



Geometrical reduction in human productive output in Nigeria as it affects Gross Domestic Products: implication for economic growth and sustainable development

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Abstract

This study investigates the geometrical reduction in human productive output in Nigeria and its implications for economic growth and sustainable development. The primary objectives were to identify the factors contributing to this decline and to explore strategies for enhancing productivity. The hypothesis posited that there is no significant relationship between the lack of relevant skills and training and the geometrical reduction in human productive output. A quantitative research design was employed, utilizing a survey method to collect data from a sample population. The data were presented in descriptive and statistical tables, with frequencies and percentages calculated to illustrate the distribution of responses. A Chi-square test of independence was conducted to analyze the relationship between skills deficits and productivity levels. The results indicated a significant association between a lack of relevant skills and a higher reduction in productivity, with a Chi-square value of 12.371 ($p = 0.002$). The findings underscore the need for targeted interventions to enhance workforce skills, improve infrastructure, and promote health and wellness initiatives. In conclusion, addressing the identified factors is crucial for improving human productive output, which is vital for Nigeria's economic growth and sustainable development. The study recommends implementing comprehensive training programs, investing in infrastructure, and prioritizing health initiatives to foster a more productive workforce.

Key words: Economic Growth, Human Capital, Productivity, Skills, Innovation, Sustainability

Background to the study

Human productive output refers to the quantity and quality of goods and services produced by individuals or groups within a specific timeframe. It encompasses various aspects of productivity, including physical labor, intellectual contributions, and technological advancements that enhance efficiency. Factors influencing human productive output include individual skills, education, motivation, work environment, and available resources (Hernita, Surya, Perwira, Abubakar, & Idris, 2021). In economic contexts, measuring productive output is essential for assessing performance, guiding policy decisions, and driving growth. High levels of productive output not only contribute to economic prosperity but also improve living standards and overall societal well-being.

The geometrical reduction in human productive output represents a significant challenge to Gross Domestic Product (GDP) and broader economic growth, particularly in a global situation. As economies increasingly rely on technology and automation, the ability of human labor to adapt and contribute effectively can diminish. This trend has manifested across developed nations, where advanced technologies have led to efficiency gains but also to concerns over job displacement and reduced workforce participation (Pawlak, & Kołodziejczak, 2020). In these contexts, the challenge lies in balancing automation with the need for a skilled labor force, ensuring that workers can harness new technologies rather than being rendered obsolete. The implications for economic growth are profound; while automation can drive productivity, it also raises questions about income distribution and the potential for increased inequality if displaced workers are not supported.

In developed nations, the geometrical reduction in human productive output often correlates with shifts toward a service-oriented economy, where value is derived less from traditional manufacturing and more from knowledge-based industries. This transformation has necessitated substantial investments in education and retraining programs to equip the workforce with the necessary skills to thrive in a rapidly changing labor market (Leng, Guo, Xie, Zhou, Liu, Gu, & Wang, 2024). However, as GDP grows due



to technological advancements, there remains an ongoing debate about whether such growth translates into equitable economic benefits for all citizens. Without inclusive policies that address the needs of displaced workers, the risk of economic disparity could undermine sustainable growth in these nations. The implications of geometrical reduction in human productive output are particularly pronounced, given the continent's diverse economies and developmental challenges. Many African countries are still heavily reliant on agriculture and informal sectors, where productivity levels are significantly lower than in developed nations (Sadigov, 2022). The shift toward automation and increased mechanization can exacerbate existing inequalities and threaten livelihoods if not approached carefully. Consequently, African nations must prioritize human capital development, focusing on education, skills training, and the promotion of entrepreneurship to mitigate the adverse effects of reduced labor output (Asongu, & Tchamyou, 2020). By fostering an environment conducive to innovation and technological adoption, these countries can leverage their demographic advantages to enhance productivity while working towards sustainable development goals.

The challenges posed by geometrical reduction in human productive output are evident in the context of its struggling economy. Despite having a young and growing population, Nigeria faces issues such as inadequate infrastructure, limited access to quality education, and high unemployment rates (Lena, Pasurka, & Cucculelli, 2022). The country must address these barriers to enhance human productivity, which is critical for increasing GDP and fostering economic growth. Moreover, as Nigeria seeks to diversify its economy away from oil dependence, there is an urgent need to invest in sectors such as technology and agriculture, promoting sustainable practices that can drive long-term development. By addressing the geometrical reduction in human productive output through targeted policies, Nigeria can create a resilient economy that supports both growth and sustainability for its future generations.

Statement of the problem

Factors such as limited access to quality education and vocational training contribute to a workforce that is inadequately equipped to meet the demands of a rapidly evolving global economy. Additionally, high unemployment rates, particularly among the youth, exacerbate economic instability and social unrest (Tri, 2022). Inefficient labor practices, poor infrastructure, and a predominant reliance on the informal sector further hinder productivity, preventing the realization of Nigeria's economic potential. This situation is compounded by issues such as brain drain, political instability, and widespread corruption, which create an environment that discourages investment and innovation, ultimately limiting productive output across various sectors.

The challenges facing Nigeria are deepened by inadequate technological adoption and a lack of support for innovation, which stifles productivity improvements and economic diversification. Health issues, including widespread diseases and inadequate healthcare access, reduce workforce productivity and increase absenteeism, further impacting economic output (Akeredolu, 2024). Environmental challenges such as land degradation and pollution also threaten agricultural productivity, a vital sector for the Nigerian economy. Coupled with socioeconomic inequalities that restrict access to resources and opportunities, the cumulative effect of these issues results in stagnation of GDP growth and undermines sustainable development efforts. Addressing these multifaceted problems is crucial for enhancing human productive output and fostering a resilient economy capable of supporting long-term growth and sustainability in Nigeria.

Literature review

Factors contributing to the geometrical reduction in human productive output

The geometrical reduction in human productive output has been a subject of extensive research, particularly in relation to its implications for economic growth. A significant factor is the quality of education and skills training available to the workforce. Studies have shown that limited access to quality education hampers the development of essential skills necessary for modern labor markets (George, 2024). In Nigeria, where a large portion of the population is youth, the mismatch between educational outcomes and labor market needs exacerbates unemployment rates and underemployment (Kayode, 2023). Furthermore, research by Indrawati, & Kuncoro, (2021) highlights the importance of vocational training programs in enhancing workforce skills, suggesting that inadequate vocational training contributes to a diminished productive output. This underscores the need for educational



reforms that align with industry requirements to foster a more productive workforce (Tangban, & Udousoro, 2025).

Another critical factor affecting human productive output is the state of infrastructure, which directly influences economic activities. Poor infrastructure, including unreliable electricity, transportation, and communication systems, creates significant barriers to productivity (Kaiser, & Barstow, 2022). In Nigeria, infrastructural deficiencies lead to increased operational costs for businesses and reduced efficiency in production processes, ultimately impacting GDP growth (Nnyanzi, Kavuma, Sseruyange, & Nanyiti, 2022). Studies by Magazzino, & Mele, (2021) indicate that investments in infrastructure can yield substantial returns in terms of increased productivity and economic development. Therefore, addressing infrastructural challenges is essential for improving human productive output and facilitating sustainable economic growth.

Health issues also play a pivotal role in the geometrical reduction of human productive output. Research by Bryan, Bryce, & Roberts, (2021) has shown that widespread health problems, including communicable diseases and inadequate healthcare access, can lead to decreased workforce productivity and increased absenteeism. In Nigeria, where health challenges are prevalent, the economic impact of poor health outcomes is significant, as it reduces the effective labor force and places a strain on healthcare resources (Modibbo, & Inuwa, 2020). Additionally, the interplay between health and productivity is complex, with evidence suggesting that healthier workers tend to be more productive and engaged. Consequently, improving healthcare access and addressing public health concerns are critical for enhancing human productive output and ensuring long-term economic sustainability in Nigeria.

Strategies for enhancing human productive output

Enhancing human productive output is crucial for driving economic growth, particularly in developing countries like Nigeria. One of the foremost strategies involves reforming the educational system to better align with labor market demands (Okunade, Alimi, & Olayiwola, 2022). Research by Alainati, (2021) indicates that implementing competency-based education and vocational training programs can significantly boost employability and productivity among the workforce. By focusing on practical skills and industry-specific knowledge, educational institutions can produce graduates who are better equipped to meet the needs of employers (Singh, & Blessinger, 2024). Furthermore, partnerships between educational institutions and businesses can facilitate internships and apprenticeships, allowing students to gain hands-on experience while also benefiting employers through access to a skilled labor pool (Aithal, & Mishra, 2024). Such collaborative efforts are vital in bridging the skills gap and enhancing overall productive output.

In addition to educational reforms, investing in technology adoption is essential for improving productivity. The integration of modern technologies, such as automation and information technology, can streamline processes and enhance efficiency across various sectors (Boina, Achanta, & Mandvikar, 2023). Studies show that businesses that embrace technological advancements experience increased productivity and competitiveness in the global market (Alliou, & Mourdi, 2023). In Nigeria, fostering a culture of innovation and providing support for startups and small enterprises to adopt new technologies can drive significant improvements in human productive output (Ekechi, Chukwurah, Oyeniya, & Okeke, 2024). Policymakers are encouraged to create conducive environments that promote research and development initiatives, which can lead to innovative solutions that enhance productivity in both agricultural and industrial sectors (Enamhe, Tangban, & Udousoro, 2025).

Addressing health and wellness within the workforce is another critical strategy for enhancing human productive output. Research has consistently demonstrated that healthier workers are more productive and engaged in their roles (Chanana, & Sangeeta, 2021). Implementing workplace wellness programs that promote healthy lifestyles, mental health support, and access to healthcare can lead to improved productivity outcomes (Baid, Hayles, & Finkelstein, 2021). Furthermore, ensuring that workers have access to adequate healthcare services can reduce absenteeism and improve overall morale, resulting in a more motivated workforce. By prioritizing health and well-being, organizations can create an environment that fosters productivity and contributes to sustainable economic growth (World Health Organization, 2024).

Material and methods

Nigeria, lies in West Africa, a dynamic and multifaceted nation that shares borders with Benin to the west, Niger to the north, Chad to the northeast, and Cameroon to the east. Its southern coastline stretches along the Atlantic Ocean in the Gulf of Guinea (John, 2022). Nigeria, the most populous nation in

Africa, is a linguistic, cultural, and traditional melting pot that covers an area of over 923,769 square kilometres. The geography is equally diverse, with broad savannas in the centre, dense tropical rainforests in the south, desert terrains in the north, and rich mangrove forests near the coast. Nigeria is home to rich agricultural techniques because of its tropical environment, which brings with it distinct wet and dry seasons (Masood, He, Shah, & Rehman, 2024). The rainy season usually lasts from May to October, while the dry season lasts from November to April. Growing staple crops like cassava, yams and maize is how many Nigerians make a living, and the nation's wealth of natural resources particularly oil and gas are vital to its economy. Trade, services, and telecommunications have all exploded in recent years, demonstrating Nigeria's dynamism and fortitude in the face of adversity (Folarin, 2024).

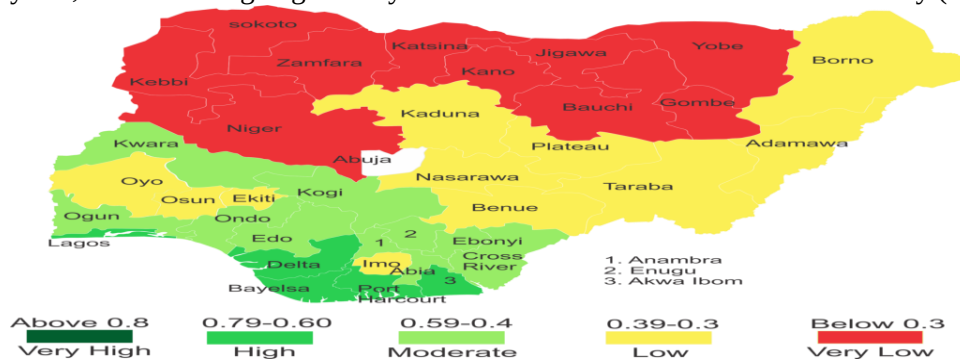


FIG. 1: Map showing human development index in Nigeria

Source: CSEA Africa

The research design for this study employed a mixed-methods approach, combining quantitative and qualitative methodologies to provide an understanding of the factors affecting productive output. The population of the study consisted of individuals across various sectors, including education, healthcare, and industry, with a focus on urban and rural workers in Nigeria. Data collection methods included structured surveys distributed to a representative sample of the population to capture diverse perspectives on the challenges and strategies for enhancing productivity. Quantitative data were analyzed using statistical techniques, such as descriptive statistics and regression analysis, to identify relationships between factors contributing to reduced productive output and GDP.

Results and discussions

The data presented in Figure 1 presents several reasons contributing to the decline in human productive output. The most significant factor identified is health-related challenges, which accounted for 27.9% of respondents. This indicates a strong recognition of the impact that health issues, including both physical and mental health, have on productivity levels. When workers face health problems, their ability to perform tasks efficiently diminishes, leading to decreased output. Additionally, the category of low motivation and morale was noted by 26.3% of respondents, emphasizing that psychological factors play a crucial role in productivity. When employees feel unmotivated or disheartened, their engagement and performance inevitably suffer, further exacerbating productivity declines. Meanwhile, 25.3% of respondents pointed to a lack of relevant skills and training, suggesting that insufficient preparation for job requirements significantly hampers worker effectiveness. Lastly, poor infrastructure, noted by 20.6% of participants, reveals how inadequate facilities and resources can create barriers to optimal productivity, impacting both efficiency and job satisfaction.

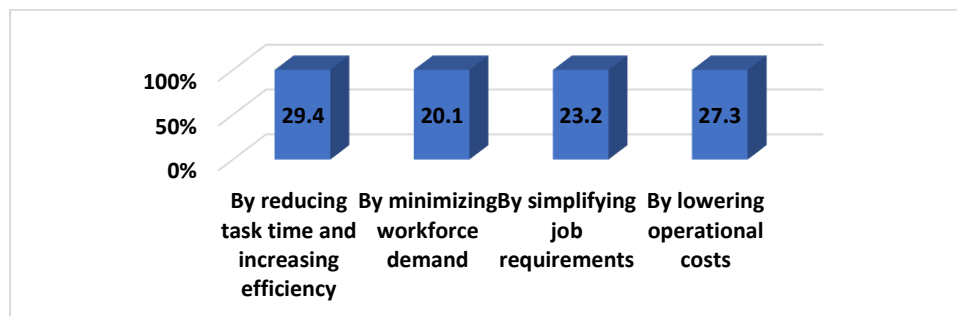


Figure 1: Reason for decline in human productive output

Source: Author's Fieldwork, 2024.

Figure 2 sheds light on the factors that respondents believe most significantly impact productivity in Nigeria. Among these, health issues emerged as the leading concern, with 27.9% of respondents highlighting its importance. This finding aligns with the previous insights regarding health-related challenges, reinforcing the notion that addressing health concerns is paramount for improving productivity levels in the country. Inadequate education and training, cited by 26.8% of respondents, underscores the critical need for a workforce equipped with relevant skills to meet the demands of a rapidly evolving job market. When education does not align with industry needs, productivity is likely to decline. Economic instability was identified by 24.2% of participants as another significant factor, indicating that financial uncertainties can create an environment of insecurity, ultimately affecting worker performance and productivity. Finally, poor workplace conditions were noted by 21.1% of respondents, pointing to the physical environment in which work occurs as a vital component that can either facilitate or hinder productivity.

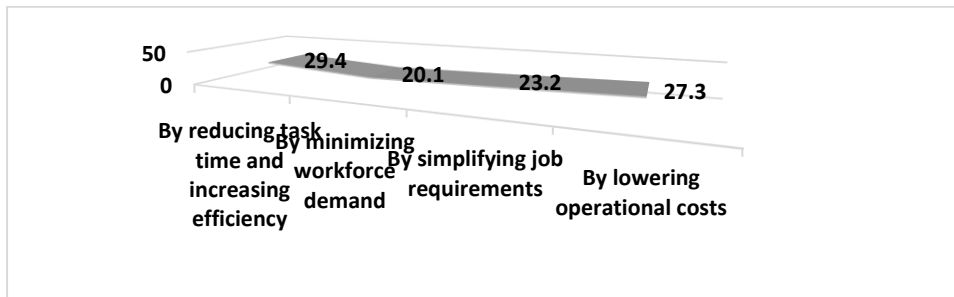


Figure 2: Factor believed to have significant impact on reducing productivity in Nigeria

Source: Author's Fieldwork, 2024.

The findings in Figure 3 focus on the strategies perceived to be most effective for enhancing productivity. Improved training programs topped the list, with 28.4% of respondents supporting this approach. This suggests a consensus on the importance of equipping workers with the necessary skills and knowledge to perform their jobs effectively. Tailored training programs can directly address the skills gap identified in previous figures, ensuring that employees are not only aware of best practices but also adept at utilizing the tools and technologies available to them. Following closely, 25.8% of respondents pointed to technological advancements as a key strategy, highlighting the potential of technology to streamline processes and enhance efficiency in the workplace. Infrastructure development received 25.3% of the responses, indicating that improvements in facilities and resources are crucial for creating a conducive working environment. Interestingly, health and wellness initiatives were noted by 20.6% of respondents, underscoring the need for a holistic approach that considers both the physical and mental well-being of employees as vital to enhancing productivity.

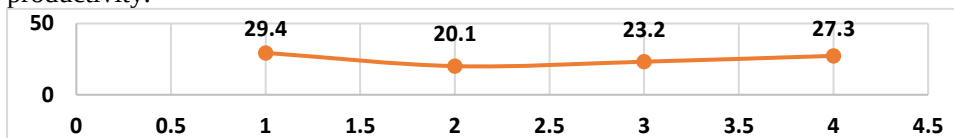


Figure 3: Effective strategy in enhancing productivity

Source: Author's Fieldwork, 2024.

In Figure 4, the data illustrates how the adoption of new technologies can lead to improvements in human productive output. The most frequently mentioned benefit, cited by 29.4% of respondents, is the reduction in task time and increased efficiency that technology can facilitate. This finding highlights the transformative power of technology in enabling workers to accomplish tasks more quickly and effectively, thereby maximizing output. Additionally, 27.3% of participants noted that lowering operational costs through technology is a significant advantage, allowing businesses to allocate resources more effectively and potentially reinvest in other productivity-enhancing initiatives. The ability to simplify job requirements was mentioned by 23.2% of respondents, indicating that technology can streamline processes and reduce the complexity of tasks, making them more manageable for employees. However, 20.1% of respondents believed that minimizing workforce demand is a concern, suggesting that while technology can enhance efficiency, it may also lead to reduced job opportunities.

if not managed carefully. Overall, the data emphasizes the importance of strategic technology adoption in driving productivity improvements while balancing workforce dynamics.

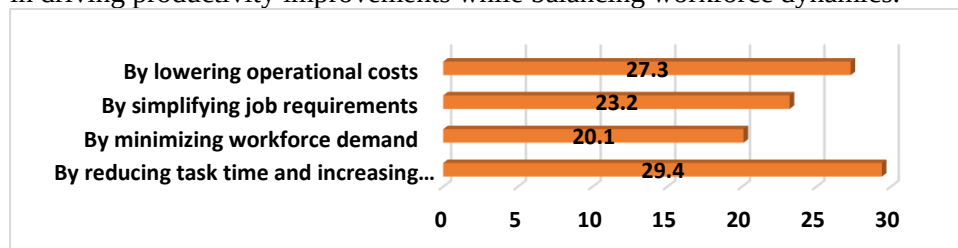


Figure 4: Improvement of human productive output through adoption of new technologies

Source: Author's Fieldwork, 2024.

Hypotheses testing

H₀: There is no significant relationship between the lack of relevant skills and training and the geometrical reduction in human productive output in Nigeria.

Table 1 provides an overview of the variables analyzed in the study. Lack of Relevant Skills is a nominal variable with two categories: Present and Not Present. Reduction in Productive Output is an ordinal variable categorized as High, Moderate, or Low. Table 2 presents the cross-tabulation of these variables, showing the distribution of productive output levels across individuals with and without a skills deficit. Among those with a skills deficit, the majority (58) report a high reduction in productivity, while those without the deficit show a higher frequency of low reduction (62). Table 3 displays the results of the Chi-square test of independence, with a Pearson Chi-square value of 12.371 (df = 2, p = 0.002). The p-value, being below the 0.05 threshold, indicates a significant association between the presence of relevant skills and the reduction in productive output, suggesting that a lack of relevant skills is statistically related to a higher reduction in productivity.

Table 1: Variables

Variable	Type	Categories
Lack of Relevant Skills	Nominal	Present, Not Present
Reduction in Productive Output	Ordinal/Categorical	High, Moderate, Low

Table 2: Cross-tabulation of Variables: Lack of Relevant Skills and Training vs. Reduction in Productive Output

Reduction in Productive Output	Present (Skills Deficit)	Not Present	Total
High	58	49	107
Moderate	47	54	101
Low	33	62	95
Total	138	165	303

Table 3: Chi-square Test of Independence

Test	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	12.371	2	0.002
Likelihood Ratio	11.918	2	0.003
Linear-by-Linear Assoc.	10.251	1	0.001

The Chi-square test of independence yielded a Chi-square value of 12.371, with 2 degrees of freedom and a p-value of 0.002. Since the p-value is less than the standard significance level of 0.05, the null hypothesis was rejected. This indicates that there is a statistically significant relationship between the lack of relevant skills and training and the geometrical reduction in human productive output in Nigeria.

Conclusion

This study has demonstrated that the lack of relevant skills and training significantly contributes to the reduction in human productive output in Nigeria. The findings highlight that a skills deficit is closely associated with higher levels of productivity loss, impacting overall economic growth and sustainable development. By identifying poor training, inadequate infrastructure, and health-related challenges as core factors affecting productivity, the study emphasizes the urgent need for targeted interventions to enhance workforce skills, improve health and workplace conditions, and foster motivational initiatives. Addressing these issues could lead to substantial improvements in productivity, benefiting Nigeria's economic growth and advancing sustainable development objectives.



Recommendations

To address the issues identified in the study, it is recommended that the Nigerian government and relevant stakeholders implement training programs aimed at equipping the workforce with relevant skills tailored to the current job market demands. Additionally, there should be an investment in improving infrastructure, such as transportation and technology access, to create conducive working environments that facilitate productivity. Furthermore, health and wellness initiatives should be prioritized to address health-related challenges affecting the workforce, including regular health check-ups and promoting a healthy work-life balance, which will ultimately enhance employee motivation and morale, leading to increased human productive output.

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