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Digitalization and Poverty Reduction in the Era of Regional Integration: A Review of the China Pakistan Economic Corridor (CPEC)

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ABSTRACT

In the era of digital transformation and deepening global interconnectivity, the nexus between digital governance, regional infrastructural integration, and poverty reduction presents growing policy relevance. This review synthesizes theoretical and empirical literatures around digitalization, poverty alleviation, and the CPEC initiatives linking China and Pakistan. It argues that CPEC's infrastructural and governance investments provide illustrative case of "regionalization where corridor driven infrastructure, institutional reform, and digital platforms converge to reshape developmental trajectories. The review identifies three key literatures: (i) digitalization and inclusive development (ii) regional corridor and value-chain integration, and (iii) poverty reduction mechanisms in developing contexts. Through a thematic analysis, the paper highlights how digitalization operates as a multiplier of infrastructural investments and governance reform in the CPEC context, yet also reveals enduring governance, geography and equity related bottlenecks. It concludes by offering a research agenda for future inquiry and policy implications for governments engaged in digital infrastructure led regional integration.

KEYWORDS: Digitalization, Poverty Reduction, China-Pakistan Economic Corridor (CPEC) Policy, Sustainable Development.

1. INTRODUCTION

The Sustainable Development Goals (SDGs) proclaimed a new goal 1 and 10 in September 2015 to eradicate poverty and reduce inequality at an extreme level by 2030, as determined by the proportion of the population surviving on less than $1.25 a day. The largest inequality between countries due to COVID-19 has been observed during the last three decades. The pre-pandemic inequality level was -0.8% which has been increased to 4.4% after post pandemic projection. Recently, research has claimed that this goal is questionable with respect to being achievable by economic growth alone. The global $1.25-a-day headcount will remain around 5-7% in 2030 if there is no change in income distribution in countries, even in those with optimistic economic growth rates (Anderson et al., 2018). Poverty is a worldwide problem that reflects a lack of resources leading to people's economic well-being. When people are unable to obtain the resources to maintain their health and well-being they are considered poor. Individuals' social and mental health may suffer as a result of poverty. When basic requirements, infrastructure, and services like schools and hospitals are scarce, poverty becomes more severe (Heshmati et al., 2015).

The global society has made significant progress in reducing poverty in the previous quarter-century. Sixty percent of countries' poorest people's earnings grew faster than the global average between 2010 and 2015. Globally, the percentage of persons living on less than $1.90 per day dropped from 42.5 in 1981 to 9.2 in 2017, but it is expected to rise slightly in 2020 (Lechman & Popowska, 2022). The poverty rate was decreased from 10.1% to 8.6% in 2015 and 2018 respectively, however, due to COVID-19 poverty percentage was slightly increased to 9.2% in 2020 rising extreme poverty since 1998 and largest poverty increase since 1990. The COVID-19 pandemic and further Ukraine

war combine increased poverty rate as 75-90 million people living in extreme poverty in 2022 (Economic & Affairs, 2022).

Meanwhile, China has started Belt and Road Initiative (BRI) in 2013 to promote exchanges through regional integration by sharing development opportunities to achieve shared prosperity. BRI aims to improve regional connectivity in addition to policy communication by facilitating the trade and non-governmental exchanges. Further, it also enhances technological advancement which leads to sustainable development of a region (Xiao et al., 2018). The flagship project of BRI is China-Pakistan Economic Corridor (CPEC) which is a significant infrastructure and economic development project connecting China's western region to Pakistan's Gwadar Port. The CPEC has promoted the development of ICT infrastructure, including the establishment of fiber-optic networks and digital communication systems to enhance connectivity (Chan, 2018).

Digitalization within the CPEC framework includes the creation of smart cities with advanced infrastructure and digital services to promote sustainable urban development (Ali, 2018). Efforts to enhance connectivity between China and Pakistan through the CPEC include the development of telecommunication infrastructure, contributing to increased digital connectivity (Shen, 2020). While digitalization within the CPEC presents significant opportunities, challenges such as cybersecurity, data privacy, and digital divide need to be addressed to ensure inclusive growth (Hussain, 2019). Digitalization within the CPEC is transforming infrastructure development, trade, urbanization, and connectivity between the two countries. The integration of digital technologies can contribute to the success and sustainability of the CPEC and foster closer ties between China and Pakistan. While presenting numerous opportunities, it is essential to address challenges related to digital security, data management, and equitable access to ensure that the benefits of digitalization are realized across the corridor.

The current study intends to analyze the interlinkages between poverty alleviation, digitalization and CPEC using thematic analysis. The present study question will be primary focus and attempt to answer it: Is there any significant relationship between poverty reduction and digitalization by intervening role of CPEC?

2. THEORETICAL FOUNDATIONS

2.1. Digitalization and Public Value Theory

Public value theory has attracted research attention for its powerful proposition that shifts the focus of public sector management from internal efficiency to the value creation process that occurs outside the organization (Panagiotopoulos et al., 2019). Based on this theory, the value that digital governance should generate can be summarized as improved public services, improved administration, and improved social value (Twizeyimana & Andersson, 2019). Public value theory provides new insights into the use of digitalization to improve governance performance, that is, to meet citizens' expectations by implementing digital government to improve government efficiency and provide quality public services (Latupeirissa et al., 2024; Shenkoya, 2025) . The utilization of digital governance to enhance the public value of governance is also reflected in the co-creation of government and the public: co-creation empowers citizens by enabling them to participate in meaningful and valuable public service design and policy decisions (Hajar & Arma, 2024).

Further, the application prospect of public value theory in e-government shows that the digital transformation of the government is not only in terms of technology, but more importantly, it should be used as a part of the country's overall development plan and strategy to carry out public governance transformation and innovation (Wu et al., 2024). Therefore, the development of e-government should proceed from a holistic approach, be driven by public values, and achieve institutionalization at all levels of government and society, which will fundamentally change the thinking mode of government employees and the way of cooperation in the public sector (Zhang & Kimathi, 2022).

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2.2. CPEC and Regionalization Theory

Regional integration is a recently emerging phenomenon, especially after BRI and plays a vital role because more than 151 countries are integrated based on the regionalization and development theory for the common objective of social, economic, and environmental dimensions of sustainable development. The growing incorporation of national economies through BRI in the world offers a concurrent example. It indicates that regional integration can function as a facilitator in multi-dimensional ways, particularly in trade advancement, digital transformation, growing markets, regional action, and the growth of sustainable socio-economic factors. Yu and Chang (2018) posited that the BRI initiative, based on the regional integration and development theory, is directed at improving global collaboration and encouraging connectivity to achieve sustainable growth and strengthen regional attachment; such measures could promote human development and health-care by creating better employment opportunities to save money for old-age benefits.

Based on the regionalization and development theory, the effect of regional integration on economic development was investigated by Obere et al. (2013), who employed the generalized method of moments (GMM) and found that economic development was significantly stimulated by regional integration. Therefore, the phenomena of regionalization have a potential relationship with the development of a sustainable economy. Bräutigam and Tang (2014) claimed that China had addressed the issue of sustainable economic development by offering the BRI proposition of sustainable development phenomenon as the key to achieving the common objectives of human development, health care and economic growth through trade, connectivity, investment and infrastructure development. Wang and Selina (2018) argued that BRI is likely to practice a development theory process somewhat as a moderator to its counterparts worldwide. If bilateral cooperation is positive, it may mitigate political instability and enhance local development with regional progression (Garofoli, 2020).

2.3. Poverty Reduction and Development Economics

Traditional poverty-reduction frameworks emphasis asset accumulation, market access, human capital, and institutional access. Digitalization and infrastructure investments can contribute by lowering barriers to service access, linking low-income households into formal markets, and improving government delivery of social protection (Nosike, 2024). Yet, these mechanisms must contend with heterogeneity, informal sectors, and regional disparities. Bringing together these three theoretical domains offers a conceptual lens: digitalization acts as the “soft” infrastructure layering over the hard corridor infrastructure of regionalization, together influencing poverty outcomes. Within CPEC, this means that digital platforms, connectivity upgrades, and institutional reforms potentially magnify the socio-economic dividends of corridor investments especially for historically marginalized populations.

3. LITERATURE REVIEW

This section reviews the literature related to the study topic. It navigates empirical studies on the contribution of digitalization measures in poverty alleviation. The chapter offerings what is already known about the digitalization and poverty in CPEC context to identify the current research gap on the contribution of technological adoption measures taken.

3.1. Digitalization and Inclusive Governance

Digitalization can be conceptualized as “a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication and connectivity technologies” (Vial, 2019). The word Information and Communication Technology (ICT), digitalization, digital technologies, digital transformation, e-government, e-governance, digital governance transition are used interchangeably. Arguably, the Advanced Research Projects Agency Network in the 1970s marked the beginning of digitalization. The prevalence of digitalized infrastructures and their rapid development into the digital economies have taken control of forms of social organization in the 2020s mark a new development (Bukht & Heeks, 2017). This divides those who are digitally connected from those who are not, creating enormous potential but also new inequalities and power relation configurations in society (Sareen et al., 2020). Feola (2020) recommends, being

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complicit in producing forms of capitalist-driven change that jeopardize the sustainability of sustainability transitions if we do not more forcefully center digitalization in the analyses and further elaborated that digitalization is a key driving force of sustainability transitions for the coming decade.

The digitalization plays a crucial role in the success of public sector transformation. Digitalization in the government context encompasses various initiatives aimed at leveraging technology to improve the efficiency, transparency, and accessibility of government services and interactions with citizens. It also enables the provision of government services through online platforms, allowing citizens to access services such as tax filing, permit applications, and social welfare applications conveniently (Othman et al., 2020). It also involves the services and social protection programs that can improve their performance, ensuring that benefits reach those in need more effectively (Aly, 2020). The Pakistani government has launched various digital governance transition initiatives aimed at improving service delivery, transparency, and citizen engagement (Shaikh et al., 2016). E-government fosters transparency through open data initiatives, making government information and data publicly available. Open data platforms enable citizens, businesses, and researchers to access and analyze government data (Reggi & Dawes, 2022).

3.2. CPEC: Infrastructure, Governance and Digital Linkages

The old Silk Route of Asia was the world's most important cross-border artery until the 13th century, when Asia was a key trading and economic center. The "Silk Road" is a vast Pan-Asian interlinked network of trade routes that connects Eastern, Western, Central, Southern Asia to the Mediterranean, including Europe and North Africa. Asia has re-emerged as a key economic force in the world over the last few decades of globalization. Many Asian economies have integrated into global production networks, benefiting from greater development, trade, and investment. However, due to a lack of regional connectivity, Asia's enormous economic potential remains mostly untapped (Bhattacharyay & De, 2009).

Meanwhile, the 'flagship' project of the BRI is the CPEC. Since it was finalized in May 2013, four months before Xi Jinping launched the BRI, it actually predates the BRI. China’s President Xi Jinping announced CPEC on April 2015 upon his visit to Pakistan. The purpose of CPEC is to connect Chinas Kashgar region to Pakistan’s Gwadar port. The investment of China is 46 billion dollars more than US aid since 2002. The purpose of the economic corridor is not only to connect with the Pakistan but to connect with the global world. In terms of budget and extent, it continues to be the BRI's largest project. Across Pakistan, there are plans for energy, infrastructure, and industrial projects totaling US$ 62 billion. By 2030, these are anticipated to be completed and finalized (Mansoor, 2021; Ritzinger, 2015).

Similary, Pakistan's electricity supply was far short of production and daily requirements which causes poverty due to lack of energy. The CPEC has improved cooperation in the power sector and given Pakistan's power sector access to new markets which resulted for poverty eradication (Xie et al., 2022). Another study examined the impact of CPEC on economic and social wellbeing of Pakistan by using snowball sampling for primary data collection and the results indicated that CPEC has provided jobs to Pakistan's less educated people, thereby reducing unemployment and poverty (Bibi & Jamal, 2022). The CPEC and its potential impact on Pakistan's economic and social stability were studied by Hussain (2022).

The study concluded that sustainability in CPEC in Pakistan is possible through improving governance and institutional frameworks, environmental sustainability, social and economic impacts, geopolitical risk management, and research and monitoring. Further, the CPEC has the potential to significantly boost fiscal conditions through careful management and planning which is necessary for long-term growth and poverty alleviation. Another article describes how CPEC has impacted Pakistan's education system and extreme poverty as in context of Pakistan Education and poverty alleviation have not been given top priority. The survey questionnaires were used for investigation the relationship among 800 Hazara respondents in KPK, Pakistan. The relationship was investigated using correlation and SEM which showed that the CPEC could transform Pakistan's education and poverty alleviation (Ullah et al., 2020).

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The studies show that CPEC will be helpful in the socio-economic development as it is the ladder towards sustainable development in Pakistan. According to globalization theory, cultural exchange and communication, technology transfer, and interconnectedness are going to increase in the region under the BRI. Under the CPEC, the transformation of human capital knowledge and technology will play a vital role in the development of Pakistan. Physical capital is expected to improve the urban sector by industrialization, which will further stabilize the economy of Pakistan. Infrastructure-led development is the foundation of socio-economic development. Natural resources and social infrastructure are planned to be effectively used under the CPEC (Menhas et al., 2019). Pakistan has introduced many institutional reforms in the industrial sector to improve domestic economic growth. Additionally, the CPEC has become a source of FDI, which will play a catalyst role in the stabilization of the shaking economy of Pakistan. The CPEC is a multidimensional project under the umbrella of the BRI, which is the leading development process in Pakistan for sustainable development. The development of infrastructure will be helpful in socio-economic development, poverty alleviation, and improving the living standard of people. Further, it will also be helpful in the reduction of the development gap between different regions. The goal of sustainable development can be achieved only through a multidimensional development project (Saad et al., 2019).

3.3. Digital Inclusion and Poverty Reduction in Corridor Contexts

According to the World Bank "people are considered as poor if their standard of living falls below the poverty line, that is, the amount of income or consumption associated with a minimum acceptable level of nutrition and other necessities of everyday life." (Bank, 1990). Numerous social issues, including political instability, unemployment, malnutrition, inefficient jobs, widespread income inequality, higher dependency rates, a lack of access to education and healthcare, vulnerability to natural disasters, high currency instability, and widespread corruption, can be exacerbated or caused by poverty. Poverty influences a variety of economic sectors, including investment, agriculture, industry, infrastructure, and governance, as well as joblessness, crime, and economic deprivation. The era of millennium development goals (MDGs), 2000-2015, particularly, the goal to eradicate extreme poverty and hunger (MDG 1) and the declaration of the sustainable development goals on 25 September 2015, unanimously endorsed and adopted by 193 countries, suggest the global consensus to 'end poverty in all its forms everywhere' and reducing inequalities (SDG 1 & 10) by 2030 (UN, 2015).

The poverty situation in Pakistan is a complex issue that involves economic, social, and structural challenges. Poverty rates, income disparities, and social inequality are among the key factors affecting the country. Poverty remains a significant concern in Pakistan, affecting a large portion of the population. The country faces challenges such as unemployment, underemployment, lack of access to basic services, and inadequate social safety nets. Pakistan's poverty rates vary across urban and rural areas. Income disparities are prominent, with a significant gap between the rich and poor. Many people live below the poverty line, struggling to meet basic needs (Saleem et al., 2021).

The poverty situation is more acute in rural areas, where access to education, healthcare, and basic amenities is limited. Agricultural communities often face challenges related to low productivity and vulnerability to climate change (Castaneda Aguilar et al., 2022). Saleem et al. (2021) examines Pakistani rural and urban multidimensional poverty through education, health, and living standards. The findings show that multidimensional poverty in Pakistan was always higher in rural areas than urban areas which increases Pakistan's fast growing socio-economic challenges. To satisfy global well-being standards, the state must offer sustainable and millennium development essentials like food, health, water, and education. Meo et al. (2020) examined the non-linear relationship between governance, poverty and unemployment in Pakistan. The study uses nonlinear ARDL co-integration data from 1984-2016. The results show that unemployment and governance shocks affect poverty disproportionately and mislead poverty modeling.

The ICT for sustainable development could be achieved through the economic dimension. In this respect, policies that encourage economic growth and poverty alleviation are highlighted as sustainable policies. ICT development can lead to higher economic growth through increase in productivity and reduction in transaction cost (Cheng et al., 2021). Globalization could equally be boosted as a result of ICT adoption which in turn increases economic growth due to

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improvements in economies of scale (Kurniawati, 2020). Digital governance transition, the integration of digital technologies into various aspects of society, has become a key driver of economic growth in recent years. Digital governance transition in the social context refers to the use of digital technologies to reshape social interactions, communication, and the way individuals engage with society. It encompasses various aspects, from online social networks and digital activism to the impact of technology on social relationships and identity. Digitalization has profoundly impacted how people connect, communicate, and engage with social issues. In the social context, digital governance transition has led to new forms of communication, activism, and identity expression. Digital governance transition has given rise to online social networks, such as Facebook, Twitter, and Instagram, enabling individuals to connect, share experiences, and maintain relationships virtually (Ellison et al., 2007). Digitalization has facilitated the organization and coordination of social movements and activism through online platforms, allowing individuals to raise awareness and advocate for social change (Bennett & Segerberg, 2013).

Digital technologies can provide farmers with access to market information, improving their bargaining power and reducing poverty through increased agricultural productivity (Khan et al., 2022). Digital platforms can offer opportunities for remote learning and skills development, particularly important in a country like Pakistan, where access to education is challenging for many (Saqib et al., 2021). Digital platforms can offer new avenues for entrepreneurship and income generation, especially for individuals from low-income backgrounds (Sufyan et al., 2023). E-government also creates new entrepreneurial opportunities, driving the emergence of digital startups and the gig economy, which can contribute to job creation (De Groen & Maselli, 2016). Surprisingly, digitalization including automation and artificial intelligence can lead to the displacement of certain jobs that are routine and repetitive in nature (Autor, 2015).

Digitalization can create a skill mismatch, where workers lacking the necessary digital skills might face challenges in finding employment, leading to structural unemployment. Therefore, it is need of the hour for a growing consensus that labor institutions around the world need to be reinvigorated in order to respond to the challenges facing the future of work (Grimshaw, 2020). Digitalization can exacerbate unemployment and inequality if certain groups lack access to digital tools and skills, leading to a digital divide in the labor market (Van Dijk & Hacker, 2003; Van Dijk, 2012) Digitalization has also given rise to negative aspects, such as cyberbullying and online harassment, which can impact mental health and well-being (Hinduja & Patchin, 2014).

Knowledge and digitalization is supposed to improve people's lives, however, digital technologies are merely tools for developing and transforming social-economic processes, and their use does not guarantee favorable results as its dependent upon institutes, conditions and goals. Thus, digitalization affects various social-economic processes and requires practical policies to ensure everyone's well-being. The study used correlation and the visualization matrix method to find out and track national trends in digitization and quality of life. The analysis and results indicate that there is close correlation between subjective and objective indicators of quality of life and between quality of life and digitalization. Further, the two-dimensional matrix proved to be a useful visual tool for identifying specific two-way relationships between human development and digitalization. This technology can manage digitalization for social progress and quality of life when combined with statistical and qualitative methodologies (Kryzhanovskij et al., 2021).

Similarly, another study conducted by Mondejar et al. (2021) elaborated that digitalization could be beneficial for society and the environment as it provides access to an integrated network of unexploited data. Smart systems connected to the internet of things can create new opportunities to strategically address UN Sustainable Development Goals (SDGs) to promote an equitable, environmentally sustainable, and healthy society. Smart technologies are expected to transform the food-water-energy nexus by improving sustainable food production, clean and safe drinkable water, and green energy generation and use. Digitalization can accelerate sustainable manufacturing and improve citizens' health by enabling digital access to care, especially for underprivileged communities.

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4. DISCUSSION AND SYNTHESIS

The importance of digitalization and ICT for poverty reduction is supported by the growing body of evidence. Yılmaz and Koyuncu (2018) examined panel data (2000-2013) for 182 countries and found that the Internet had the strongest, among all ICT indicators, impact on poverty and inequality reduction. The evidence from Rashid (2016) supports the claims that digital inequalities mirror the patterns of social inequality, hence ICT diffusion shall be fostered. Another study by Agalo (2024), focusing on the poverty reduction among women indicate that ICT contributes significantly to reduce poverty and improve the livelihoods of women by strengthening social networks, cutting down travel costs, and facilitating the efficiency of economic activities. To achieve the sustainable goal of poverty reduction CPEC has played a crucial role as the CPEC has improved cooperation in the power sector and given Pakistan's power sector access to new markets which resulted for poverty eradication (Xie et al., 2022). Consequently, CPEC has also played a vital role in transforming the economic and social wellbeing of Pakistan. The study using snowball sampling for primary data collection and the results indicated that CPEC has provided jobs to Pakistan's less educated people, thereby reducing unemployment and poverty (Bibi & Jamal, 2022). The CPEC and its potential impact on Pakistan's economic and social stability were emphasized by Hussain (2022).

5. POLICY IMPLICATIONS, FUTURE DIRECTIONS AND CONCLUSION

a. Policy Implications

The adoption and incorporation of digital technology into society has given rise to a plethora of different ideas and conceptual frameworks that attempt to grasp the implications of digital governance transition. Researchers and intellectuals are able to investigate the effects of digital governance transition using these notions. They shed light on the relations between technology and society as well as how digitalization influences the dynamics of social, economic, and cultural life. When examining digital governance transition, researchers frequently combine several theories to develop more comprehensive frameworks. Theories of digital governance investigate the ways in which digital technologies impact society as a whole, as well as businesses and people, hence support empirical studies and policy initiatives for poverty reduction.

b. Research Gap and Future Directions

Research on the intersection of digital governance transition and poverty, providing a contemporary understanding of the topic, and offer up-to-date insights into the theoretical perspectives of e-government and poverty which is a noteworthy research problem and the gap which identified from the Appendix-A. This highlights the importance of digital governance transition, governance or institutional insights and poverty or inequality and the challenges associated with bridging the digital divide. One potential research gap in the context of digitalization and poverty reduction in Pakistan is the limited research of e-government initiatives taken in context of CPEC which impact various dimensions of poverty.

Further, there is need to focus on the moderating role of institutional quality in measuring the relationship among digital governance transition and poverty. All the studies address the relationship between ICT and poverty alleviation in various perspectives. However, most of them focus on one aspect of the poverty reduction or provide a broad geographical coverage. Therefore, this research offers limited and specific perspective on the presumed relationship. This will contribute to the existing body of knowledge by providing solid empirical evidence.

c. Conclusion

The CPEC focuses on infrastructure development, energy projects, and trade connectivity between China's western regions and Pakistan's Gwadar Port. Alongside these traditional development goals, digital governance transition has been identified as a potential driver for economic growth and poverty reduction. Under the CPEC, digital infrastructure development is a key component. This includes the establishment of high-speed internet networks, data centers, and e-governance systems. These digital initiatives aim to improve connectivity, facilitate cross-border trade, and enhance access to information and services (Ali, 2016; Ali, 2020).

The CPEC which is a major infrastructure development project includes various sectors, including energy, transportation, and telecommunications. Broadband infrastructure is a significant component of the CPEC, aimed at

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enhancing digital connectivity and communication between China and Pakistan facilitating trade, information exchange, and digital collaboration. The development of broadband infrastructure under the CPEC can contribute to the growth of the digital economy in Pakistan by improving access to digital services, e-commerce, and online entrepreneurship (Chohan, 2021). CPEC envisioned the development of smart cities with advanced digital infrastructure, including smart grids, e-governance systems, and digital public services. The CPEC aimed to enhance digital connectivity between China and Pakistan, facilitating cross-border data exchange, trade, and collaboration. The corridor's development was expected to boost cross-border e-commerce and digital trade between the two countries, promoting economic growth through digital channels which includes measures to enhance digital skills and promote tech innovation through capacity building, research, and technology transfer (Farooq et al., 2022).

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