e-Bangi Faculty of Social Sciences and Humanities Universiti Kebangsaan Malaysia
Journal of Social Sciences and Humanities

eISSN: 1823-884x

Volume 22, Issue 2, DOI: https://doi.org/10.17576/ebangi.2025.2202.03

Review Paper

Bridging the Digital Divide: How Internet Access Shapes Human Capital Development and Economic Inequality

Jinyan Liao, Sameer Kumar* & Fumitaka Furuoka

Asia-Europe Institute, Universiti Malaya, 50603 Kuala Lumpur, Malaysia

*Corresponding Author: sameer@um.edu.my

Received: 07 January 2025
Accepted: 27 March 2025

Abstract: This study investigates the relationship between the digital gap and the development of human capital concerning economic inequality. Despite the swift progression of the digital economy, which presents novel chances for knowledge acquisition and skill development. The unequal access to the internet has deepened disparities in human capital across different socioeconomic groups, thereby contributing to broader economic inequality. The digital divide is primarily influenced by a combination of factors: access to technology, digital literacy, and financial circumstances. We examine specific regions and demographic groups to analyze the impact of digital skills on human capital development and employment opportunities in countries with differing economic statuses. The primary finding of the studies indicates that, particularly in disadvantaged regions, digital literacy significantly enhances individuals' economic mobility. To ensure equitable access for marginalized populations, it presents policy recommendations centered on targeted educational reforms in digital literacy and infrastructure investments to bridge the digital gap. Based on these findings, policymakers should prioritize creating inclusive digital education programs and improving internet accessibility in rural areas to reduce economic disparities. These insights include strengthening digital education policies and prioritizing internet infrastructure in marginalized areas, aiming to narrow socioeconomic disparities.

Keywords: Human Capital; digital divide; economic inequality; technological equity; digital literacy

Introduction

Informatisation and digital transformation are worldwide trends. Within this context, the connection between the digital divide and human capital development has become a major focus in academic and policy discussions (Korupp & Szydlik, 2005). As a basic engine of economic development, the accumulation and development of human capital directly affects individual income levels and career advancement while greatly increasing society productivity and therefore supporting macrolevel technological innovation (Golovina et al., 2022). However, existing studies have often overlooked the specific factors within the digital divide that impede human capital development, such as access to quality digital education and technology infrastructure in lower-income areas. The exacerbation of economic inequality stems from the widening digital gap, which intensifies disparities in access to technological resources and educational opportunities across various socioeconomic strata. The notion of human capital, initially suggested by economist Gary Becker, delineates the impact of investments in health, education, and skills on economic productivity and societal advancement. Three main characteristics describe human capital—a basic quality of the labour force: accumulativeness, substitutability, and transferability (Labrianidis & Kalogeressis, 2006). These traits highlight how important human capital is for the modern economy (Carbonaro et al., 2022). However, few existing studies have directly

examined how the digital divide influences the accumulation and adaptability of human capital, especially in terms of long-term learning capacity and skill replacement. Accumulativeness refers to the ability of individuals to continuously enhance their competencies through sustained education and training over time (Shirinkina et al., 2019). Higher educated people often make far more than those with only secondary education; this trend has been fully supported by multi-national polls carried out by the International Labour Organisation (ILO) (Iorgulescu, 2015).

Human capital's substitutability lets workers use skill development to meet changing market demands and the needs of new economic sectors (Atasoy et al., 2013). Given rapid advancement in information technology, the concept of human capital has evolved from traditional education and skill acquisition to the development of digital competences. To keep a competitive edge in a market growingly competitive, workers must be proficient in data analysis, programming, cybersecurity, and other fundamental skills of the modern economy. Studies have demonstrated that the adoption of digital tools plays a crucial role in improving economic resilience, particularly in resource-limited sectors. For example, research on smallholder tea farmers in Sri Lanka found that integrating digital technology in agricultural extension services significantly enhanced their productivity and sustainability, reinforcing the idea that technology adoption mediates economic inequality (Kumara et al., 2025). Globally, employees with strong digital capabilities often get more than twice the pay of their low-skilled colleagues (Yuan & Zhang, 2024). This salary difference shows the mediating effect of technical proficiency on economic inequality and underlines the need of digital skills for personal professional growth (Li & Wang, 2024). As the digital divide widens, the distribution of digital skills shows significant socioeconomic separation, further aggravating disparities in employment opportunities and income levels (Buchinskaya, 2024). The digital divide is seen not just in internet availability but also in the quality of access, knowledge of using digital technologies, and degree of their use. OECD studies show that low-income groups, limited by inadequate technical support and digital literacy, usually engage in only basic activities including social networking, entertainment, or ineffective communication; whereas high-income groups show more mastery in using the internet for knowledge and skill acquisition. Studies have also demonstrated that media plays a significant role in shaping public perceptions of technology and digital engagement across different socioeconomic groups. A bibliometric analysis of country image and media between 2004 and 2023 highlights how media narratives can influence the perceived importance of digital literacy and economic mobility, further reinforcing disparities in digital adoption (Jin et al., 2025). This disparity instantly reduces the competitiveness of low-income groups in the employment market, therefore impairing their capacity to overcome financial challenges(Shkurat et al., 2024).

The digital divide is somewhat large worldwide (Shirazi & Hajli, 2021). Developed countries typically give their residents a major advantage in digital capacities because of their greater digital infrastructure and educational resources (Riggins & Dewan, 2005). In the 1990s, Ireland made significant investments in vocational training and higher education, which clearly increased the digital capacity of its population. This deliberate choice attracted the interest of multinational companies like Google and Facebook to set their European headquarters in the country, therefore improving employee productivity and accelerating economic development (Law, 2015). One of the best examples of the strong link between technology development and the investment in human capital is the phenomena known as the "Celtic Tiger" (James, 2007). Inadequate educational resources and poor digital infrastructure cause marginalisation to many people living in poorer countries, so hindering their skill development (Qiu et al., 2023).

To visualize this mechanism, Figure 1 maps the pathway from digital access disparities to economic inequality. It shows how the digital gap influences the accumulation of human capital thereby intensifying economic inequality. Three layers define the structure. The first layer represents the digital divide, manifested in disparities in digital literacy, internet access, and degree of technological use.While disadvantaged groups lacking technical support and digital literacy are often limited to simple entertainment aims, rich groups can efficiently use the internet to obtain knowledge and skills.Emphasising career advancement, skill development, and educational access, the second layer links to the buildup of human capital. The digital gap greatly influences human capital development; OECD statistics reveal that low-income groups' participation rate in digital skill development is just 40% of that of high-income groups, therefore restricting their educational and job options. Third layer refers to economic inequality, represented in income differences, occupational

stratification, and social immobility. Lack of digital skills prevents low-income people from finding high-paying jobs, therefore aggravating economic inequalities and prolonging poverty cycle. The general paradigm stresses digital skills as a necessary mediator in this process. Lack of digital competency not only affects paths of personal growth but also aggravates systematic social inequalities. This negative loop can only be broken through focused talent development and technology dissemination programs aimed at underserved communities.

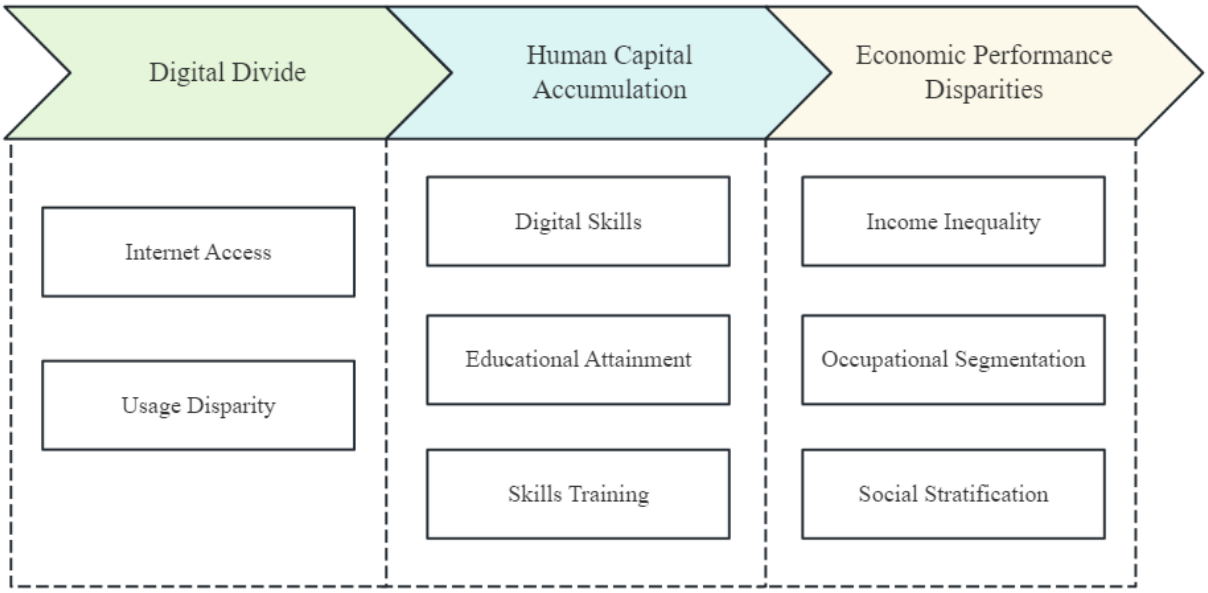

Figure 1. Mechanism of Digital Divide's Impact on Economic Inequality

Focusing on three basic questions, this paper investigates the relationship between the digital divide and economic inequality: Does the digital divide restrict human capital accumulation, therefore aggravating economic inequality? In this process, what mediator function does human capital perform? And how may policy interventions close the digital divide to attain equitable growth of human capital? The study suggests three research hypotheses to help to answer these questions: (1) there is a notable negative correlation between the digital divide and human capital accumulation; (2) insufficient human capital accumulation is the main pathway through which the digital divide intensifies economic inequality; and (3) policy interventions can greatly reduce this issue by optimising the allocation of digital infrastructure and educational resources. This paper methodically investigates the processes via which the digital divide influences human capital development and economic inequality using a combination of theoretical analysis and case studies and suggests corresponding policy recommendations based on international comparisons and representative cases from China. Specifically, the study examines how the unequal distribution of digital technology limits human capital accumulation, therefore aggravating economic inequality from both the twin angles of human capital and the digital divide. The creative contributions of this research include: (1) revealing the deep mechanisms by which the digital divide affects human capital development; (2) using qualitative methods to investigate the dynamic role of digital skills in economic inequality; and (3) providing policy recommendations that concentrate on closing the digital divide by means of the optimisation of educational resources and infrastructure development. This study emphasizes the need for educational reforms and increased internet infrastructure coverage to reduce the digital divide. It not only shows how the digital divide exacerbates economic inequality by hindering human capital accumulation but also provides clear instructions for policymakers. These policies aim to eliminate technological capacity differences between social groups, thus providing theoretical underpinning and policy direction for fairer economic development.

Methodology

This paper adopts a qualitative review and cross-national comparative approach. It synthesizes academic literature, international policy reports, and secondary data from organizations such as the ITU and World Bank to examine how digital inequality shapes human capital development and exacerbates economic disparities.

The study does not aim to test hypotheses statistically but instead focuses on conceptual and policy-oriented analysis. While multiple countries and regions are referenced, China and India are discussed in depth as representative cases to illustrate contrasting development strategies and their implications. This method enables the exploration of common structural mechanisms as well as region-specific challenges and interventions. All data used in this study are secondary and publicly available, and have been ethically sourced in accordance with academic research standards.

The Findings and Discussion

1. Digital Divide

Usually associated with socioeconomic level, the digital gap exposes differences in the use of digital skills, internet access, and information technology. Apart from technical access, this gap draws attention to important issues about social resource distribution, educational access, and economic development (Wilson et al., 2003). Various elements contribute to the digital divide: policy actions, geographic location, economic situation, and academic performance (Rajam et al., 2021). Though a lot of research looks at the relationship between internet use and socioeconomic inequalities, little is known about the basic structural causes of these divisions including the unfair distribution of digital infrastructure and educational resources. To gain a more profound understanding of this issue, it is possible to model the correlation between economic inequality and the digital divide mathematically. Let I signify the magnitude of internet use, H represent the level of human capital, and G indicate the rate of economic growth. Although earlier models have suggested that economic growth is linearly correlated with both internet usage and human capital, they often fail to account for the complexities of how digital divides are distributed across different social groups. We can assert that economic growth is linearly associated with internet utilisation and human capital.

$$G = \alpha H + \beta I$$

In this way, α and β respectively show metrics displaying, suitably, the influence of human capital and internet usage on economic development (Zhou et al., 2024). Low levels of I mixed with the widening digital divide defined by unequal internet access could slow down the rate of economic growth, thereby increasing economic inequality (James, 2011). This ending, however, ignores the effect of government programs and educational initiatives meant to minimize the bad results of the digital divide. Apart from internet access, the digital divide considerably influences educational options, professional development, and broad skill development as well (Sang, 2024). Many research concentrate on the direct link between technology availability and economic opportunity, even if most of them ignore to investigate the mediation role of education and digital literacy in either diminishing or worsening these impacts (Zhang, 2019).

A causal model linking the use of digital technologies with economic inequality indicates that people in rich areas are more inclined to access educational resources including online courses, digital libraries, and skill development platforms, so reflecting the complex character of this problem (Wijers, 2010). These people are therefore more likely to find better-paying jobs, a reality occasionally missed in the studies that mostly stresses access rather than the quality of the digital materials provided. Development of human capital and economic inequity depend on internet connectivity, so it is vital. People who have strong digital skills usually have a competitive advantage in the job market, particularly in high-tech sectors that need for large digital proficiencies (Venkat, 2002). Still, present studies occasionally disregard the need of access to high-quality digital education and the necessary infrastructure to enable such access, hence simplifying the challenges faced by low-income populations. While traditional businesses impose quite moderate standards, high-tech sectors usually need great digital competencies for recruitment. For low-income populations without digital knowledge to access high-income sectors, this makes life more difficult (Yates et al., 2010). This inclination accentuates social inequality, hence creating a climate in which the rich get richer and the poor get poorer (Булатова et al., 2023).

2. Internet Use And Economic Inequality

Current Status and Challenges of Internet Popularization

This section examines how varying levels of internet penetration influence the Human Capital Index across different income groups. Table 1 presents a comparative overview of internet usage rates and human capital indices in countries at different income levels. The data reveal a positive correlation between internet penetration and human capital development, indicating that improved digital access may contribute to greater educational outcomes and economic mobility.

Table 1. Impact of Internet Usage on Human Capital Development

Country/Region	Internet Penetration Rate	Human Capital Index
Low-Income Countries	20%	0.30
	25%	0.35
	30%	0.40
Middle-Income Countries	50%	0.55
	60%	0.60
	80%	0.80
Left alignment	85%	0.85
	90%	0.90

Source: International Telecommunication Union (2022); World Bank (2022)

A careful study of the exact consequences of internet use is necessary to grasp how the digital divide in human capital development and internet use exacerbate economic inequality. Although current research show a link between internet penetration and human capital development, they usually overlook the ways in which unequal access to high-quality digital resources greatly reduces the possibility for human capital development, particularly in underprivileged areas. Self-efficacy theory holds that a person's confidence in finishing a task directly determines their behavior; hence, their access to the required tools and resources determines their confidence as well. This theoretical perspective is rarely used, though, in the research, which sometimes ignores the part community and regional support systems play in building confidence and competence in the evolution of digital skills.

Online platforms allow many groups to improve their knowledge and abilities; yet, access to these opportunities is closely related to personal capacity, social resources, and regional inequities. Here a more nuanced approach is needed; although Table 1 shows a clear correlation between internet access and human capital growth, it ignores the difficult obstacles many areas face in encouraging digital literacy. Strong educational and digital infrastructure countries like Germany and the United States show show much higher human capital indices than middle- and low-income countries like India and Nigeria, which deal with issues including poor internet access and educational inequalities. This disparity emphasizes the need of legislative changes covering both digital literacy resources and internet infrastructure as well as educational aspects.

Further data from the International Telecommunication Union (ITU) expose a nonlinear relationship between internet penetration rates and human capital development. Recent studies have sometimes extended this link, neglecting the reality that poor connectivity in low-income areas creates a "digital divide" that lowers the efficiency of online learning and skill acquisition, hence perpetuating the poverty cycle. Lack of internet connectivity greatly reduces people's possibilities in low-income nations and locations. Lack of internet connectivity and smart devices causes economically underprivileged populations to gain significantly less even if online courses with substantial materials and communication features are becoming more and more popular. Apart from proving the existence of the digital divide, this disparity aggravates social inequality. Therefore, particularly in educational reform and skill development, the increase in internet penetration calls for a mix of technology strategies and government policies to produce more fair opportunities for low-income countries, so enabling economic transformation and human capital development.

3. Social Network Theory and Internet Usage Disparities

Social Network Theory serves as an effective instrument for examining disparities in internet usage across different social groups (Hatala, 2006). Information is shared online, professional contacts are established, and

job searches are conducted there. Many studies, meantime, fail to look at how differences in digital literacy and access prevent some groups from effectively using online resources for professional development, therefore aggravating social and economic inequalities. People from underprivileged backgrounds are especially susceptible to the "information island" phenomenon, which limits their professional opportunities and social contacts therefore aggravating their economic inequities (Chiu, 2011). We aim to close this disparity by examining certain countries or areas and the laws passed during the birth of the internet. The study will look at the interactions among internet access, human capital development, and economic inequality so equipping data for legislators to lessen the digital divide and increase economic equality (Xu et al., 2014). This paper aims to bridge a vacuum in the literature by means of a thorough and critical research of the interplay among internet use, social mobility, and economic disparities.

4. Differences in Internet Usage among Social Groups

The degree of internet access and usage habits shows notable differences among socioeconomic levels, which closely reflects more intricate problems of economic inequality. Analysing the segmented market based on "gender," "age," and "region" helps one to see the different effects of internet usage patterns on either reducing or aggravating economic inequality (Anandhita & Ariansyah, 2018). Examination of gender categories reveals notable variations in men's and women's frequency and goals of internet usage. On internet systems, men users show about 15% more active participation than female users. This is seen not just in their proactive information collecting but also in sectors including e-commerce and online learning, where men's participation rates usually surpass those of women (Gray et al., 2017). These disparities may stem from unequal social and cultural origins and educational opportunities, placing women at a disadvantage in the acquisition and utilisation of human capital. Younger and older demographics demonstrate significant differences in internet usage trends from an age perspective. Recent studies indicate that more than 90% of those aged 18 to 34 regularly engage with social media, however just 30% of users aged 65 and older do so. Adolescents are more inclined to use the internet for information dissemination and knowledge acquisition, but older adults face challenges such as insufficient technical skills and reduced psychological acceptance (van Deursen & van Dijk, 2014). Generational inequalities affect the pace of human capital accumulation and further marginalise older individuals in the digital economy, exacerbating socioeconomic inequality.

5. The Impact of the Internet on Human Capital Development

The fast growth of digital technology and the popular acceptance of the internet are significantly influencing the accumulation of human capital by creating new opportunities like online study and remote job. However, these developments may have unintentionally intensified income disparities by disproportionately benefiting digitally connected populations. For China in 2024, for instance, the 22.28 million participants in vocational skills training expected reflect the same level as in 2022. This suggests that the participation rate has not notably changed even if the demand for human capital training never goes away. The growing economic inequality, which deprives lower-income groups of access to pertinent training opportunities and resources, may be blamed for this inertia. Consequently, the explosion of vocational skills development has not sufficiently raised the economic capacity of every group. Rather, it might help to maintain the condition of technology and skill deficits, especially in underprivileged groups.

Figure 2 illustrates the growth trajectory of internet penetration in China between 2020 and 2024. This trend highlights both the scale of digital infrastructure expansion and the potential for reducing regional inequalities in digital access. However, it also invites a deeper examination of how this progress is unevenly distributed among different income and geographic groups. This upward trend, while promising, also reveals persistent regional and socioeconomic disparities in digital access and its impact on human capital accumulation.

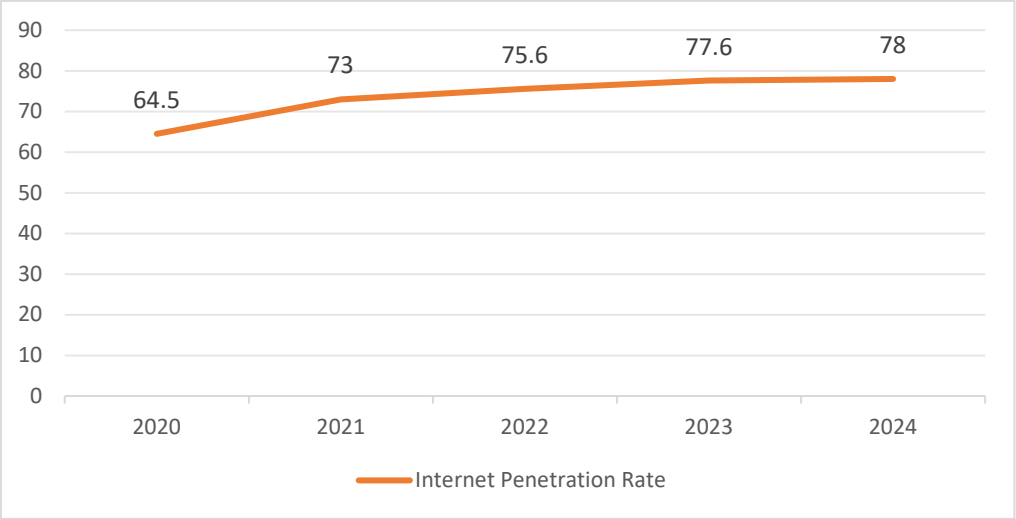

Figure 2. China's Internet penetration rate in the past five years
Source: CNNIC "Statistical Report on China's Internet Development" (2020-2024)

Examining China's internet penetration data, the penetration rate increased steadily from 64.5% in 2020 to 78.0% in 2024. Although this growth appears to enhance information access and human capital development on the surface, a deeper analysis reveals that high-income groups are often able to leverage these resources more quickly and comprehensively. Low-income groups, on the other hand, find it difficult to evenly gain from the benefits of the internet as their limited access to devices and inadequate network settings define their situation. This unequal distribution of resources aggravates economic disparity even more since individuals without internet connection or poor quality access suffer in terms of knowledge acquisition, online learning, and remote employment possibilities.

Figure 3 shows mobile communication user distribution globally, reflecting disparities in digital access across countries and regions. The map highlights the digital divide between high-income and low-income countries, which has significant implications for human capital formation and economic inclusion.

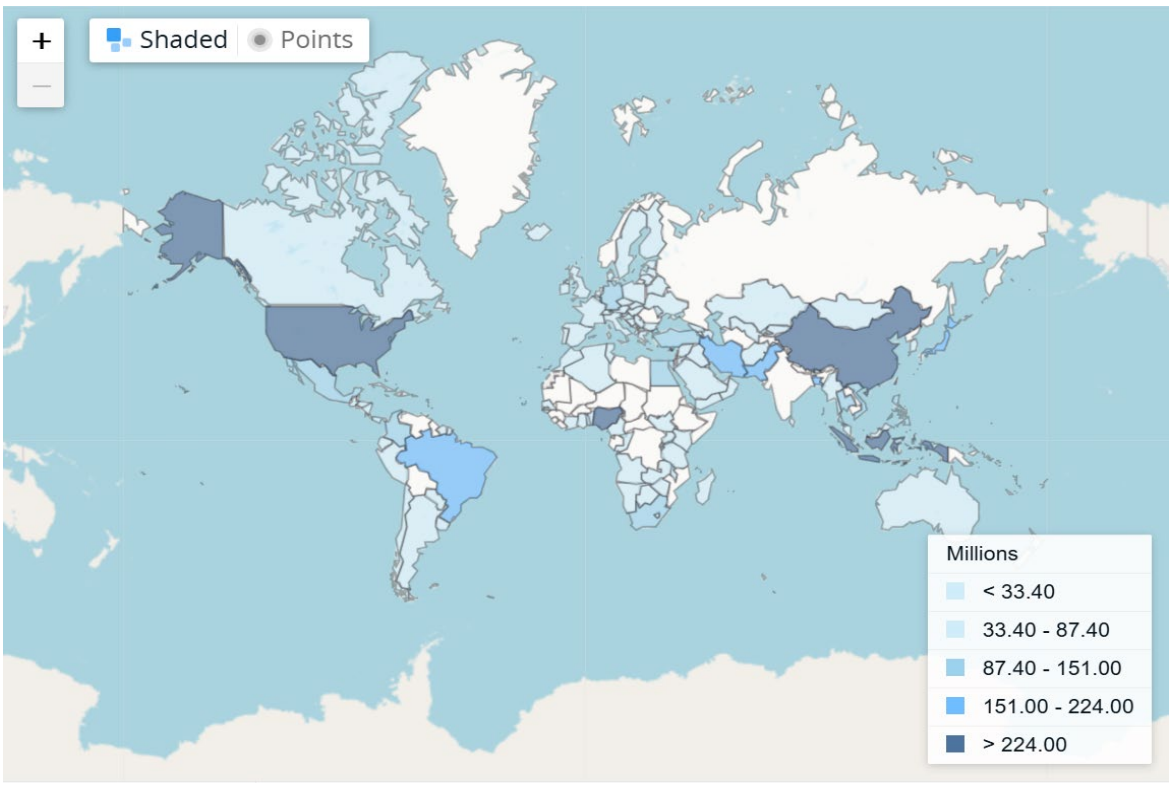

Figure 3. Global Mobile Communication Users Distribution and Digital Divide (2023)
Source: International Telecommunication Union, World Telecommunication/ICT Development Report and database (2023)

In 2023, China, India, and the United States each recorded over 224 million mobile subscribers, reflecting both large populations and substantial investment in digital infrastructure. In China, mobile user penetration exceeds 120% of the population, driven by widespread smartphone adoption and rural 4G expansion. India, despite lower internet penetration (43%), has seen broad digital adoption through its “Digital India” initiative. The United States leads in advanced communications, especially 5G. Conversely, Sub-Saharan Africa and many small island nations recorded fewer than 33 million users, reflecting persistent underinvestment in digital infrastructure.

The Democratic Republic of Congo has a mobile penetration rate of only 45%, as most rural regions lack fundamental network access. ITU research indicates that in Sub-Saharan Africa, the average monthly expenditure on mobile data surpasses 20% of individual monthly income, whilst in affluent countries, the average is only 2%. The high connection prices greatly limit mobile communication and internet use in the area, hence widening the digital divide. This differences reduces access to education and skill development as well as involvement in the digital economy. Unlike in countries with mobile penetration rates over 100%, like South Korea, evidence shows that less than 20% of workers in Sub-Saharan Africa can access educational resources via mobile devices. This clear difference emphasises the need of mobile communication in the development of human capital. Policy-driven subsidies for rural telecoms and the implementation of the "Digital Countryside" strategy have clarified the 15 percentage point difference in cell penetration between rural and urban areas in China from 2010 to a 5 percentage point modification.The "Broadband Access for Every Village" project enhanced 4G network coverage in remote rural parts of Guizhou Province by 15 percentage points, thereby facilitating inhabitants' access to information and online education. Nonetheless, a uniform global reduction of the digital divide remains absent. According to ITU statistics, differences in mobile communication penetration between rural and urban areas still exist with gaps of roughly 25–30 percentage points in locations like Sub-Saharan Africa and South Asia, therefore restricting educational and economic opportunities for rural communities.

Consequently, we have identified numerous significant findings. The expansion of mobile communication substantially enhances economic growth. World Bank research indicates that a 10% rise in mobile communication penetration results in an average income growth rate of 1.5%-2% for low-income demographics. Through the "Digital Bangladesh" initiative, mobile connectivity penetration in rural regions rose from 38% in 2010 to 73% in 2023. This transition not only enhanced the growth of small and medium-sized firms in rural regions but also markedly elevated female labour force participation. Data shows that the percentage of rural women using mobile devices to engage in e-commerce increased from 2% in 2015 to 12% in 2023, thereby greatly improving their economic independence. Moreover, the global differences in mobile communication use have sharpened economic opportunity disparities.While the national mobile communication penetration rate in Brazil is 103%, the rate in the northern region is just 74%, far less than the 130% in the southern region. The digital divide hurts northern workers in the labour market competition. Data indicates that the average wage of labourers in the northern region is 30% lower than that in the southeastern region, with over half of the discrepancy attributable to differences in skill acquisition and restricted access to networking opportunities.

Secondly, successful policy initiatives can substantially reduce the digital divide. The Bangladeshi government enhanced mobile penetration via subsidies for rural network development, simultaneously fostering e-commerce and remote education in rural regions under the "Digital Bangladesh" plan. As of 2023, rural internet penetration in Bangladesh reached 55%, while e-commerce transaction volumes increased by 47%. India's "Digital India" effort has significantly advanced national digital infrastructure over the past five years, elevating 4G coverage in distant rural areas from under 50% to 82%, thus enhancing the competitiveness of the rural labour market. The presented data and case analyses demonstrate that mobile communication penetration serves not only as a technology metric but also as a vital indicator of a country or region's human capital development and economic potential. The global digital divide is substantial, necessitating extensive infrastructure investments and focused policy assistance to guarantee equitable access to economic opportunities and foster the sustainable development of the global digital economy.

The impact of the internet on several aspects of commercial relevance goes beyond the improvement of personal skills, therefore changing the whole socio-economic scene. Rich, capable people with more

possibilities for career development—including access to advanced courses via online learning platforms and participation in worldwide remote work projects—can find the internet to help them to generate more revenue and professional success. Still, low-income occupational groups often rely on traditional, low-paying jobs, therefore limiting their economic mobility, hampered by inadequate skills and limited internet access. To some extent, the internet has helped human capital to flourish; but, its consequences are very unequal. Unquestionably, the internet is a necessary tool for improving human capital for people in favourable economic conditions who can fully use digital resources. On the other hand, the development of the internet can aggravate the marginalisation of economically deprived and skill-deficient groups, therefore increasing their economic inequality. Therefore, promoting the use of internet technology and granting fair access to all social groups has become a top issue needing quick action.

6. Internet Skills and Employment Opportunities

The alignment between an individual's skill level and market demand directly influences the availability of employment prospects, claims the framework of "skills matching theory." Groups without internet knowledge, especially low-income and underprivileged groups, suffer more intense competition in the employment market, therefore worsening their financial situation. Lack of online knowledge leads to shortcomings in using resources and obtaining information. Many hiring procedures in modern society have moved to online platforms, which demand job searchers to be not only somewhat technologically competent but also conversant with digital job search tools including electronic resumes and online interviews. An empirical analysis of how internet use affects work prospects showed job searchers with basic internet abilities had a 37% better chance of getting an interview (DiMaggio & Bonikowski, 2008). As a result, those without such abilities are seriously handicapped in the job hunt process since they cannot efficiently obtain or apply pertinent information. Many firms nowadays would rather link higher-level roles with digital capabilities (Reljic et al., 2021). In the IT industry, those with knowledge in programming and data analysis show definite pay benefits. According to a study of tech industry pay scales, workers with extensive data analysis abilities made an average annual income about 40% greater than those with basic skills (Abowd et al., 2007). This pay gap emphasises even more the need of internet knowledge in the employment scene. Those without such abilities not only fight to land better jobs but also run the danger of job instability brought on by technology developments.

7. Case Analysis

Given the digital gap drastically affects economic growth and inequality, the link between human capital development and internet usage has become ever more important in recent years. Signifying its increasing importance inside the national economic framework, the digital economy's share to China's national GDP climbed from 38.6% in 2020 to 42.8% in 2023. This growth, however, hides more complex problems of economic disparity including the digital gap across different regions and demographic groups. Globally, industrialised countries usually show better digital infrastructure and higher internet penetration rates, which helps them to keep a relative edge in internet use and human capital development. Along with great internet penetration, the higher enrolment rate in higher education in Nordic nations exceeds 90% and helps to promote overall socioeconomic development by enabling notable human capital growth.

On the other hand, even if China boasts about a billion internet users, there are still clear geographical variations. In some areas, differences in internet use between urban and rural areas as well as between eastern and western areas have led to stagnant human capital development. From a policy standpoint, industrialised countries usually deploy systems aimed at universal education to help to close the digital divide. Many organisations have developed free or low-cost higher education programs in order to encourage general participation in the digital economy. The effectiveness of relevant policies implemented by the Chinese government—digital rural initiatives and the "Internet Plus" action plan—has been uneven depending on local government execution and resource allocation. Consequently, China still shows significant regional differences in human capital investment, which keeps certain rural areas from benefiting from the growth of the digital economy.

With China and India as case studies, this paper investigates the interactions among internet usage, human capital development, and economic inequality. China was selected for its rapid expansion in digital infrastructure and significant policy initiatives like the "Digital Countryside" program; India provides a clear contrast with its "Digital India" strategy, aimed to increase digital accessibility but challenged with issues in rural regions. These cases were selected because of the governments' major efforts to close the digital gap and provide a structure to evaluate how well these policies promote human capital development. Analyzing the digital divide in human capital development and its influence on economic inequality reveals various cases of the main effects of differences in internet usage on the allocation of educational resources, upgrading of vocational skills, and involvement in the digital economy. From 50% in 2010 to 98% in 2023, 4G network coverage improved in Guizhou Province allowing rural residents to access online education and vocational training. Nevertheless, differences in the distribution of educational resources lead to rural areas showing over 30% lower participation rates in digital skills training than urban areas, therefore reducing the competitiveness of rural labour in high-skill markets. Despite government efforts to improve internet access under the "Digital India" plan, rural involvement remains minimal in India; over 60% of the workforce lacks digital skill training, therefore restricting their economic potential.

8. Data Sources

The foundation of this case study is government data including reports from China's national digital rural initiative, data from foreign organizations including the International Telecommunication Union (ITU), and empirical studies on internet penetration rates and human capital indices. Other sources besides World Bank statistics include studies on digital inequality in China and India. When taken together, these sources offer a whole picture of the human capital development in both nations as well as the current issues they are experiencing and the digital infrastructure expansion.

9. Research Limitations

One should understand the limitations of this research. First of all, even if the case study approach provides thorough understanding of certain locations, the findings could not be completely relevant to all industrialized or developing country. Variations in local legislation, economic conditions, and educational systems point to differences in the ways in which the digital divide affects human capital in different environments. Furthermore, as this is essentially a qualitative research, researcher bias or subjective assessment of policy efficacy could influence the case study outcomes. Furthermore, the study largely relies on secondary data, which naturally has restrictions in timeliness, quality, and regional consistency. Through means of main data collecting methods—such as questionnaires or interviews—one could enhance knowledge of local inhabitants' viewpoints on digital infrastructure and human capital development, so addressing these constraints in next research.

Conclusion

This study reveals that variations in socioeconomic groups on internet connectivity, usage intensity, and digital competences greatly affect access to education, skill development, and employment prospects, so deepening economic inequality. Particularly for poor groups, elements including gender, age, geography, and educational level all point to the methodical reasons of the digital gap. Those with low income, who lack digital literacy and resource support, are limited to low-wage jobs or conventional sectors, therefore continuing a "low-skill-low-income" cycle. On the other hand, people with sophisticated digital abilities are more likely to find good employment prospects and improved resources. This loop greatly reduces overall social production and sustains social inequality, therefore preventing fair economic development. Dealing with this difficulty calls for a comprehensive, multifarious plan based on the improvement of human capital. It is absolutely necessary to improve internet infrastructure in underdeveloped rural areas using public-private cooperation (PPP) methods. This approach will attract private capital and offer reasonably priced, high-quality, all-encompassing network services, therefore improving internet access for underprivileged groups and laying a foundation for learning and skill development.

To effectively close the digital divide, policy makers have to create a multi-tiered digital skills training program catered for different demographic groups. This means designing flexible, age-appropriate training courses considering variations in career path and educational background. These projects should combine online and physical courses offered by educational institutions and community organizations with subsidies to help economically underprivileged people cover participation costs. Furthermore, the distribution of online learning materials has to be standardized to ensure that poor areas get similar opportunities for excellent education as those in cities. Improving device accessibility and increasing network coverage will help to greatly increase educational equity.

While improving digital infrastructure is crucial, it must be complemented by targeted educational and institutional interventions, as technology alone cannot fully eliminate the digital divide. Instead of just making the internet more accessible, policies should support the growth of human capital in a deep way. Governments, businesses, and educational institutions taken together could help underdeveloped areas flourish in the digital economy. These initiatives greatly contribute to address the social justice concerns raised by the digital divide. By giving the complete development of human capital top importance, governments may reduce the negative consequences of the digital divide on economic inequality, increase general society productivity, and offer the basis for more fair and inclusive economic growth. These projects will enable underprivileged people to reach their full potential and grow society and economy toward higher quality of life.

Acknowledgement: We would like to thank all individuals and organizations that contributed to this research. Special thanks to the International Telecommunication Union (ITU) and the World Bank for providing access to essential statistical data. We also express our gratitude to colleagues who reviewed the manuscript and provided valuable feedback. Lastly, we appreciate the support of the editorial team for their guidance throughout the publication process.

Informed Consent Statement: This article is based entirely on secondary data from publicly available sources. As it does not involve any human participants, informed consent is not required.

Conflicts of Interest: We declare no conflict of interest.

References

Abowd, J., Haltiwanger, J., Lane, J., McKinney, K., & Sandusky, K. (2007). *Technology and the Demand for Skill:An Analysis of Within and Between Firm Differences*. w13043. https://doi.org/10.3386/w13043

Anandhita, V. H., & Ariansyah, K. (2018). Gender Inequality on the Internet Access and Use in Indonesia: Evidence and Implications. *2018 International Conference on ICT for Rural Development (IC-ICTRuDev)*, 142–147. https://doi.org/10.1109/ICICTR.2018.8706856

Atasoy, H., Banker, R. D., & Pavlou, P. A. (2013). *Information Technology Skills and Labor Market Outcomes for Workers* (SSRN Scholarly Paper 1958038). Social Science Research Network. https://doi.org/10.2139/ssrn.1958038

Buchinskaya, O. N. (2024). Digital globalization of the labor market as a factor of deepening inequality. *National Interests: Priorities and Security*, *20*(8), 1583–1600. https://doi.org/10.24891/ni.20.8.1583

Becker, G. S. (1964). *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education.* University of Chicago Press.

Carbonaro, A., Breen, J. M., & Piccinini, F. (2022). A new digital divide threatening resilience: Exploring the need for educational, firm-based, and societal investments in ICT human capital. *Journal of E-Learning and Knowledge Society*, *18*(3), 66–73. https://doi.org/10.20368/1971-8829/1135567

Chiu, W. (2011). *The analysis of social capital in online social communities*. https://www.semanticscholar.org/paper/The-analysis-of-social-capital-in-online-social-Chiu/f308ea3804293d9a6914f9f99cc275f1b9eaceba?utm_source=consensus

DiMaggio, P., & Bonikowski, B. (2008). Make Money Surfing the Web? The Impact of Internet Use on the Earnings of U.S. Workers. *American Sociological Review*, *73*(2), 227–250. https://doi.org/10.1177/000312240807300203

Golovina, T., Anoshina, J., Markov, R., Melnikov, P., & Zaborovskaya, O. (2022). Human Capital Development via Digital Inclusion. *Proceedings of the 3rd International Scientific Conference on Innovations in Digital Economy*, 7–14. https://doi.org/10.1145/3527049.3527074

Gray, T. J., Gainous, J., & Wagner, K. M. (2017). Gender and the Digital Divide in Latin America*. *Social Science Quarterly*, *98*(1), 326–340. https://doi.org/10.1111/ssqu.12270

Hatala, J.-P. (2006). Social Network Analysis in Human Resource Development: A New Methodology. *Human Resource Development Review*, *5*(1), 45–71. https://doi.org/10.1177/1534484305284318

Iorgulescu, R. (2015). HUMAN CAPITAL, THE DIGITAL DIVIDE, AND THE POSSIBLE CONNECTION TO THE FLOW-FUND ANALYSIS OF SOCIOECONOMIC METABOLISM. *Annals - Economy Series*. https://www.semanticscholar.org/paper/HUMAN-CAPITAL%2C-THE-DIGITAL-DIVIDE%2C-AND-THE-POSSIBLE-Iorgulescu/4a9cc10085b232cf211b7144e704dae241894868?utm_source=consensus

Jin, F., Ahmad, A. L., & Kadir, S. A. (2025). *Country Image and Media (2004–2023): A Bibliometric Analysis. E-Bangi: Journal of Social Sciences & Humanities,* 22(1), Article 1. https://doi.org/10.17576/ebangi.2025.2201.05

James, J. (2007). From Origins to Implications: Key Aspects in the Debate over the Digital Divide. *Journal of Information Technology*, *22*(3), 284–295. https://doi.org/10.1057/palgrave.jit.2000097

James, J. (2011). Are Changes in the Digital Divide Consistent with Global Equality or Inequality? *The Information Society*, *27*(2), 121–128. https://doi.org/10.1080/01972243.2011.548705

Korupp, S. E., & Szydlik, M. (2005). Causes and Trends of the Digital Divide. *European Sociological Review*, *21*(4), 409–422. https://doi.org/10.1093/esr/jci030

Kumara, A. L. R. U., Burhan, N. A. S., Sabri, M. F., & Jaafar, W. M. W. (2025). Mediating Effect of Technology Adoption: Agricultural Extension Services Enhances Sustainability of Smallholder Tea Farmers in Sri Lanka. *E-Bangi: Journal of Social Sciences & Humanities,* 22(1), Article 1. https://doi.org/10.17576/ebangi.2025.2201.06

Labrianidis, L., & Kalogeressis, T. (2006). The digital divide in Europe's rural enterprises. *European Planning Studies*, *14*(1), 23–39. https://doi.org/10.1080/09654310500339109

Law, R. (2015). The global digital divides: Explaining change. *Information Technology & Tourism*, *15*(2), 185–187. https://doi.org/10.1007/s40558-015-0026-z

Li, Y., & Wang, X. (2024). Micro Study on the Impact of the Digital Economy on Income from the Perspective of Labor Matching. *Journal of Fintech and Business Analysis*, *1*, 1–7. https://doi.org/10.54254/3049-5768/1/2024001

Qiu, Y., He, N., Yan, C., & Rao, Q. (2023). Whether the digital divide widens the income gap between China's regions? *PLOS ONE*, *18*(2), e0273334. https://doi.org/10.1371/journal.pone.0273334

Rajam, V., Reddy, A. B., & Banerjee, S. (2021). Explaining caste-based digital divide in India. *Telematics and Informatics*, *65*, 101719. https://doi.org/10.1016/j.tele.2021.101719

Reljic, J., Evangelista, R., & Pianta, M. (2021). Digital technologies, employment, and skills. *Industrial and Corporate Change*, dtab059. https://doi.org/10.1093/icc/dtab059

Riggins, F., & Dewan, S. (2005). The Digital Divide: Current and Future Research Directions. *Journal of the Association for Information Systems*, *6*(12). https://doi.org/10.17705/1jais.00074

Rajam, M., Kumar, S., & Mishra, S. (2021). The Digital Divide and Its Socioeconomic Implications in Developing Countries. J*ournal of Global Development, 34*(2), 145-158.

Sang, Y. (2024). Research on China's Digital Divide and its Bridging. *International Journal of Social Sciences and Public Administration*, *4*(2), 42–49. https://doi.org/10.62051/ijsspa.v4n2.06

Shirazi, F., & Hajli, N. (2021). IT-Enabled Sustainable Innovation and the Global Digital Divides. *Sustainability*, *13*(17), 9711. https://doi.org/10.3390/su13179711

Shirinkina, E. V., Zavedeev, E. V., & Strih, N. I. (2019). *Assessing the digital development of human capital*. 692–698. https://doi.org/10.2991/iscde-19.2019.6

Shkurat, M., Kushko, Z., & Shkurat, O. (2024). ANALYSIS OF THE STATE OF THE GLOBAL LABOR MARKET IN THE CONTEXT OF GLOBAL DIGITALIZATION. *Actual Problems of Economics*, *1*(274), 66–79. https://doi.org/10.32752/1993-6788-2024-1-274-66-79

van Deursen, A. J., & van Dijk, J. A. (2014). The digital divide shifts to differences in usage. *New Media & Society*, *16*(3), 507–526. https://doi.org/10.1177/1461444813487959

Venkat, K. (2002). Delving into the digital divide [Speakout]. *IEEE Spectrum*, *39*(2), 14–15. IEEE Spectrum. https://doi.org/10.1109/6.981859

Wijers, G. D. M. (2010). Determinants of the digital divide: A study on IT development in Cambodia. *Technology in Society*, *32*(4), 336–341. https://doi.org/10.1016/j.techsoc.2010.10.011

Wilson, K. R., Wallin, J. S., & Reiser, C. (2003). Social Stratification and the Digital Divide. *Social Science Computer Review*, *21*(2), 133–143. https://doi.org/10.1177/0894439303021002001

Wilson, P. H., Turner, R. S., & Cole, M. W. (2003). *Technological Access and Its Role in Economic Development.* Technology and Society, 22(3), 75-89.

Xu, J., Chau, M., & Tan, B. (2014). The Development of Social Capital in the Collaboration Network of Information Systems Scholars. *Journal of the Association for Information Systems*, *15*(12). https://doi.org/10.17705/1jais.00385

Yates, D. J., Gulati, G. J., & Tawileh, A. (2010). Explaining the Global Digital Divide: The Impact of Public Policy Initiatives on Digital Opportunity and ICT Development. *2010 43rd Hawaii International Conference on System Sciences*, 1–10. https://doi.org/10.1109/HICSS.2010.196

Yuan, K., & Zhang, X. (2024). The impact of internet usage preferences on labor income: Evidence from China. *PLOS ONE*, *19*(8), e0308287. https://doi.org/10.1371/journal.pone.0308287

Zhang, H. (2019). *Digital divide " Measurement and its Impact on Regional Economic Development*. https://www.semanticscholar.org/paper/Digital-divide-%22-Measurement-and-its-Impact-on-Zhang/f41c957cbce3df0bd14d037d8eef519c858e8dea?utm_source=consensus

Zhou, Y., Chen, M., Liu, X., & Chen, Y. (2024). A New Framework, Measurement, and Determinants of the Digital Divide in China. *Mathematics*, *12*(14), Article 14. https://doi.org/10.3390/math12142171

Zhou, X., Li, M., & Zhang, W. (2024). *The Role of Digital Skills in Economic Development: A Case Study of Rural and Urban Disparities.* Journal of Economic Inequality, 45(1), 102-118

Булатова, О. В., Резнікова, Н. В., & Іващенко, О. А. (2023). Цифровий розрив чи цифрова нерівність? Нові виміри глобальних асиметрій соціально-економічного розвитку і міжнародної торгівлі в умовах техноглобалізму. *Серія: Економіка*, *25*, 45–57. https://doi.org/10.34079/2226-2822-2023-13-25-45-57