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Innovative technologies as a tool for reducing inequality and increase the potential of human capital

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Abstract. This paper explores the role of innovative technologies as a strategic tool in combating poverty. As poverty remains a persistent global challenge, the utilization of innovative technologies presents new opportunities to empower individuals and communities economically, socially, and culturally. The paper examines various approaches to leveraging technology for poverty reduction, including the use of information and communication technologies (ICTs) to enhance access to resources and opportunities, the integration of engineering expertise to develop and disseminate new knowledge, and the application of modern ICTs to create, store, manage, and disseminate information effectively. By highlighting the potential of innovative technologies to address poverty from multiple dimensions, the paper contributes to a deeper understanding of how technological advancements can play a transformative role in improving livelihoods and fostering socioeconomic empowerment.

1 Introduction

The challenge of poverty reduction revolves around empowering the disadvantaged with knowledge and skills, thereby providing them with new opportunities to enhance their livelihoods. This entails not only increasing income but also improving access to essential needs such as food and healthcare. Utilizing Information and Communication Technologies (ICTs) creatively is a strategic approach to bridge the gap in economic, social, cultural, and political opportunities between the rich and the poor. The role of ICTs in poverty reduction

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extends beyond addressing income poverty to include empowerment. This can be achieved through various strategies, including sustainable livelihood approaches, production-oriented growth strategies, distribution-oriented strategies, and rights and empowerment strategies.

Professional groups like the engineering community can significantly contribute to implementing these strategies. Engineers possess the knowledge and skills to develop and disseminate new knowledge, making them valuable in not only developing ICTs but also adapting these tools to Tanzanian society. By acquiring valuable knowledge or information, disadvantaged individuals gain a significant advantage in equalizing or increasing their opportunities.

Modern ICTs offer several desirable characteristics and attributes useful for poverty reduction. These include interactivity, permanent availability, global reach, reduced per unit transaction costs, increased productivity and wealth creation, and multiple sources of information and knowledge. ICTs facilitate two-way communication, increase transparency, and empower citizens. They are available round the clock, transcend geographic barriers, reduce transaction costs, enhance productivity, and provide access to vast knowledge resources, all of which are essential for poverty alleviation efforts.

2 Research methodology

Food insecurity is just one symptom of a larger issue stemming from the systemic failure to ensure adequate living conditions for all. Merely providing food does not address the underlying structural problem, which is deeply rooted in social and economic exclusion and the precarious balance between capital interests and social reproduction. Despite the belief that employment is the pathway out of poverty, the global working poverty rate stood at 21% in 2018, highlighting the growing number of employed individuals living in poverty. In times of economic crisis and shrinking welfare states, alternative economies have emerged, exacerbating existing inequalities.

Food assistance initiatives, while well-intentioned, often inadvertently support a neoliberal agenda that undermines the welfare state. Critics argue that such initiatives fail to address the root causes of inequality within the food system and economy, merely redistributing food without addressing underlying issues of wealth and power distribution.

However, there are groups taking an emancipatory approach to address these challenges, advocating for the reconceptualization of food as a common resource. Antipower theory challenges existing power structures and promotes the expansion of decommodified spaces.

3 Results and Discussions

Science and technology play a crucial role in the development of any nation. Technology encompasses knowledge, methods, tools, and skills, and its enhancement requires a focus on upgrading knowledge and skills, as well as acquiring tangible elements such as methods and tools. Adequate development of manpower in science and technology is essential for efficiently utilizing natural resources and reducing dependence on external sources for industrialization.

The challenges of under-development in the world's lowest-income countries extend far beyond economic issues alone. There is a glaring absence of the necessary science and technology needed to address critical problems related to health, food security,

environmental management, and climate change, which pose significant barriers to economic progress. Market forces, which typically drive innovation in affluent nations, do not exert sufficient influence in addressing the challenges faced by low-income countries.

This disparity in the application of science and technology is at the core of the widening gap between rich and poor nations. The phenomenon can be attributed to what I refer to as a "quadruple bind," which encompasses four interrelated problems. Firstly, science and technology, like other social phenomena, follow market demand. In countries with substantial demand for new products and innovation, the supply of scientific advancements is driven by profit motives. However, the lack of market impulse for research and development (R&D) in impoverished nations exacerbates this divide.

Secondly, technological innovation often exhibits increasing returns to scale, meaning that collaboration among scientists leads to greater output than individual efforts. As a result, countries with a higher concentration of scientific expertise benefit from amplified innovation, further widening the gap between rich and poor nations.

The third aspect of this quadruple bind relates to the role of education and human capital. High-income countries typically invest more in education and skill development, creating a virtuous cycle of innovation and economic growth. In contrast, low-income countries struggle to provide adequate education and training opportunities, hindering their ability to harness scientific advancements for development.

Lastly, the presence of institutional and governance challenges in low-income countries inhibits the effective utilization of available resources for scientific research and technological innovation. Limited funding, weak infrastructure, and governance issues impede the development and implementation of sustainable solutions to pressing societal problems.

Addressing these interconnected challenges requires concerted efforts at the global level to promote equitable access to scientific knowledge and technology. By enhancing collaboration, increasing investment in education and R&D, and fostering supportive governance structures, the international community can help bridge the gap between rich and poor nations and foster sustainable development worldwide.

The challenges of under-development faced by the world's lowest-income countries extend beyond economic issues, encompassing critical deficits in science and technology that impede progress in vital areas such as health, food security, and environmental management. In recent years, it has become increasingly evident that low-income nations are caught in a "quadruple bind," comprising four interrelated challenges that hinder their access to scientific advancements and technological innovations.

The first challenge stems from the differential in market demand between high-income and low-income countries. Market forces, which typically drive innovation in affluent nations, do not exert sufficient influence in impoverished countries to stimulate research and development (R&D) efforts. Moreover, the limited capacity of impoverished governments to fund R&D exacerbates this disparity.

The second challenge relates to the nature of technological innovation, which often exhibits increasing returns to scale. Collaboration among scientists in high-income countries results in amplified innovation, whereas low-income nations struggle to harness scientific advancements due to insufficient resources and infrastructure.

The third aspect of the quadruple bind underscores the critical role of education and human capital in fostering innovation. High-income countries invest more in education and skill development, creating a conducive environment for technological advancement. In contrast, low-income nations face significant barriers to education and training, hindering their ability to leverage scientific advancements for development.

The fourth challenge arises from the disproportionate impact of anthropogenic climate change on low-income countries. Climate change exacerbates existing challenges by imposing additional burdens on vulnerable populations, particularly in tropical regions, where extreme weather events and environmental degradation pose significant threats to livelihoods and well-being.

Addressing these interconnected challenges requires a concerted global effort to promote equitable access to scientific knowledge and technology. International cooperation, financial assistance from wealthy nations, and support for research initiatives targeting poverty-related diseases and agricultural productivity are essential to bridge the gap between rich and poor countries and foster sustainable development worldwide.

Efforts to mobilize development must prioritize awakening international policymakers to the urgent need for action. Relying solely on globalization to address the challenges faced by low-income countries is unrealistic and insufficient. Instead, a comprehensive approach that combines international cooperation, financial support, and targeted research initiatives is necessary to overcome the quadruple bind and promote inclusive development for all nations.

4 Conclusions

The theory of institutional regulation underscores the influence of economic and social regulations on organizational behavior. Enterprises navigating pollution emission and green technology innovation inevitably contend with environmental regulatory policies. As elucidated above, human capital significantly impacts enterprise-level green technology innovation, with environmental regulations exerting a moderating influence on this dynamic.

Formal environmental regulations can reshape capital allocation within industries, fostering green total factor productivity improvement by reducing the relative reliance on physical capital and mitigating capital-factor mismatches. Moreover, environmental pollution's impact on nearby communities' well-being underscores the urgency for pollution control, potentially diverting funds from human capital investment and attenuating its influence on green technology innovation.

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