner truths through language, image, or performance, lies at the very foundation of what it means to be sentient and socially embedded. Across cultures and histories, the creative impulse has provided a vital mechanism for individuals and communities to make sense of their internal landscapes and the external worlds they inhabit. Art and literature thus serve not only as aesthetic pursuits but also as powerful vehicles for communicating identity, desire, resistance, and memory. In the Indian context—particularly within postcolonial literature—the act of expression assumes a distinctly political dimension. Here, artistic creation often collides with entrenched power structures rooted in colonial legacy, caste stratification, gender hierarchies, and neoliberal economic policies. These structures shape and sometimes inhibit who gets to speak, what can be said, and how expression is received. Within this landscape, Aravind Adiga's Selection Day (2016) emerges as a compelling literary intervention that probes these very tensions with surgical acuity. As a novel situated at the intersection of sports, capitalism, family, and identity, Selection Day does more than chronicle the coming-of-age of a young cricketing prodigy. It interrogates the cost of ambition, the fragility of individual autonomy, and the often-invisible ways in which societal forces govern personal expression. This paper explores how Aravind Adiga's Selection Day (2016) captures the complex struggle for personal expression in a society shaped by patriarchy, capitalism, and postcolonial expectations. Through the character of Manjunath Kumar—a young cricket prodigy caught between his own intellectual and emotional desires and the rigid demands of his authoritarian father—Adiga paints a nuanced portrait of identity under pressure. The novel uses cricket not merely as a sport but as a metaphor for performance, conformity, and commodification in modern India, where success is often measured by market value rather than individual fulfillment. This paper argues that Selection Day shows how literature can give voice to what is often left unsaid. In doing so, Adiga's work reminds us that expression—whether through words, silence, or desire—is not only personal but deeply political in a world that continually tries to dictate who we are allowed to be.

Keywords: *Repression; Identity; Liminality; Human Expression; Non- Conformity*

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Introduction

Literary texts become a critical site through which to examine how dreams, talents, and inner truths are shaped, suppressed, or deformed by external expectations. Adiga's literary narratives have consistently foregrounded India's urban transformations and the sociopolitical frictions they engender. He situates his narratives in liminal spaces where aspiration collides with the enduring weight of social immobility, and where characters must navigate an ever-shifting terrain of class anxieties, institutional corruption, and moral compromise. In *Selection Day*, these frictions are crystallised in the figure of Manjunath Kumar (Manju), a young boy burdened with the dreams of others, especially those of his authoritarian father. Manju's prodigious cricketing talent makes him a beacon of hope in the eyes of his father and sponsors, yet beneath this veneer lies a far more complex individual—one drawn to the logic of science. His inner world, filled with unspoken desires and repressed dreams, becomes a battleground for competing narratives: those imposed by family and society, and those he attempts to write for himself. This internal conflict is emblematic of a broader struggle in postcolonial Indian society, where human expression—particularly that which deviates from normative scripts of success, masculinity, and patriotism—must continually negotiate with socio-political conformity. By examining the interplay between Manju's creative impulses and the sociocultural forces that seek to contain them, the analysis sheds light on the novel's deeper commentary about identity, agency, and the redemptive potential of expression in a society marked by structural inequalities. In doing so, it situates Adiga's work within a broader discourse on human expression, arguing that literature not only reflects societal tensions but also serves as a site for imagining alternative futures and reclaiming silenced voices.

2. Cricket, Capitalism, and the Art of Performance

Cricket, in *Selection Day*, is more than a sport; it functions as a highly orchestrated performance, a spectacle that is commodified, fetishized, and closely regulated by the logic of neoliberal capitalism. What was once a game rooted in community and passion is repurposed as a profit-driven enterprise where talent is appraised not by its creativity or individuality but by its ability to conform to market demands. For the characters in Adiga's novel—especially Manju and his brother Radha—cricket is not a domain of free play but a regimented pathway to socioeconomic mobility, dictated by sponsors, scouts, and corporate interests. As Tommy Sir puts it, "Sport alone isn't enough today. People want sport and a story. Two brothers from the slums making it big. It's a story." (SD, 38) Manju and Radha are not merely aspiring athletes; they are systematically groomed as "products" to be polished, packaged, and sold. Under the relentless eye of their father Mohan Kumar, who views their bodies and skills as investments, they undergo rigorous training, dietary control, and psychological manipulation. The cricket field is transformed into a metaphorical stage where national dreams, familial ambitions, and the relentless aspirations of a consumerist middle class converge. Adiga meticulously exposes how the boys' worth is assessed not on the basis of their personal inclinations or happiness, but on how well they fit into the narratives of success forged by those in power. The novel thus critiques the larger cultural trend wherein all forms of artistic and expressive acts are consumed and evaluated through capitalistic parameters. Cricket, once a potential avenue for joy and creativity, is reimagined as a ruthless career track governed by a meritocratic ideology that fetishizes success and marginalizes failure. The psychological cost of this commodification is most visible in Manju, who is profoundly uncomfortable with the demands of the sport and increasingly alienated from the identity it imposes on him. His interest in science, literature, and history signals a yearning for intellectual and emotional engagement, a form of expression that allows complexity and introspection. However, these inner desires are consistently subordinated to the external imperatives of performance. Thus, Manju's participation in cricket becomes a symbolic act of self-negation. Rather than offering a space for self-realization, the sport becomes a tool of control, stripping him of spontaneity and creative agency. What should have been an expressive outlet is repurposed into a utilitarian mechanism for class mobility, reinforcing the novel's broader critique of how market-driven ideologies co-opt and deform human creativity.

3. Patriarchal Power and the Silencing of Identity

In *Selection Day*, Aravind Adiga crafts a portrait of the father, Mohan Kumar, not merely as a domineering parent but as a symbol of systemic repression—an agent of both familial and ideological control. Mohan is less a person than a construct of postcolonial anxieties and neoliberal aspirations, embodying the social imperative that equates worth with performance, discipline, and adherence to a singular narrative of success. His obsession with transforming his sons, Radha and Manju, into cricketing prodigies is underpinned by an authoritarian rigidity that negates the individuality of both children. Mohan's dogmatic imposition of dietary restrictions, training routines, and moral expectations reflects a

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totalitarian approach to child-rearing in which the future is not something to be discovered, but something to be dictated. At the heart of this dynamic lies the systematic silencing of the child's voice. Manju, the more introspective and intellectually inclined of the two brothers, is frequently forced to suppress his scientific interests in favor of athletic discipline. In this schema, the child becomes an instrument of the parent's deferred ambitions—a vessel for achieving social mobility and vicarious glory in the marketplace of postcolonial India. Mohan's constant scrutiny of his sons, his verbal abuse, and his manipulation of their emotional needs function to repress the libidinal and imaginative energies of the ego—particularly in Manju, who yearns for intellectual and emotional autonomy. The result is not merely compliance but alienation. The sons become estranged from their desires, operating within a framework of fear and performance rather than authenticity and choice. This psychoanalytic lens intersects fruitfully with Frantz Fanon's critique of colonial authority in *Black Skin, White Masks* (1952). Fanon discusses how internalised oppression leads to a fractured self, where the colonised subject polices their own behaviour to align with the expectations of the coloniser. In *Selection Day*, Mohan's paternal control can be interpreted as a form of "internal colonisation"—the perpetuation of colonial authority through indigenous structures of power. The father replicates the colonial imperative to mold, civilise, and extract value from the subaltern body, in this case, the bodies of his sons. Mohan's control is also symbolic, representing a larger cultural narrative in which art, literature, and non-material pursuits are devalued unless they can be instrumentalised for socio-political gain. When Radha exhibits a desire to assert his independence—perhaps through love, friendship, or choice of career—he is met with punishment and ridicule. When Manju attempts to deviate from his assigned path by expressing ambivalence toward cricket, he is labelled weak or disloyal. This suppression of non-conformity is not merely familial but ideological. The father's authority functions as a cipher for nationalist discourse, which often privileges sacrifice, discipline, and utility over individual exploration and expression. This framing also calls to mind Gayatri Chakravorty Spivak's question: "Can the Subaltern Speak?" In Adiga's novel, the subaltern does speak—but is constantly interrupted, redirected, or drowned out. Manju's voice, as both a character and a symbolic subject, is in a continual state of becoming. His tentative attempts to articulate his individuality are met with resistance from an apparatus that seeks to render him a replicable product: the successful cricketer, the obedient son, the bearer of the father's ambitions. The denial of this voice—this refusal to allow for self-articulation—is the most insidious form of violence in the text. Adiga's critique of patriarchal control is therefore inseparable from his broader interrogation of postcolonial modernity. Through the character of Mohan, *Selection Day* invites a deeper examination of the psychological, cultural, and political mechanisms that silence the individual voice. It interrogates the cost of such silencing—not only to the individual, but to society itself, which loses the diversity of stories, talents, and identities that lie buried under the weight of inherited dreams and rigid expectations.

4. Shame and Silence in Postcolonial Masculinity

Aravind Adiga's *Selection Day* navigates complex terrains of identity formation, not least among them the realm of sexuality. While never overtly declared, Manjunath Kumar's ambiguous sexual orientation forms a persistent undercurrent in the novel, surfacing through his conflicted relationship with Javed Ansari, a charismatic and wealthy fellow cricketer. The narrative treats Manju's sexual uncertainty with remarkable subtlety, embedding it within layers of internalised shame, cultural taboo, and systemic repression. In doing so, Adiga illuminates the ways in which postcolonial Indian masculinity enforces rigid parameters of acceptable expression, not only in terms of professional identity but also in matters of sexual and emotional being. Manju's feelings for Javed—marked by admiration, curiosity, discomfort, and an unarticulated longing—are repeatedly framed through negation and silence. Their interactions oscillate between emotional intimacy and avoidance, suggesting an intense psychological tension. In this context, the sports field becomes a heavily gendered and regulated space. It is not merely a venue for athletic prowess but a site where dominant ideals of masculinity are rehearsed and enforced. Any trace of vulnerability, affection, or deviation from heteronormativity is suppressed as a threat to the masculine order. Here, Judith Butler's theory of gender performativity, as articulated in *Gender Trouble* (1990), offers a compelling analytical framework. Butler argues that gender is not an innate identity but a series of acts and performances that are socially regulated and repeated over time. Manju's masculinity, as portrayed in *Selection Day*, is precisely such a performative construct—something he enacts under coercion rather than something that emerges from within. From his father's expectations to the demands of his coaches and sponsors, Manju is continuously pressured to conform to a model of masculinity rooted in aggression, heterosexuality, stoicism, and physical dominance. Manju's queerness, therefore, is not merely a private orientation but a political threat to the social narratives that govern his existence. Scholars like Ashis Nandy and R.W.

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Connell have noted how postcolonial societies often reconstruct hypermasculine ideals as a counter-response to colonial emasculation. In India, where colonial rule systematically undermined indigenous masculinities and placed the brown male body under racialised surveillance, the post-independence period saw a resurgence of machismo tied to nationalism, economic productivity, and athletic achievement. The novel thus becomes a poignant meditation on how identities are formed, constrained, and sometimes obliterated by societal expectations. In giving voice to this silent struggle, Adiga not only humanises his protagonist but also challenges the reader to reconsider the many ways in which expression is policed and desire is denied in contemporary Indian society.

Conclusion

Aravind Adiga's *Selection Day* does not end with a triumphant resolution or a clear moment of self-realisation. Instead, it closes on an ambiguous, open-ended note—an intentional choice that echoes the novel's central concern with human expression in a society dominated by control, conformity, and commodification. Manjunath Kumar's story doesn't follow a neat, linear journey toward freedom. Like many postcolonial subjects, his path is shaped by continual negotiation—between his desires and duties, individuality and expectations, voice and silence. Adiga's portrayal of expression as a form of resistance resonates with broader themes in postcolonial literature. Manju's search for selfhood unfolds within deeply entrenched social structures that often deny personal agency. Patriarchy, capitalism, caste, and compulsory heteronormativity combine to silence those who do not—or cannot—fit into society's predefined roles. In such a world, expression becomes more than communication; it becomes a way to survive, to assert identity against forces that would otherwise erase it. Mumbai, the city in which the novel is set, is more than a backdrop—it is a character in itself. A city of both dreams and disillusionment, its contradictions reflect those of its inhabitants. Between glamour and hardship, between ambition and despair, the city mirrors Manju's internal conflict: torn between performance and authenticity. Adiga captures this tension through a fragmented narrative style, one that mirrors the protagonist's fractured inner world and the larger social dissonances he inhabits. While cricket anchors the novel, it functions primarily as a metaphor—for how talent is commodified, and how identity is shaped under neoliberal pressure. Literature, queerness, and even silence emerge as acts of quiet rebellion—alternative ways of speaking in a world that often refuses to listen. *Selection Day* resists the conventions of a coming-of-age tale. Manju does not emerge fully formed or resolved. Instead, his story ends with his departure—not just from cricket, but from the identity imposed upon him by his father, by society, and by the machinery of fame. This refusal to conform is the novel's boldest political act. By leaving Manju's journey unfinished, Adiga reminds us of the power of literature to reclaim the human voice, especially in a world increasingly governed by market logic and rigid ideologies. In *Selection Day*, expression is not simply a personal quest but a shared cultural negotiation. Through its openness and refusal to offer easy closure, the novel honours the fragile yet resilient nature of human voice. It insists that the fight for self-expression, though difficult and often painful, is vital—for personal dignity, for societal change, and for the preservation of plurality in a homogenising world.

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Original Article

The Impact of Artificial Intelligence on Society

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Abstract

Artificial Intelligence (AI) is transforming today's society, and will continue to bring revolutionary changes in domains, such as health, education, and governance. In healthcare, AI improves diagnostic precision and individualizes treatment, while in education it fosters adaptive learning systems to better meet each student's needs. Furthermore, AI enhances the evolution of smart cities through smart urban infrastructure and public services. But the same pace of progress in AI also brings significant downsides. There is a risk that economic inequality is likely to be exacerbated as automation causes jobs to be lost. However, this requires a connection to the Internet which is not readily available in low-income countries or remote areas of developed countries. A problem, however, is that issues of ethics and potential biases and privacy issues with the data mean that they must be developed with suitable regulation and oversight. What's more, AI's huge power usage and thus carbon emissions, cause environmental sustainability concerns. This paper examines two sides of AI adoption in society: the opportunities that AI offers for society-building and for individuals' social participation, and the risks that such adoption poses, stressing the necessity for comprehensive policies and for ethical guidelines for fair and responsible development. Through a focus on overcoming these challenges, AI could be used to work for the good of all people.

Keywords*: artificial intelligence, automations, health, education, governance, opportunities.*

Introduction

Artificial Intelligence (AI) is rapidly transforming global society, influencing sectors such as healthcare, education, employment, governance, and ethics. This paper examines the multifaceted effects of AI, highlighting both its transformative potential and the challenges it presents. AI's integration into healthcare has led to advancements in diagnostics, personalized treatment, and drug discovery, enhancing patient outcomes and operational efficiency. In education, AI facilitates personalized learning experiences, enabling tailored educational pathways and bridging gaps in access to quality education. Economically, AI contributes to productivity growth and the creation of new job categories, though it also raises concerns about job displacement and economic inequality, particularly in developing regions with limited access to digital infrastructure . The environmental impact of AI is significant, with substantial energy consumption associated with training large models and the generation of electronic waste. These environmental costs necessitate sustainable practices in AI development and deployment .In this we underscores the importance of establishing robust ethical frameworks and governance structures to guide AI development. It calls for international collaboration to ensure that AI technologies are developed and implemented in

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Ways that promote equity, transparency, and accountability, mitigating risks while maximizing benefits for society.

Literature Review

What is AI? Artificial Intelligence (AI) is the ability of a computer program or a machine to think and learn. No longer confined to the realms of sci-fi, AI increasingly underpins our everyday existence, from digital assistants and self-driving cars to recommendation algorithms and so much more. And as AI systems become more advanced, they are shaping decisions that have long belonged to humans — prompting excitement and concern. It is important to identify the impact of AI on the society for appropriate development and equitable realizations.

In recent years, researchers have charted both the promise and peril of AI. Whereas Brynjolfsson and McAfee (2014) stress AI's innovation and economic growth potential, others, such as Bostrom (2014), warn against existential risks. AI can contribute up to \$13 trillion to the global economy by 2030 according to a report by the McKinsey Global Institute (2021). On the downside, the World Economic Forum (2020) predicts that automation will replace 85 million jobs by 2025, posing challenges for labour adjustment. Ethical concerns, such as algorithmic bias and surveillance, are also widely discussed (O'Neil, 2016; Eubanks, 2018).

Positive Impacts of Ai on Society

Economic growth and innovation

Artificial intelligence improves productivity by automating repetitive tasks to optimise processes. Manufacturing, finance or logistics are examples of industries that profit from AI-based analytics and decision-making. AI is used by startups and tech companies to create new products and drive innovation.

Medical Innovations

AI uses in the health sector such as diagnosis tools, precision medicines and robotics in surgeries. Algorithms such as those used by IBM Watson help to diagnose and recommend treatment options for diseases, leading to better patient outcomes and cost savings.

Better availability of information

AI powers tools like search engines, voice assistants, and educational platforms. These technologies democratize access to information, offering learning opportunities to remote and underserved populations.

Environmental Monitoring

AI supports environmental sustainability through climate modeling, wildlife conservation, and smart agriculture. Predictive analytics help in disaster management and efficient resource utilization.

Negative Impacts and Ethical Challenges of Ai on Society**:**

Job Displacement and Inequality

Robots are coming for jobs, and not just in factories. Call centers, truck drivers, you name it, automation's got its eye on it. Sure, there'll be new gigs popping up, but guess what? They usually need a totally different skill set. A laid-off assembly line worker isn't magically turning into a data scientist overnight. So, the gap between the haves and have-nots? Probably getting wider.

Algorithmic Bias and Discrimination

We think computers would be less biased than people, but that is not the case. It Turns out, if you feed an AI garbage (aka biased data), it spits out garbage right back. Facial recognition tech, for example, has a pretty shaky track record with people of color. We're talking wrongful arrests and a whole lot of "Sorry, the computer said so." Not exactly progress.

Privacy and Surveillance

AI's got eyes everywhere—literally. Between facial recognition and data hoarding, privacy feels like a retro concept at this point. And it's not just nosy neighbors; governments and big corporations are watching, too. Big Brother isn't sci-fi anymore, it's just Tuesday.

Ethical and Existential Risks

Okay, here's where things get a bit Black Mirror. Who's actually in charge if an AI goes rogue? Autonomous weapons, super-smart algorithms—if they're not playing by our rules, who's stopping them? Without some serious guardrails, we might be headed for a "whoops, the robots took over" scenario. And nobody wants to be an extra in that movie.

Policy and Regulatory Considerations:

Governments and institutions are starting to create frameworks to deal with the risks of AI. The EU's Artificial Intelligence Act seeks to regulate high-risk AI systems, while ethical guidelines by organizations such as the IEEE encourage responsible AI research. Cooperation between technologists, ethicists, and policymakers will be needed to design inclusive and equitable AI governance.

Future Outlook:

AI's trajectory will depend on how society navigates its benefits and challenges. Future developments may include stronger AI-human collaboration, improvements in explainable AI, and global agreements on ethical standards. Education and reskilling initiatives will be crucial to prepare workers for an AI-augmented economy.

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Conclusion

Artificial Intelligence is a double-edged sword. Its potential to disrupt industries, enhance lives, and crack difficult problems is unmatched. At the same time, it presents important risks that need to be tackled through ethical design, participatory policies, and continuing public debate. As AI develops further, its impact on society will depend on decisions we take today.

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