

Inequality in Information and Communication Technologies: A Multifaceted Examination

Eric Loures ^a.

^a Faculty of Economics, Federal University of Juiz de Fora, Juiz de Fora, Brazil, eric.loures@yahoo.com.br

Abstract. The Information and Communication Technology (ICT) sector plays a significant role in the context of the new economy, being crucial for managing the high-level integration among governments, markets, individuals, sectors, and countries. It is also related to economic growth and higher levels of productivity, creation of high-skilled jobs, and cost reduction. However, its development may be accompanied by increased inequality in many different ways. This study aimed to investigate the benefits and drawbacks of ICT development on inequality from various perspectives, wishing to provide a concise overview of the scattered information on the topic through a literature review. The literature suggests that the sector is capable of reducing internal inequalities within a country, provided that the returns are homogeneous across different regions and individuals. However, to achieve this homogeneity, it is necessary to ensure sufficient infrastructure and human capital for ICT access, use, and proficiency. Studies on the interaction of developing countries with ICTs propose that these technologies can reduce gender inequality, mitigate CO₂ emissions, and boost small and medium-sized enterprises, both locally and nationally, as well as internationally. Thus, policymakers in a given country need to develop consistent inclusion strategies, aiming to reap all the benefits without incurring the collateral of poor investment, such as lower returns and increased inequalities. These strategies need to aim at enabling general access and use of information and communication technologies, meaning they must permeate the themes of infrastructure and human capital.

Keywords. ICT, New Economy, Inequality, Potentials

1. Introduction

Information and Communication Technology (ICT) is closely intertwined with the pursuit of enhanced productivity, network positive externalities, and aggregate income growth [1]. Structurally, ICT comprises a complex network of interrelated components, encompassing a blend of data, technical, and human resources [2].

ICT serves as a driving force behind globalization, facilitating the rapid transformation of distant and isolated information units into interconnected global superhighways [2]. For that reason, it's strongly related to the "new economy", characterized by a high degree of digitalization and economic and social integration with ICTs [3]. The rapid pace at which information is being transmitted through various communication channels and electronic platforms is significantly influencing the efficiency of decision-making processes within organizations, ultimately resulting in quicker resolutions and actions being

taken [4].

However, despite the numerous potential benefits, contributions to development are not always evident, especially in low-income countries [5]. Social inequality risks are primarily associated with the risk of social, regional, and national exclusion caused by the disparity between technologically advanced and underdeveloped regions [6]. It suggests that failures to invest in new ICT applications and services exacerbate the already significant gap between wealthy and impoverished countries, as well as between affluent and deprived regions within impoverished countries [6].

Thus, it becomes possible to observe inequalities not only among countries but also regionally, socially [6], and environmentally [7]. With this understanding, the process of customizing ICTs for more effective use, especially by the least developed countries, marginalized groups in rural areas, and women, receives special attention [8].

Despite the significant importance of addressing inequalities related to information and communication technologies, this knowledge remains widely scattered. Therefore, this paper endeavors to consolidate crucial information on ICT-related inequality and address this dispersion by checking it from various perspectives.

2. Research Methods

The research encompassed key terms in the database, including "ICT", "inequality", "emerging" and "undeveloped". Utilized data was accessed through the Web of Science, and the results were obtained from the year 1999 onwards. Additionally, Google Scholar searches were performed. Papers with abstracts that presented research to understand and address inequalities within the ICT sector were selected.

The selected articles were chosen to aim to explore a wide range of economic perspectives and diversify the forms of inequality addressed. The selection was guided by the pursuit of a comprehensive and enriching review that could capture the diverse dimensions of inequality in the ICT sector. This strategic approach aims to provide a more complete and balanced insight into the disparities present in the context of information and communication technologies.

3. Results and discussion

3.1 International Inequality

While it is evident that Information and Communication Technologies (ICTs) have the potential to contribute to poverty reduction significantly, facilitate novel educational opportunities, and mitigate the adverse impacts of social marginalization, the realization of these benefits hinges upon the effectiveness of national or regional policies in mobilizing resources [6]. It is proposed that ICT development in undeveloped countries might be affected by factors such as low tele-density, insufficient telecommunication infrastructures leading to congestion, unreliable network design, poor interconnectivity, insufficient human resources development, poor maintenance culture, vandalization of facilities, and exorbitant/unjustifiable billings and poor recovery strategy [2].

It was found that accessibility, skills, use, and impact are important measures for assessing the ICT sector [3]. In that context, it can be observed that developing countries and low-income regions have a low access and skills level to reach usage and impact of ICTs, primarily due to their low human capital and inadequate infrastructure [9], [10]. The failure to invest adequately in new network applications and services further amplifies existing inequalities, widening the gap between wealthy and impoverished nations [6]. Moreover, this disparity

extends within impoverished countries themselves, as affluent and deprived regions continue to face stark differences in access to ICT resources and opportunities [6]. These challenges underscore the critical importance of strategic and equitable investment in ICT infrastructure and development initiatives to foster inclusive growth and mitigate the risks of exacerbating existing inequalities.

ICT applications do not offer a solution to social and economic development challenges, as they carry risks of unemployment and disruption. However, failure to engage in the ICT 'revolution' exacerbates existing disparities between affluent and impoverished countries, as well as within impoverished regions. The key challenge lies in leveraging ICTs to empower marginalized groups whose needs are unmet by market forces [6]. In light of this, it is worth noting that the risks of non-engagement in ICT development appear to be more severe than the negative domestic outcomes. The Working Group of the United Nations Commission on Science and Technology for Development (UNCSTD) concluded that, although the costs of building new information infrastructures are high, the costs of not doing so are likely to be much higher [6].

Technological advancements in certain developing nations, like India, Brazil, and Egypt, set a precedent for other emerging economies to integrate ICT investments into their long-term strategies. ICTs contribute to the growth of high-value-added industries and the establishment of robust infrastructure, both of which are sought after by emerging economies [11].

Given the high production costs of hardware, emerging countries have increasingly shown interest in software development, as this approach emphasizes human creativity and entails significantly lower entry costs [6]. However, without the requisite skills, individuals in developing nations will lack the ability to innovate and harness ICTs effectively to address development challenges. Customized applications tailored to local requirements are essential [6]. On the demand side for ICT goods, it is observed that software has a greater impact in high-income countries, while telecommunications have a greater effect in low-income countries [11].

However, according to The Working Group of the United Nations Commission on Science and Technology for Development (UNCSTD), generic models of "best strategies" for the ICT sector cannot be developed due to the significant differences among countries [6]. Therefore, policymakers must bear in mind the minimization of burdens associated with ICT sector development while adapting their strategies to local conditions, taking into account all their particularities.

3.2 Social and Regional Inequality

The risks stemming from the misallocation of ICT investments in underdeveloped countries are multifaceted. Chief among these risks is the potential for exacerbating social, regional, and national disparities, driven by the divide between technologically advanced and underdeveloped regions [6].

Accessing information conveyed through Information and Communication Technologies (ICTs) necessitates the availability of various explicit resources such as a telecommunications infrastructure to facilitate network connectivity, an electrical infrastructure for the functioning of ICTs, a skilled workforce to maintain the technology, financial means to procure or utilize ICTs, proficiency in utilizing these technologies, and literacy skills to comprehend the information presented [12]. Regrettably, individuals experiencing poverty lack access to these essential resources.

If individuals in developing countries are unable to acquire the skills necessary to utilize the new ICT applications, they will increasingly face disadvantages or exclusion from participating in the global information society. The social and economic potential of these new technologies for development is enormous, but so too are the risks of exclusion. Individuals who lack opportunities to acquire the skills essential for navigating such environments will face disadvantages or exclusion as ICTs become increasingly ubiquitous, irrespective of the level of investment in network infrastructure, computers, and software. Strategies must consider that the 'user' may vary, from someone in a rural village to an employee operating a robotic system on an assembly line, or a government official. Different users possess diverse skills, capabilities, cultural understandings of ICT application roles, economic resources, and political influence. Hence, strategies must accommodate these variations [6]

The government is capable of minimizing risks and achieving greater benefits from new ICT applications through compensatory or corrective policy strategies in key areas, particularly in underserved communities [6]. Governments and donor agencies are striving to supply resources for ICTs, however, realistically the poor will not possess or have control over the technology in significant numbers. Therefore, the focus has been on providing ICTs to intermediary institutions like government agencies, NGOs, and community-based organizations to act as 'intelligent intermediaries' bridging resource gaps for the poor to utilize ICTs effectively [12]

Addressing rural regions, ICT can serve a crucial role in bridging the information gap between farmers and markets, potentially enhancing farmers' incomes through improved market efficiency [13]. Despite challenges like inadequate infrastructure and lack of initiative, ICT technologies have the potential to facilitate sustainable development and assist underserved populations in meeting their basic

needs at the bottom of the social hierarchy. ICT initiatives by public and private sectors can benefit the poor if projects achieve cost advantage and scale economies, currently mostly in pilot stage. For reducing the digital divide, commitment to leveraging ICTs with the same creativity used in their development is crucial, especially focusing on the socioeconomic impact. Improving health and education services and enhancing market efficiency for agricultural inputs can uplift lower economic strata significantly [13].

Finally, concerning social inequality, it is worth analyzing the effects at the individual level, such as income and gender inequality. Shas et al. (2024) concluded that the ICT sector is capable of reducing gender inequality, and gender inequality, in turn, is capable of reducing income inequality [14]. Such effects are observed at a speed proportional to the level of development of the country. Therefore, the less developed the country, the longer it will take to see the effects of reducing gender and income inequality [14].

3.3 ICT Use in SMEs: Impact on Inequality

ICT infrastructure empowers SMEs to participate in e-commerce, enhancing efficiency and facilitating business growth through access to new markets and improved information flow [15]. Global access to information is vital for SME success, enabling them to compete internationally and reinforce their business strategies [27c]. Moreover, countries that lag in ICT development face comparative challenges in international competition.

However, SMEs in developing countries face numerous obstacles in adopting ICTs. These challenges include high telecommunications costs, inadequate government ICT policies, reliance on outdated technologies, underutilization of existing technologies, limited local resources and digital illiteracy, shortages of skilled manpower, poor communication infrastructure, lack of awareness about ICT benefits, high internet connectivity costs, expensive ICT equipment, and resistance to change [16], [17]. Thus, ICT applications yield no results if their usage is not feasible [5]. Infrastructure and human capital are primary prerequisites, and these aspects are deficient in developing countries. Therefore, maximizing the benefits of ICT investment for SMEs entails addressing these factors [15].

The government typically devises infrastructure strategies to aid SMEs, offering subsidies and incentivizing ICT providers to provide SMEs with special discounts at reduced rates. Government interventions often shape ICT policies, which are essential for infrastructure development, research and development investment, facilitating technology transfers, establishing science parks, and creating a legal framework. Additionally, there are ICT policies that offer tax incentives for ICT investments and subsidize ICT training for SMEs [18].

3.4 Green ICT in Emerging Countries

The concept denoted by the term "green development" relates to the recent rise of the idea of separating economic growth from CO₂ emissions [19]. Green development Green ICT is a field of study dedicated to exploring the diverse applications of ICT in urban environments with an emphasis on environmental sustainability. Despite the ICT sector contributing to around 2% of global emissions in 2021 [20], with predictions of an increase [21], the sector has the potential to provide smarter solutions to reduce emissions in other sectors [7].

The findings suggest that developing countries should utilize ICTs to drive energy transition and embrace green innovations to mitigate the adverse environmental impacts of ICT. Increasing ICT usage in emerging countries can contribute to CO₂ emissions reduction [18], particularly when paired with renewable energy sources — however, the resulting environmental impact hinges on the level of development and institutional quality of countries. Importing environmentally friendly technologies may prove advantageous for developing economies with moderate to high emission levels. While ICT offers environmental benefits, the intricate relationship between CO₂ emissions and ICT poses challenges in formulating effective policies for these nations [7].

4. Conclusion

Consequently, the information and communication technology (ICT) sector has been responsible for an economic and social revolution worldwide, offering significant developmental potential. The non-engagement of a country in this movement poses a critical risk of lagging behind the rest of the world, resulting in the worst-case scenario regarding the inequality that ICT sector strategies may engender.

However, given that abstaining from engaging in ICT transformation is highly unadvised, great caution must be exercised regarding the asymmetric outcomes within a nation. Ensuring that all regions of a country possess sufficient infrastructure to enable ICT access and that skilled individuals are capable of utilizing and creating innovative solutions is essential to prevent the new technologies from further widening existing economic and social disparities among individuals with varying abilities, cultures, wealth, and routines.

With these precautions in place, fortunately, the ICT sector can reduce social inequalities, economic and productive growth, pollution reduction, and increased efficiency and satisfaction, both at the micro and macro levels. Therefore, I emphasize the immense value that the ICT sector carries and reaffirm the importance of its investment and development. Strategies need to differ concerning establishing favorable internal conditions for the homogeneous development of sector returns, considering each country's conditions to achieve

growth without inequality.

5. References

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