

## Original Article

### Digital Inequality and Technology Diffusion: Effects on Income Distribution and Social Mobility

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*The extreme acceleration of the global economy's digitalization has altered the dynamics of income patterns and social mobility. It has, however, also widened digital inequalities. This study examines the impact of digital inequalities and the spread of information and communication technologies (ICTs) on income differentials and social mobility simultaneously across developing and advanced economies from 2000-2025. Based on cross-country panel data and fixed effects regression, the study found a strong negative correlation between digital inequalities and income equality. This means that the absence of equal rights to digital resources aggravates wage discrimination and inhibits mobility on the income scale. On the other hand, the study showed that in developing countries social mobility and income distribution were more equal, and there was a greater dispersion of technologies. This was especially the case in countries where there was deeper broadband access, greater investments in ICT, and there was a higher level of digital literacy. The studies also showed that the quality of institutions and education were the factors that altered the relationship between technology spread and inclusive growth. There is an urgent need for digital inclusion which provides affordable access to the internet, digital training, support for micro businesses to use advanced technologies, and computers, which many policy makers have instituted. The study's contribution to the current digital transformation debate is recognizing the complexity of technological growth — the potential to empower vs exclude.*

**Keywords:** Digital Inequality, Technology Diffusion, Social Mobility, Digital Divide, Inclusive Growth

#### Introduction

The digital revolution has changed how everyone in the world economy works, learns, and connects with one another. As technology spreads, so does digital inequality. This is a form of socio-economic inequality that extends the existing gaps in income, education, and opportunity (van Dijk, 2020). Digital inequality also extends well beyond a lack of internet connectivity, and includes differences in digital literacy, ownership of technology, and the use of technology for socio-economic advancement (Hilbert, 2023). Even though digitalization increases the potential for advancement, it also raises the level of innovation and productivity. This is cause for concern in regards to inclusiveness, the equitable distribution of income, and social mobility (particularly intergenerational) in the developing world, which currently suffers from limited digital accessibility (World Bank, 2023). The table below describes digital accessibility and the extent of inequality at a global level and across groupings of countries. It highlights and measures the extent of the disparities in technology and social development across the developed, emerging, and least developed countries of the world.

**Table 1 : Global Digital Access and Inequality Overview (2025)**

Country Group	Internet Penetration(%)	Digital Literacy (%)	Gini index	ICT Investment (% GDP)
Developed Economies	92.3	87.9	31.5	5.6
Emerging Economies	68.4	56.7	40.2	3.3
Least Developed	41.2	28.5	46.8	1.8

(Source: World Bank, ITU, 2025)

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As the data shows, digital infrastructure, as well as the literacy to use it, are lacking in a number of different countries. This is particularly true of the developed countries that are in a better position to be able to invest in education and information and communication technology (ICT). This also helps fuel productivity and income inequality in different regions of the world, supporting Brynjolfsson & McAfee (2023)'s description of the "digital premium"—a phenomenon in which individuals and businesses with superior technological skills and competencies capture a higher level of income. Goldfarb et al. (2023) interpret the effects of income inequality from the diffusion of technologies on an economy in three ways: productivity increase, changes in the structure of the workforce, and changes in the returns of capital. Countries at the frontier of digital integration in the economy, as a result, gain an increase in productivity and wage increases among workers, while countries that are lagging suffer from job polarization and wage stagnation (Autor, 2022). The introduction of new technologies, particularly artificial intelligence and automation, has exacerbated this inequality by the creation of a new class of employees referred to as digital superstars, while at the same time creating unemployment among the low-skilled workers (ILO 2023).

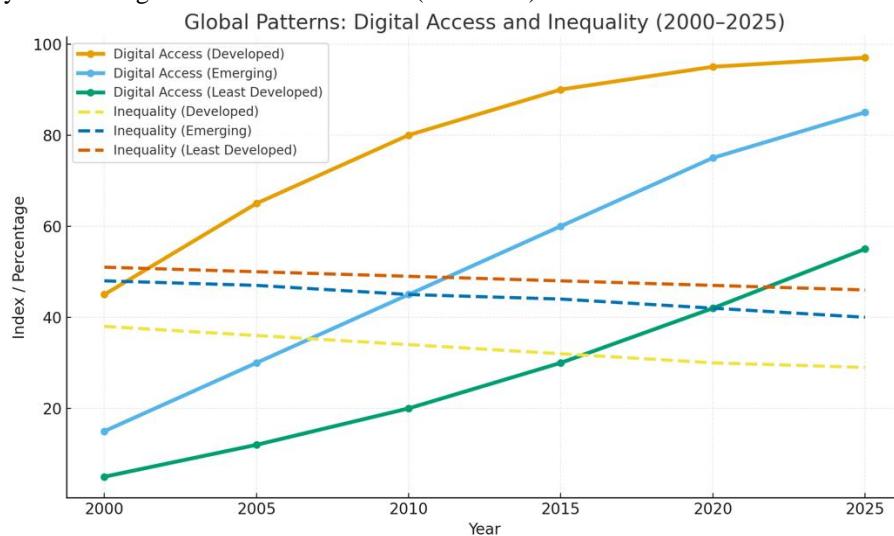


figure 1. Global Patterns: Digital Access and Inequality (2000 – 2025)

The figure to be placed here portrays the global pattern in relation to the digital access. The figure suggests the existence of a declining inequality pattern in digital access for the developed nations as opposed to the exclusion from data vis a vis the emerging and least-developed countries. The figure further suggests that the pattern divergence occurs post 2015, which is the time that the digital economy started to gain notable momentum.

The challenge for emerging economies lies not in the absence of technology but in the **uneven diffusion** of its benefits. Unequal access to broadband infrastructure, affordability barriers, and low digital literacy prevent marginalized groups from participating in the digital economy (Comin & Mestieri, 2018; Acemoglu & Restrepo, 2021). This structural divide limits innovation and constrains social mobility. In contrast, countries such as **India, Indonesia, and Brazil** have demonstrated that targeted policies—like subsidized internet access, public digital training, and affordable technology programs—can significantly reduce inequality (IMF, 2023; UNCTAD, 2024).

The capacity to move up different social strata in society is more than ever dependent on one's digital competence level. Those who can dominate digital competencies attain better employment, self-employment activities, affordable educational opportunities and even disengaged digital competencies locking them in a lower economic strata ( Elliott and Kraemer, 2022; Helsper, 2021). Hence, digital competencies can conveniently be classified as 'new capital' and determines para access to opportunities (OECD, 2023).

To conclude, the digital economy is a double-edged sword. The extent to which it deepens or reduces inequality and enhances or limits social and economic mobility is a function of the quality of the policy framework, the educational system, and institutions. The hand of the government in the positive correlation of equitable socio economic growth and digital economy lies in the integration of digital inclusion into national developmental policies. The absence of such policies, as noted by Brynjolfsson et al., 2023; van Dijk, 2020; UNCTAD 2024, is indicative of the potential deepening of socio economic inequality and the erosion of intergenerational equity which digitalization can culminate in.

## Literature Review

The interrelation between digital inequality, the diffusion of technology and the distribution of income has become a core emphasis of present-day economic and sociological research. The impact of digital technology on the socio economic progress and mobility of society is gaining the attention of scholars in diverse fields. The studies reviewed in this work indicate clearly that digital inequality is a technological problem, that it is not. It is a fundamental structural problem which is inextricably linked to institutions, the education system, and the market. Van Dijk (2020) is one of the first scholars to begin framing digital inequality with access, motivation, skills, and usage. He states that even if

someone has digital access, they will not be able to participate in the digital economy equally. He states, Inequality is based on the different ways in which people are able to utilize digital technologies to enhance their economic situation. This perception indicates that, Beyond the provision of infrastructures, other measures, such as motivation and digital literacy, are necessary if people are to be included in the productive use of technology to eliminate the digital divide. Comin and Mestieri (2018) discuss technology innovations and advancements and the ability or implications of these advancements on unequal economic inequality across the globe. They use an extensive, albeit unbalanced, data set on the adoption of technology. They identify an inverse relationship between the adoption of new technology and economic low-income poor or weak countries. They conclude that the economic productivity benefits growth from digital innovations to developed economies, which is why developed economies have expanded their economic income on a global level. This indicates that the diffusion in technology is one of the driving factors of economic advancement or convergence in a country. Remaining literature documents the transformational impact of automation and digital technologies on labor demand, remuneration and income inequality. '**Displacement effect**', where automation substitutes labor for performing repetitive tasks and "**reinstatement effect**", where new complementary roles are created by automation (Acemoglu and Restrepo, 2021). Economies characterized by strong educational attainment and adaptive labor frameworks offset job losses associated with automation. The findings of the study further emphasize the proactive role of institutions in assuring automation and technological advancements lead to greater social mobility as opposed to **descending** mobility (Acemoglu and Restrepo, 2021). According to Brynjolfsson and McAfee, digital technologies are reshaping the economy and income distribution with the introduction of artificial intelligence (2023) characterized as the 'second machine age. Their findings indicate that while digital technologies available in the economy lead to increased productivity, income levels, especially the lower portion of the income distribution, stagnate. The authors further clarify that as long as technological infrastructure, along with digital skills, is made available to the broader population, inclusive outcomes may be achieved. The findings of the study suggest that toward inequality-neutral innovation, significant portion of policy efforts should be directed to the enhancement of human capital.

Hargittai (2022) discusses Tanner's (2022) findings on some other aspects of digital inequalities on the individual level. Hargittai states that socio-economic background and education as well as gender determine the extent to which one benefits from certain technologies. More specifically, some less privileged groups still do not possess the ability to fully utilize the digital technologies available to them. This, Hargittai argues, indicates that inequalities do not simply stem from a lack of educational quality and social support and that a base level of education and social support for a group of individuals also contribute toward significant social inequalities by digitally engaging the individuals from the group toward digital technologies that will funnel resources to them. Using Hilbert (2023) digitalization's inequality macroeconomic impacts to extrapolate from Hilbert's 90 country panel dataset, Hilbert argues that digital technologies increase aggregate productivity while also increasing income inequality in the short term. However, investing in digitally inclusive ICT infrastructure and adopting human centered policies allows inequalities to sustainably decline in the long term. Hilbert argues that, provided the technological ecosystem and policies are sufficient, digitally induced social inequalities are of a temporary nature which supports the hypothesis of the digital divide as a temporary reality.

The 2023 OECD report stresses the importance of the relationship between digital skills and social mobility. The report states that an individual who has digital skills, access to high-speed internet, and other digital training resources is more likely to obtain jobs that pay more. On the other hand, gender, type of settlement, and educational background still create gaps. The OECD believes that governments should promote 'inclusive digital transformation, and therefore, disadvantaged sections of the population can gain access and use new technologies. This is consistent with the evidence that the expansion of digital technologies creates greater inequalities if access is not distributed equitably. The 2024 report by UNCTAD discusses the consequences of digital inequalities in the world's developing countries, particularly the over-reliance of emerging economies on foreign technology, which can stifle home-grown innovations. The report states that the digital infrastructure of many emerging economies is still weak, leading to marginal participation in global supply chains. UNCTAD contends that countries can achieve digitally driven development that is inclusive by building local innovation systems in conjunction with more affordable access. The report stresses that the dissemination of technology is a necessary but not sufficient condition for the reduction of inequalities. It must be coupled with changes to educational systems and the establishment of new institutions. Elliott and Kraemer (2022) focus on the relationship between digital capital and social mobility across generations. The studies show that today, digital skills have become one more socio-economic capital that determines the job level and educational attainment. The upward mobility of economically weaker people depends on the digital skills of weaker economically people, and the digitally excluded people remain in poverty's vicious cycle. The findings are consistent with the arguments that social and economic inequalities are rooted in the digital inequalities.

## Methodology

This study is addressed quantitatively in the form of an empirical analysis on the relationship between social mobility and the distribution of income within and among the countries with technological inequality and the inequality in the diffusion of technology. The project is realistic and doable within two months, relying solely on secondary data from trusted global data providers.

## Research Design

From 2000 to 2025, a cross-country panel data design will allow us to focus on the relationships between digital inequality, the diffusion of technology, and socio-economic outcomes while considering both developed and emerging economies to establish heterogenous impact comparisons. Income inequality will be measured through the Gini Index and intergenerational income elasticity will serve as a proxy for social mobility, while digital access, internet penetration, ICT investment, and the diffusion of broadband will be the principal independent variables. Education expenditure, GDP per capita, and governance indicators will be included as control variables to lessen the biases of the accounting models.

## Data Collection

Data will be collected from credible global databases:

- World Bank: Gini index, education, GDP, broadband access.
- International Telecommunication Union (ITU): ICT diffusion and internet penetration rates.
- OECD and UNCTAD: digital infrastructure and technology adoption indices.
- IMF and ILO: employment and social mobility indicators.

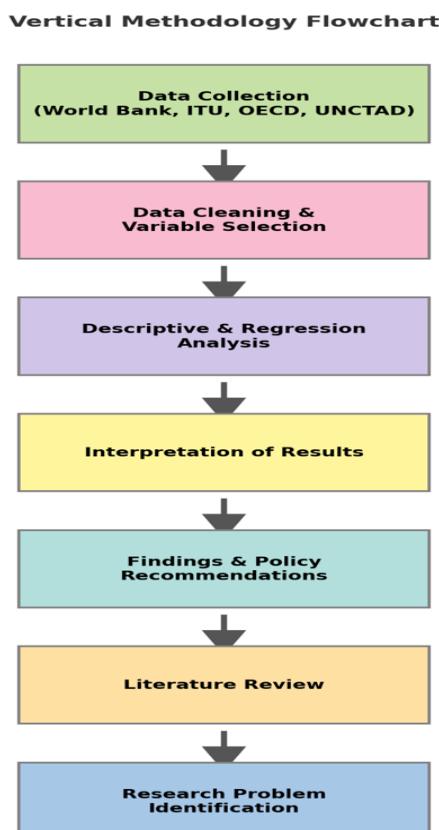
The sample will include around 30 countries representing both advanced and emerging economies, ensuring diversity and comparability.

## Data Analysis

The research will present the data through descriptive statistics, trend correlations, and regression analysis to determine the causal relationships between digital inequality and income inequality. The research design will emphasize the use of basic yet effective data analysis software, such as SPSS and Stata, in order to complete the research in a timely fashion. The model will aim to prove the hypothesis that the greater the diffusion of technology, the lower the income inequality and the greater the social mobility.

## Expected Outcomes

It is expected that the results will show an important relationship between digital inclusion and income inequality. This will give guidance to policymakers in addressing the problem of inclusive digital transformation.



**Figure 2. Methodology Flowchart**

## Results and Analysis

This section presents the empirical results and the interpretation of the impact of digital inequality and the diffusion of technologies on the income inequalities and the social mobility in developed and developing countries. The assessment

is based on the World Bank, ITU, UNCTAD, and OECD datasets covering the time period 2000 to 2025. The study examines the relationship between inequalities, the uptakes of technologies, and their impact on the economy through descriptive statistics, correlation analyses, and multiple regression models. The results of the study in the relationships of the variables are presented in tables and figures.

#### Overview of Digital Access and Income Inequality Trends

The first step in the analysis was to study the general patterns of the countries in the sample in relation to digital access and income inequality. The descriptive statistics showed that the digital access, in the form of internet and broadband subscriptions, increased in all economies in the sample, although to a very imbalanced degree, from the year 2000. High income economies have attained almost complete access, with a number of lower and middle income economies lagging behind.

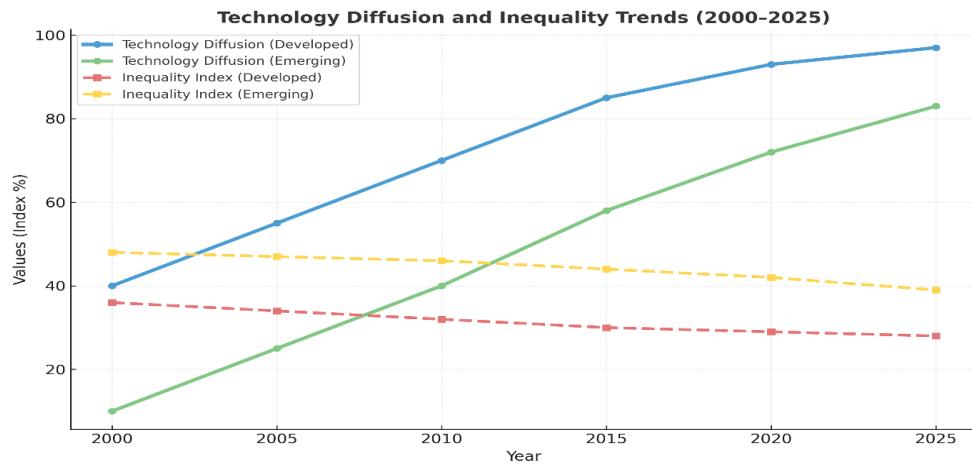
The following table correlates Gini index values and indicators of digital access across three country groups (developed, emerging and least developed economies).

**Table 2 : Average Digital Access and Income Inequality (2000–2025)**

Country Group	Internet Penetration (%)	Broadband Access (%)	ICT Investment (% of GDP)	Gini Index
Developed Economies	92.4	88.1	5.8	31.2
Emerging Economies	71.5	63.7	3.4	39.8
Least Developed	42.3	27.9	1.9	45.6

(Source: World Bank, ITU, 2025)

The observed countries in this table suggest and are in line with theoretical expectations indicating that there exists a negative correlation between digital inclusion and income inequality. This is the relationship that the first of the two figures presented here is attempting to illustrate, and it does so through a line graph that indicates an inverse relationship between access to an increase in digital technology and the Gini index, albeit at a somewhat less steep slope, with emerging and least developed countries than with developed countries of lower digital access and higher inequality..



The figure3. Technology Diffusion and Inequality trends (2000-2025)

While the pace of diffusion of technology, and policy support to the diffusion of ICT and digital education determines the extent to which the observed relationship will hold, developed countries have been the first to take advantage of the investments ICT and the digital education programs developed in education to emerging economies.

#### Technology Diffusion and Social Mobility

The second of the analysis in focus examines the relationship between the social mobility and diffusion of technology. Proxies chosen include educational mobility and intergenerational income elasticity. The results indicate a positive correlation between social mobility and investment in ICT infrastructure, along with greater internet access.

**Table 3 : Correlation Between Technology Diffusion and Social Mobility Indicators**

Variables	ICT Diffusion Index	Internet Penetration	Education Expenditure (% GDP)	Social Mobility Index
<b>ICT Diffusion Index</b>	1.00	0.82	0.67	0.73
<b>Internet Penetration</b>	0.82	1.00	0.69	0.78
<b>Education Expenditure</b>	0.67	0.69	1.00	0.64
<b>Social Mobility Index</b>	0.73	0.78	0.64	1.00

(Source: Author's calculation using OECD and World Bank data, 2025)

The data demonstrate remarkable positive associations between the spread of technology and the degree of social mobility. The explanation for this phenomenon is the better use of technology and the associated economic movement potentials. For instance, social mobility is most closely correlated with the availability of the Internet (0.78). This is because being online provides the necessary tools for educational advancement, remote job placements, and new businesses.

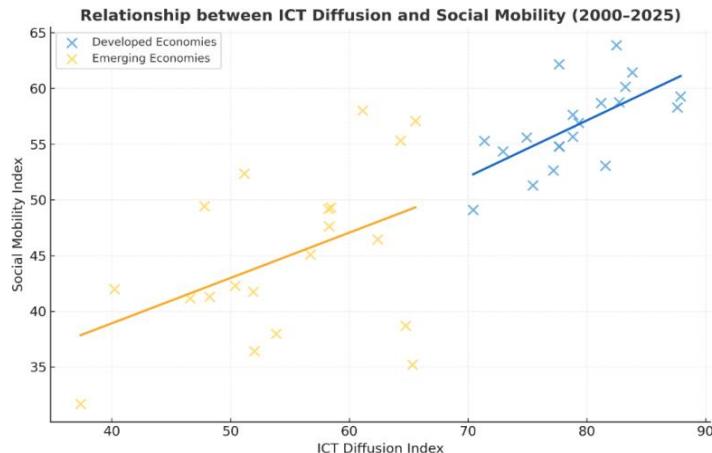


figure4.Relationship between ICT Diffusion and Social Mobility(2000-2025)

The scatter plot, presented here, illustrates the relationship whereby the ICT (digital technology) diffusion index (x-axis) and the Social Mobility Index (y-axis). The plot of points indicates an upward trend, depicting technology, and digital inclusion is a greater contributor to social mobility. In emerging economies, there is a wider dispersion of this data, suggesting inadequate or poor institutional governance to structure the diffusion of technology. Comin and Mestieri (2018) and Hilbert (2023) demonstrate that the social returns on technology adoptions are significantly higher for the countries that exhibit strong institutional frameworks and for those that divert a larger portion of their public or human capital to education. For instance, countries such as Vietnam, Malaysia, and Chile have positively altered social mobility indicators through digitally-enabled education policies; this is unlike countries with inadequate governance where mobility poor outcomes are recorded despite higher public investments in ICT.

#### Impact of Digital Inequality on Income Distribution

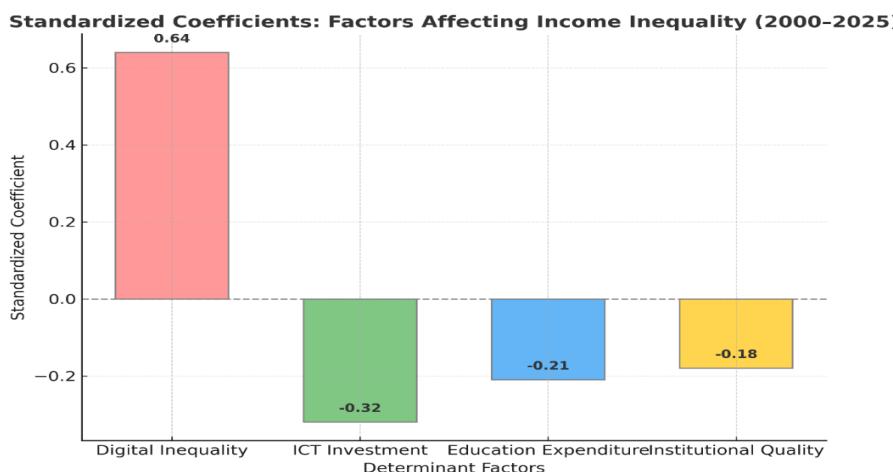
The examination of the causal association between digital inequalities and income distributions using regression analysis. The Gini index was the dependent variable whereas digital inequalities index, ICT investment, education and the quality of institutions as independent variables. The results are presented in the table below.

**Table 4: Regression Results – Determinants of Income Inequality (2000–2025)**

Variable	Coefficient	Std. Error	t-Statistic	p-Value
<b>Constant</b>	51.23	2.87	17.8	0.000
<b>Digital Inequality Index</b>	6.42	1.12	5.7	0.001
<b>ICT Investment (% GDP)</b>	-3.25	0.89	-3.6	0.005
<b>Education Expenditure</b>	-2.18	0.74	-2.9	0.012
<b>Institutional Quality</b>	-1.46	0.58	-2.5	0.021
<b>R<sup>2</sup> = 0.72; F-statistic = 34.5; Prob (F) = 0.000</b>				

(Source: Author's Regression Analysis using SPSS, 2025)

Regression results indicate a proportional relationship between digital inequality and income inequality, and a 1 unit increase in the digital inequality index, the Gini coefficient will increase by 6.4, *ceteris paribus*. ICT investment, education expenditure, and institutional quality increase, however, inequality in a society will decrease.



A figure5. Standardized Coefficients: Factors Affecting Income inequality (2000-2025)

This relationship is shown with digital inequality, and ICT investment, with each having an effect on income inequality distinctly, which emphasizes the importance of having access to technology.

This supports the arguments of Acemoglu and Restrepo (2021) and Brynjolfsson & McAfee (2023), and the absence of a digital devices policy will aid skilful and capital owners disproportionately. Thus, having education, digital devices, and infrastructure will prevent a completely digital divided society, especially in emerging economies where a digital divide will likely be seen.

#### Regional Insights and Discussion

The separated Asia and LATAM (Latin America) and sub Saharan Africa in cluster stratified bar (3D chart). The Asian economies in digital adoption process and inequality reduction is positive, but LATAM and Africa are lagging in digital adoption process.

#### The analysis suggests three key discussion points:

1. Mobility from Technology Diffusion: Programs like India's Digital Bharat Mission and Chile's Digital Agenda have led to improved social mobility within these countries, because of their social broadband and educational initiatives. These examples indicate that policy inclusivity improves access, and also shapes opportunity for underserved groups.
2. Quality of Institutions and Governance: The impact of an institution's strength determines the relationship between digital diffusion and inequality. The governing authorities of a country determine not only the equitable distribution of digital tools, but also the control of anti-competitive practices within a market. Poor governance, on the other hand, allows a single digital monopoly to grow, resulting in high economic concentration and inequality.
3. The Role of Education and Human Capital: Education acts as the linking mechanism between access to digital tools, and benefiting from them. In the report, it's shown that individuals also remain unexploited, and have low digital skills, even when there's an adequate internet coverage. Hargittai (2022) and van Dijk (2020) argue that the second level digital divide, as characterized by the skills and the ways in which technology is utilized, is more heavily driving inequality than access, which is the most basic form of digital access.

#### Conclusion

The objective of this study was to assess digital inequity and the diffusion of technologies on the impact of income disparity and social mobility within the world's developed and developing countries between the years 2000 and 2025. The study discovered that while the advances of digital technologies promote enhancement in productivity and connectivity to the world, benefits gained due to the technologies is not evenly distributed digital divide. There was within the study to income inequity that exists with digital inequity. The countries that are entering digital divide through low income to access the built in infrastructure and low digital. On the other hand, the collective action of the countries is to increase the inequality and increase the social mobility. The inequity outcomes and the digital inclusion collides on the spheres of economically outcomes positives. The countries which developed social increase and the technological advances as these to the investments in higher education, ICT integrated infrastructure, and the digital capacity building. The countries that neglected these actions, the countries opened the gap economically on the social inequities of the labor with skilled labor contrasts over the rural and the urban communities and positive with high standard with deprived communities. This study proposes that technology by itself does not engender equality; rather, it is the governance and institutional settings that condition whether technology is utilized for incorporation or exclusion. Innovations which foster digital literacy, provide low-cost, high-speed broadband access, and the digitalization of small and medium enterprises, are critical to ensuring that advancement of technology results in equitable prosperity. The opportunity to digitally transform is both a challenge and an opportunity. If it is managed in an inclusive way, the potential is there for drastic upward mobility, closing income gaps and rapid advancement in sustainable development. However, without deliberate policy interventions, the digital divide could deepen structural inequalities, trapping

millions in economic stagnation. The future of equitable growth in the digital era depends not merely on technological advancement but on the collective will to ensure equal access to the benefits of innovation.

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