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Framework for Strategic Investments in Technology to Enhance Sustainable Economic Development in Emerging Markets

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Abstract:- Technology has become a major force behind economic development, especially in emerging markets where innovation can potentially play a transformative role. However, insufficient infrastructure, regulatory issues, and limited resources frequently make it difficult to strategically apply technology in these areas. By examining how technology investments can support long-term growth and address developmental difficulties, this review explores and suggests a systematic strategy for improving sustainable economic development in emerging markets through focused investments in technology. Technology investments can increase productivity, enhance social inclusion, and assist environmental sustainability when properly aligned with local economic goals and backed by enabling legislation. Development of infrastructure, investment in human resources, innovation ecosystems, and sectoral integration of digital technologies are among the important elements identified. Therefore, the study emphasizes how critical it is to approach technological investments holistically, incorporating social, economic, and environmental factors.

Keywords:- *Sustainability, Innovation, Technology, Emerging Markets, Investments, Economic Growth.*

I. INTRODUCTION

In recent times, innovations and technological breakthroughs have driven economic growth and transformed labour markets, industries, and social structures. However, in developing economies, when challenges like unemployment, poverty, and inadequate infrastructure persist, attaining sustainable economic growth remains a primary objective (Teona, 2021; Song, 2024). Industries like low-cost manufacturing, natural resource extraction, and agriculture have primarily driven economic development in emerging economies (Singh et al., 2023). As such, due to factors like unstable commodity pricing, minimal value addition, and environmental degradation, these industries frequently find it difficult to provide long-term, sustainable growth.

Additionally, technology has been a major factor in achieving sustainability. Businesses can lessen their environmental effect and create more economical and efficient products by implementing cutting-edge technologies and processes (Fernando et al., 2019; Ali et al., 2021). Therefore, resource consumption is decreased, business profitability is aided, and economic growth is spurred. Subsequently, there is a considerable amount of opportunity for economic development in areas with rich resources. Governments can develop economically while preserving sustainability by utilizing these resources (Wang et al., 2023; Ahmad et al., 2020). Investing funds in contemporary technology can thus promote economic expansion and innovation while protecting the environment.

Financial commitments tailored to the development, uptake, and integration of technological innovations that enhance productivity, efficiency, and creativity across a range of industries are referred to as technology investments (Javaid et al., 2022). According to Soltanisehat et al., (2019) and Ruzzante et al., (2021), these technology investments encompass, funding for digital infrastructure, renewable energy, advanced manufacturing, financial tech, agricultural technology, and information and communication technologies (ICT) in developing countries. In light of this, developing nations may increase their economic resilience, lessen their reliance on conventional industries, and build more diverse, knowledge-based economies by carefully allocating investments into these areas.

Although it is well known that technology may hasten sustainable economic progress, emerging markets and developing economies have been slowly grasping the opportunity presented by technology investment (Perifanis & Kitsios, 2023). With this, there is an increasing awareness that technologically driven investments can act as an effective catalyst for long-term, sustainable economic development. However, inadequate infrastructure, substandard institutional frameworks, and unfavourable investment conditions might be responsible for the poor adoption, discouraging investment and impeding progress (Hassan et al., 2017; Loo M. K. et al.,

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2023). There is thus a growing disparity between the potential and actual implementation of technology-driven economic growth, which prevents many developing countries from fully engaging in the global digital economy. Consequently, developing economies can potentially improve growth and development given global increasing technological innovation, since they risk a major decline in the global digital transformation, if they fail to adopt thoughtful and strategic initiatives. Therefore, this study aims to explore and recommend a methodical approach to enhancing sustainable economic development in emerging markets through targeted technology investments.

II. FRAMEWORK FOR SUSTAINABLE ECONOMIC GROWTH

The concept of sustainable economic growth has changed throughout time and now encompasses more than just gains in a nation's GDP or productivity. It alludes to long-term, inclusive growth that balances social progress, environmental preservation, and economic expansion (van Niekerk, 2020). Numerous important economic theories, serve as the foundation for the theoretical framework for sustainable economic growth.

Proponents of mercantilism (15th–17th century) are the source of growth theories. The French economist Antoine de Montagne brought the term "mercantilism" into scholarly discourse (Montchrestien and Billacois, 1999). Mercantilists believed that the primary driver of economic expansion and the primary goal of the state's and traders' economic activity was the amassing of wealth (McDermott, 1999). Early mercantilists favoured coins and precious metals as absolute liquid materials, but later mercantilists supported a trade surplus and measured the nation's economic strength by the total quantity of products produced. The growth of local markets and manufacturing contributes to this tendency. The ability to profit from the creation of commodities and credit availability, in the opinion of mercantilists (Osipian, 2007), contributes to the growth of wealth. Access to credit facilities and comparatively cheap interest rates on loans were made possible by the country's vast supply of metallic money, especially gold and silver coins. Early mercantilists insisted on limiting the nation's gold exports because of this. Thus, the presence of gold and silver coins in circulation was raised to a necessary fundamental principle of economic growth, while active commercial activity was considered a requirement for such expansion.

Osipian (2007) further stated that there was not a substantial quantity of industrial capital at the time, all of the capital was reported as trade capital, which makes this method a historical pattern. Based on the aforementioned stance, the mercantilists supported restricting the import of products into the nation while also welcoming the export of goods as a source of foreign exchange inflow. The goal of this policy was to maintain economic growth through a trade surplus and enough metal money. The mercantilists gave way to physiocrats in the latter part of the eighteenth century. Physiocracy, which means "Government of Nature" in Greek, is an economic theory that was developed in the eighteenth century by a group of progressive French economists. They held the view that agricultural products should be highly priced and that the value of land agriculture or land development was the only source of a nation's wealth. The second part of the 18th century saw the greatest popularity of these views, which had their origins in France. The Physiocrats' emphasis on productive labour as the source of state prosperity was their most important contribution. The first school of economics to recognize labour as the exclusive source of value was the Physiocratic school.

A. Classical Theory of Economic Growth

According to previous research, Adam Smith (1723-1790), David Ricardo (1772-1823), Thomas Malthus (1766-1834), Karl Marx (1818–1883), John Stuart Mill (1808–1873), Jean-Baptiste Say (1767–1832), and other notable figures are the most well-known and exceptional representatives of the classical school. The core assumption of Smith's work was that commerce was the source of a nation's wealth: total wealth rises when two people voluntarily agree to exchange valuables because they both stand to gain from the transaction.

In a situation when there is no coercion, markets often self-regulate, according to classical economics. Adam Smith called this the metaphorical "invisible hand" that drives markets towards a state of natural equilibrium where consumers have a choice of providers and businesses that are unable to successfully compete are permitted to fail. Smith emphasized the need for competition and issued several warnings about the perils of monopolies (Smith, 1776). In this regard, Adam Smith established the connection between rising human wealth and improved output from the three factors of production: land, labour, and capital, which is demonstrated by increased labour productivity and expanding amounts of functional capital. Therefore, extensive emphasis was paid to factors that led to widespread growth, such as investment, geographic discoveries, worker participation in the material production sector, and population growth.

According to Smith, population growth is endogenous and reliant on the resources available for subsistence. It was also acknowledged that investment was endogenous and that it was dependent on the labour and savings of the capitalists, who defined savings as the total amount of reserves allocated to industrial rather than personal use. Therefore, geographical discoveries and technological advancements in land fertility were related to the increase in land productivity (Sharipov, 2015). The division of labour and advancements in technology were Smith's primary sources of improved productivity. Smith felt that technological advancements, which include the division of labour, are a major factor in the ability of a nation's economy to grow without delay.

Thomas Malthus (1766-1834), a prominent economist, viewed economic growth as pessimistic, predicting a dire situation when population growth exceeds means of subsistence. He argued that if population growth exponentially exceeds the means of subsistence, the Earth will face imminent depletion, leading to wars, epidemics, hunger, and mass disease (Lavrov and Kapoguzov, 2006).

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Malthus proposed restraining population growth, particularly for the poorest, and ensuring children's subsistence for a decent life. Despite his flawed calculations, his theory of diminishing returns of production was widely used in the 20th century.

David Ricardo (1772-1823), a renowned classical economist, emphasized the concept of comparative advantage, suggesting that nations should concentrate resources in internationally competitive industries and trade with other countries for non-produced products. He also emphasized the importance of respecting capital performance and recognizing the impact of technological innovations.

John Stuart Mill (1808–1873) made a great contribution to the systematization of the classical school since he effectively collected earlier research into the "classics" framework. Specifically, he finished the traditional theory of economic dynamics, which takes long-term economic patterns into account. The idea of capital accumulation through time is central to this concept. The idea states that rising capital raises labour demand, a stable population raises real wages, and stable population growth promotes long-term population growth. These processes can theoretically go on forever if capital accumulation outpaces labour force growth.

B. Keynesian and Post-Keynesian Growth Theories

These theories are based on the concept of aggregate demand, which is the main factor contributing to economic growth. Keynesian theory suggests that during recessions and rising unemployment, the reduction of income leads to decreased consumption, savings, and investments. To stimulate the economy, governments should implement macroeconomic policies such as tax cuts or increases in government spending.

Post-Keynesian (neo-Keynesian) growth theories were formulated by Evsey Domar and Roy Harrod. Domar's theory focuses on the role of investment in income and production capacities, determining the tempo at which investment should grow to ensure revenue growth. This tempo is directly dependent on the share of savings in national income and the average efficiency of investments. Roy Harrod's theory is devoted to studying the economy's growth trajectory, based on the accelerator theory. It describes the mechanism of balanced growth, grounded on the functional relationship between income, savings, and investments and the analysis of entrepreneurs' expectations. The growth rates of labour and capital productivity determine the actual growth rate in Harrod-Domar's theory. However, the theory has limitations, including dependence on investment, lack of consideration for labour use, and not taking into account technological progress. Additionally, historical conditions can affect the theory's limitations, as it could not adequately describe the actual processes of economic growth in the 1930s and post-war periods when growth depended on the growth of production capacity utilization.

C. Neoclassical Theory of Economic Growth

The 1950s and 1960s saw the emergence of the first neoclassical growth theories, as concerns about dynamic equilibrium began to recede and the issue of achieving potential growth, which was more likely to emerge from the introduction of new technology, increased productivity, and improved production organization was at the forefront. Among the most prominent members of this school are Irving Fisher (1867–1947), John Bates Clark (1847–1938), Carl Menger (1840–1921), Friedrich von Wieser (1851–1926), Leon Walras (1834–1910), and Alfred Marshall (1842–1924).

Along with other academics, American economist Robert Solow (1924–present) supported permitting major corporations to use the majority of their resources to reach their potential for growth in a market that is competitive rather than allowing the government to meddle in the economy. Both the theory of marginal productivity, which holds that the income received by owners of the factors of production is determined by the marginal products of these factors, and the classical theory of the factors of production, which views labour, capital, and land as independent factors of the formation of national product, provided the methodological foundation for their theories. However, criticisms of the neo-Keynesian growth theory were made by neoclassical theorists (UN, 2011). This includes the fact that technological progress is a growth factor that Neo-Keynesians focus on, ignoring other factors like education and skill development. The Neoclassical model, which considers capital and labour interchangeability, allows for a change in capital coefficients. Neo-Keynesians underestimate market mechanisms for automatic rebalancing and oppose inflationary government spending, believing only competitive market systems provide balanced economic growth and stable monetary systems.

D. Endogenous Growth Theory (EGT)

EGT emerged in the 80-90s, reflecting the impact of imperfect competition and the role of possible changes in the profit rate. American economists Paul Romer and Robert Lucas hypothesized about the endogenous character of technological innovations based on investment in technological development and human capital. These theories differ significantly from neoclassical models, as they reject the premise of diminishing marginal productivity of capital, assume the possibility of production scale effect throughout the economy, and often focus on the impact of external effects on the profitability of investments.

In the theories of endogenous growth, technological progress is not the only possible cause of economic growth in the long term. The value of intensive, high-quality determinants of economic growth is defined in the theories of endogenous growth, including the quality of human capital, creation of necessary conditions for the protection of intellectual property rights in imperfect competition, state support for the development of science and technology, and the role of government in creating a favourable investment climate and attracting new technologies.

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The theories of endogenous growth can be divided into two groups: those that include human capital as an important determinant of economic growth, and those that describe the effect of research and development as a key factor of growth. These theories examine the reasons for differences in the growth rates of different countries, the effectiveness of various measures of the state's scientific, technical, and industrial policies, and the impact of the processes of international integration and trade on economic growth. Therefore, this theory states that over an extended period, growth can become self-sustaining due to the growing returns that come from knowledge, innovation, and technological advancements. This change is important for long-term economic growth because it emphasizes how innovation and technology can enhance output without placing an undue strain on finite resources.

III. DIGITAL INFRASTRUCTURE: TECHNOLOGY-DRIVEN INVESTMENTS FOR ECONOMIC DEVELOPMENT

Economic growth is significantly influenced by productivity, especially in emerging areas with enormous modernization and progress opportunities (Surya et al., 2021). In these economies, productivity gains in a variety of industries from manufacturing and agriculture to services and infrastructure are mostly attributed to technology (Matthess & Kunkel, 2020). Therefore, technological innovations have the ability to release these industries' unexploited economic potential, resulting in increased productivity, efficiency, and worldwide competitiveness. In general, investments generated by technology have come to be seen as essential to economic growth, especially in developing and rising nations. These investments include a broad spectrum of activities, including the creation of digital infrastructure and the encouragement of entrepreneurship and innovation in industries like banking, healthcare, education, and agriculture (Du et al., 2022; Lottu et al., 2023). The ability to leverage these investments can greatly increase productivity, create jobs, and promote sustainable economic growth as global economies shift to knowledge-based and technology-driven models.

The development of digital infrastructure, such as data centres, mobile platforms, and broadband networks, is essential to the success of other technology-driven investment initiatives (Javaid et al., 2024). Inadequate infrastructure has impeded economic growth in emerging nations by restricting access to financial services, markets, and education (Hassan et al., 2017). On the other hand, technologically driven investments in digital infrastructure can close this gap and offer a venue for public service delivery, corporate development, and innovation.

In nations like Kenya, India, and Brazil, investments in mobile networks and broadband internet have significantly raised internet penetration rates, allowing consumers to access essential services and businesses to run more smoothly (Nchake & Shuaibu, 2022; Alderete, 2022). Specifically, millions of unbanked people were able to engage in the formal economy in Kenya as a result of the revolutionary transformation of the financial sector, brought about by the mobile money network M-Pesa (Ndung'u, 2021). By facilitating easier access to financial services, this form of technology-driven investment promotes inclusive growth in addition to increasing productivity in the financial industry. Since the new economy, or digital economy, is the term for an economy that utilizes digital computing technologies for economic purposes, certain indices as shown in *Figure 1* can be measured to determine the impact of technology infrastructure investments.

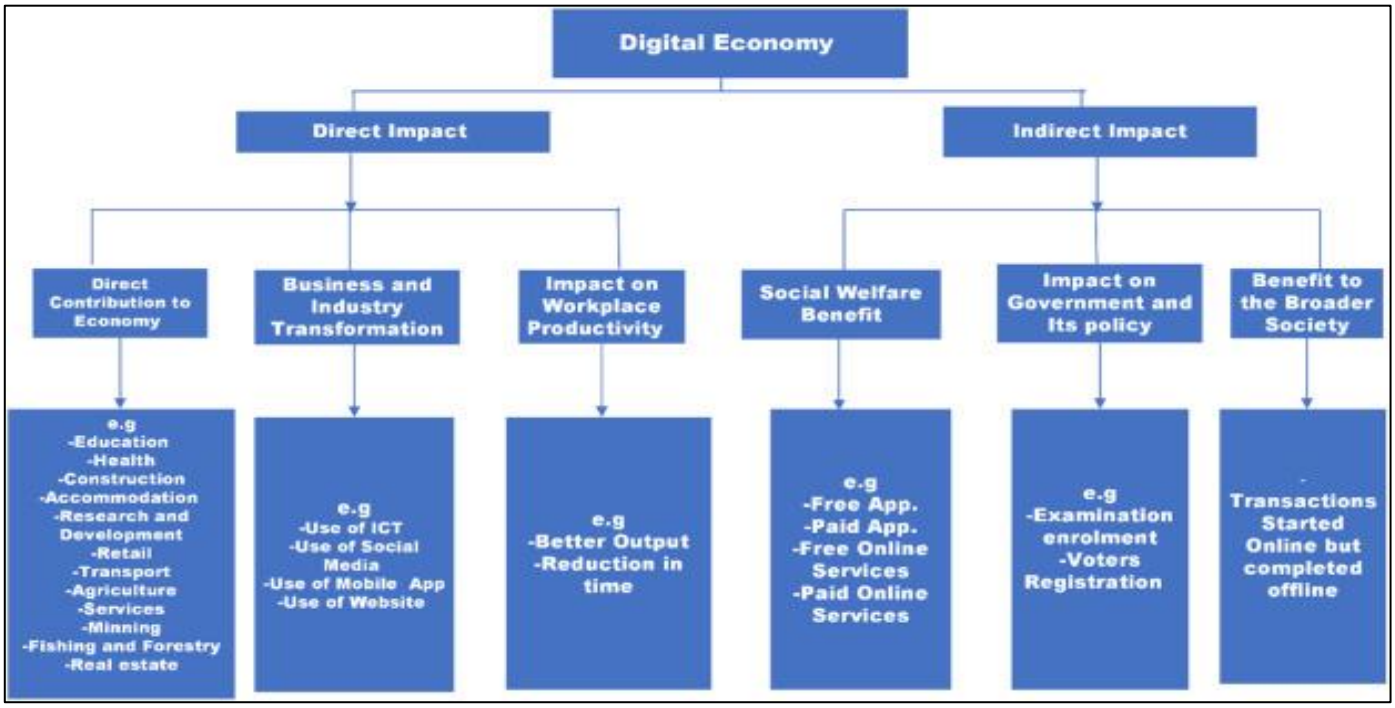

Fig 1: Direct and Indirect Impact Measurements (Oloyede et al., 2023)

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Additionally, numerous research and empirical data support the claim that nations with higher broadband penetration rates typically have faster rates of GDP growth. By enabling firms to run more efficiently, promoting innovation, and facilitating digital transformation, broadband infrastructure acts as a driver for economic development. Strong broadband networks enable nations to take advantage of digital technology to boost economic growth, increase access to markets and information, and increase productivity (Aldashev & Batkeyev, 2021). Furthermore, by giving startups and new enterprises a platform to grow, broadband infrastructure can promote entrepreneurship and the development of jobs. The substantial link between GDP growth and broadband adoption raises the possibility that investment in digital infrastructure is essential to fostering current economic progress.

IV. STRATEGIES FOR ADOPTION OF TECHNOLOGY TO PROMOTE SUSTAINABLE ECONOMIC GROWTH

The Technology Adoption Framework offers a systematic way of comprehending and managing the integration of novel technologies in communities and organizations. This concept is especially pertinent when discussing sustainable economic growth since it makes it easier to recognize and take advantage of the opportunities and problems that may be triggered by technological advancement (Hooks et al., 2022; Hasan, 2023). Investigating the demands and acceptability of individuals is a crucial first step for any organization, as it can guide future development. For this reason, it is important to study the elements that influence users' acceptance or rejection of technologies. Frameworks and models (technology acceptance model, theory of planned behaviour and so on) have been established to describe how users embrace new technologies, and these models include variables that may have an impact on user acceptance (Taherdoost, 2018). Therefore, organizations and societies can maximize the advantages and minimize the hazards of technological change by adhering to the frameworks when making decisions about technology adoption (Roberts et al., 2021). This can foster innovation, increase productivity, and ultimately provide opportunities for individuals and companies, all of which can support sustained economic growth.

Table 1: Essential Features of the Technology-Driven Economic Growth Framework

Feature	Description	Impact	References
Inclusive economic development	Encouraging equitable access to economic opportunities through technology that improves markets, education, and financial resources.	Financial Inclusion: The unbanked can now access financial services through mobile banking and fintech. Education: E-learning platforms make education and skill development more accessible. Growth of micro, small and medium enterprises (MSMEs): Digital tools enable MSMEs to access broader markets and run more effectively.	(Ouma et al., 2017; Elcullada Encarnacion et al., 2021; Hendrawan et al., 2024)
Increasing productivity	Increasing productivity and efficiency by implementing technologies (artificial intelligence, internet of things, and automation)	Agriculture: By maximizing resource use, precision farming raises yields. Manufacturing: AI and automation speed up production and cut waste. Services: Fintech and telemedicine lower expenses and improve accessibility.	
Green technology and environmental sustainability	Promoting economic expansion while limiting negative effects on the environment through the use of sustainable green technologies.	Renewable energy sources: hydropower, wind, and solar lessen reliance on fossil fuels. Energy Efficiency: Electric vehicles, energy-efficient buildings, and smart grids cut energy use. Circular Economy: Recycling and waste minimization contribute to resource optimization.	(Strielkowski et al., 2021; Paraschiv & Paraschiv, 2023)
Innovative concepts and technological environments	Building an environment that encourages ongoing innovation through partnerships between government, businesses, and research institutions.	Research & Development Investment: South Korea and other nations are leaders in this area, which fuels technological innovation. Entrepreneurial Ecosystems: innovative ideas and businesses are fostered by technology hubs such as Silicon Valley.	(Erciş & Ünalan, 2016; Tula et al., 2024)

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Utilizing technology to accelerate economic transformation is based on the core elements of the framework for technology-driven economic growth, which includes infrastructure development, human capital upgrading, innovation ecosystems, and regulatory support. These key components need to be viewed as both urgent solutions and progressive measures that will influence sustainable development in emerging markets. By addressing these pillars strategically, stakeholders may guarantee that technology investments are linked with long-term economic goals, supporting inclusive growth, environmental sustainability, and global competitiveness. Therefore, these pillars should be recognized as crucial aspects in improving sustainable economic growth, serving as the basis for policy design, public-private partnerships, and investment strategies targeted at favourable technology outcomes in emerging economies.

V. GLOBAL CONTEXT AND FUTURE DIRECTIONS

One of the main challenges to technology investment in developing nations is the absence of adequate infrastructure (Hassan et al., 2017; Kala, 2023). Many emerging nations frequently lack basic technological infrastructure, such as digital connectivity, dependable electricity, and broadband internet (Offordile, 2024). This deficiency restricts the possibility of universal technology adoption, which impedes innovation and economic growth.

In addition, the issue of inadequate infrastructure impacts the uptake of fundamental and innovative services, including cloud computing, mobile banking, and e-government platforms (Imbamba & Kimile, 2017; Oloyede et al., 2023). Particularly, this is a major concern as these technologies are essential to public service delivery, financial inclusion, and the growth of small and medium-sized businesses (SMEs) in developing nations (Osabutey & Jackson, 2024; (Mothobi & Kebotsamang 2024). Therefore, populations might remain excluded from the economic prospects presented by technology-driven economies because they lack access to these tools and these challenges are made worse by the global context. Developing nations risk lagging as developed economies continue to adopt more innovative technologies, widening the economic divide worldwide, and consequently rendering them unable to engage significantly in the global economy.

Furthermore, even while there is potential for growth in many nations due to the wide range of investment ratios, the trajectory ahead may not be straightforward and there is not much opportunity for public investment in low-income developing countries to increase (Kararach et al., 2022). Considering that the growth prospects of these economies have deteriorated, external funding conditions have tightened, and public debt levels have increased, the circumstances in which infrastructure investment is made are difficult by these factors. Public investment management institutions in low-income nations are generally poor, and strengthening those institutions could significantly enhance public investment efficiency. Moreover, raising domestic revenue and setting investment priorities may offer more dependable and long-lasting sources of growth (Stamm & Vorisek, 2023). However, foreign direct investment (FDI) in the technology sector can also be impacted by geopolitical factors and global economic uncertainties, such as trade tensions and market volatility (Alharthi M. et al., 2024). Thus Cheng et al., (2024) highlighted that developing economies frequently depend on FDI to build infrastructure and introduce advanced technologies, but political unpredictability, regulatory obstacles, and an uncertain return on investment can discourage investors, resulting in underinvestment in vital technology sectors.

A. Future Directions: Public-Private Partnerships

Public-private partnerships (PPPs) are a viable way to promote more technological investments in developing economies and address likely infrastructural issues. PPPs facilitate cooperation between public and private sector entities in the areas of financing, constructing, and administering technology infrastructure (Kopańska et al., 2024). Subsequently, assisting in bridging the gap between public-sector resources and private-sector innovation by utilizing the assets of both sectors, resulting in more scalable and sustainable investments.

The capacity to pool resources to finance large-scale projects that would be challenging for governments or private investors to undertake independently is one of PPPs' main advantages, as stated by Fabre & Straub (2023). Specifically due to high costs and low demand, building broadband infrastructure in rural or underserved areas may not be immediately lucrative for private corporations. However, by collaborating with governments, businesses can obtain subsidies or incentives that increase the viability of such investments (Schmit & Severson, 2021). In turn, governments also benefit from the knowledge, effectiveness, and innovation provided by private institutions. PPPs in technology investment might be directed towards areas like digital education, smart cities, and green energy in the future. These sectors have the potential for long-term growth, which makes them consistent with the global goals of sustainable development and may result in additional private investment.

VI. CONCLUSION

From this study, effective technological decisions can increase output, improve social inclusion, and support environmental sustainability. For maximum benefit, a comprehensive framework that tackles infrastructural deficiencies as well as one that supports policies, and synchronizes technical improvements with regional economic objectives is necessary. Additionally, for technology adoption to significantly contribute to long-term economic stability and prosperity, governments, the private sector, and international organizations must work together in a coordinated manner.

An important insight is the cruciality of adapting technological investments to specific local contexts. In emerging economies, certain technology adoption strategies frequently fail because of a variety of infrastructure,

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regulatory, and socioeconomic issues. Instead, the influence of technology can be increased by focused plans that concentrate on important industries like energy, healthcare, education, and agriculture when paired with solid public-private partnerships. Therefore, emerging markets may tackle pressing social and environmental concerns and establish themselves as competitive actors in the global digital economy by prioritizing infrastructure, human capital, innovation, and policy assistance.

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