

Technological Innovation on Corporate Sustainability: A Study of Airtel Nigeria

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Abstract

When assessing the modern strength of business enterprises, organizational sustainability and the state of technical innovation are becoming increasingly important considerations. As a result, the research looks at how technological innovation affects organizational sustainability, specifically mentioning Airtel Network Nigeria in Ilorin, Kwara State. The study's precise goals were to investigate how product innovation affects environmental sustainability, how process innovation affects economic sustainability, and how marketing innovation affects social sustainability. The study utilized a descriptive research design and employed a simple random sampling approach to randomly choose 103 employees from a population of 140 working at Airtel Network Nigeria in Ilorin, Kwara State. The sample size was determined using the Taro Yamane formula. A structured questionnaire was employed, and SmartPLS version 3 was utilized for analysis. PLS Algorithm and bootstrapping were used to test hypotheses at the 0.05 significant level. The results showed that there is a significant positive correlation (R² value of 42.8%) between environmental sustainability and product innovation; an even stronger correlation (R² value of 32.6%) exists between economic sustainability and process innovation; and an even stronger correlation (R² value of 40.5%) exists between social sustainability and marketing innovation. As a result, the study highlights technological innovation has a very favorable effect on business sustainability. The study's conclusions lead to several recommendations: Airtel Network Nigeria and other telecom firms improve their product innovations to account for new goods or services to open up new markets or attract existing ones. Additionally, it recommends that they take into account innovative organizational methods, distinctive inputs that produce novel outputs, and a variety of organizational techniques.

1. Introduction

An increasing number of firms in the twenty-first century are facing the challenge of becoming smarter, more efficient, and more sustainable as the corporate environment changes dynamically throughout time. Singh (2022) claims that this has compelled today's commercial enterprises to pursue corporate sustainability. Meanwhile, technological innovation seems to be receiving more attention as a trustworthy and successful strategy for advancing sustainability principles in the corporate setting. Business companies in the twenty-first century must strive for the greatest outcomes to thrive in the dynamic business environment (Chovancová et al., 2023). In actuality, new advances in creativity and invention typically occur on a daily basis. As such, the importance of

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organizational sustainability and the state of technical innovation are increasingly being considered when assessing the modern-day viability of economic enterprises.

It is certain that things change in the world and that technology advances, impacting human behavior and interaction in all its forms. Technology has virtually infiltrated every aspect of our lives, including our jobs and personal lives. Sustainability is, therefore, a goal for every company hoping to survive in the global market, as it has lately emerged as a prominent trend in both public and private sector companies. Technology serves as a precursor to significant transformations in the fundamental structure of organizations and the nature of work itself. As noted by Chege and Wang (2020), the impact of technological advancements is profound and far-reaching. This sentiment is echoed by Vacchi et al. (2021), who argue that the pace of technological change is accelerating, highlighting the transformative potential of these shifts. Various factors are driving the current wave of technological innovation. According to Vargas-Hernández et al. (2023), two of the most critical factors are the sustainability of business practices and humanity's remarkable ability to innovate and adapt to its environment.

Information and communication technology (ICT) product organizers and transmitters have long been a part of Nigeria's telecommunications industry, to which Airtel Nigeria Network belongs. Mass media has unavoidably drawn a great deal of public attention because of them. Nonetheless, the fierce rivalry in the telecommunications sector of the service industry ensures it is much harder for businesses to survive over the long term (Hinmikaiye, Awodele, & Akinsola, 2021). The future will continue to speed up technological progress in our high-tech, rapidly changing modern society. Productivity inside a company is contingent upon the effective integration of suitable technologies. Thanks to technological improvements, firms have undergone a full restructuring as their business operations have become more efficient and seamless than before (Amadasun et al., 2021).

In general, technical innovation deals with the modification and/or enhancement of a product's and/or process's functional features that make a substantial difference from the previous version. According to Maneejuk and Yamaka (2020), technological innovation has been proven to be a helpful instrument in offering many advantages in the telecommunications industry as well as other service sectors. Developing sustainable technologies that enable businesses to adapt to the demands of the massive marketplace and giving control over several service systems are two additional advantages of technological innovation, according to other writers (Bello et al., 2022). Though the industry offers many advantages and success stories, the dynamics of the market and the rapid evolution of technology, especially in the global ICT sector, provide challenges. In several literary works, service innovation and business sustainability at Airtel Nigeria Ltd. continue to be contentious issues. The research looks at how technological innovation affects Airtel Nigeria Network Ltd.'s business sustainability in Ilorin, Kwara state.

The Nigerian information and communication technology sector, or "tech sector," happens to be the fastest developing. Notwithstanding the virus coronavirus epidemic, 15% of the 2020 GDP was contributed by the sector, which makes agriculture the only sector ahead of it. Regrettably, international competitors like Verizon Wireless and American Telephone and Telegraph proved to be formidable foes for Nigerian telecom companies. The continual escalation of network faults in Nigeria has rendered local telecom businesses unable to compete with their global counterparts in terms of product quality sustainability. This is also visible in other areas of marketing capacities. According to Amadasun, Short, and Crosbie (2020), the majority of international businesses use strategic plans as part of their toolkit to break into and maintain their place in the global market, something that local Nigerian providers of networks and the internet often lack. Multinational corporations are thriving as a consequence, while local industries are performing worse.

Still, this industry has been identified as a driver of job creation, a source of wealth, and a barrier to sustainable development. However, many telecom companies find it difficult to embrace ecologically desirable technologies because of current environmental issues in Nigeria, including the country's diminishing money value and ongoing market inflation. For instance, Okocha (2023) noted that over the past 20 years, there has been an increase in Nigeria's awareness of environmental degradation and the alternative solutions accessible to businesses to reduce their environmental impact, with technology being primarily viewed as the most desirable but pricy option. Numerous empirical research supports the concept that technology is the greatest option for organizational sustainability. But as a result of the many environmental issues that have arisen since the 1990s, internal conflicts were unavoidably raised, which pushed the companies to develop internal innovation, technology improvisation, and non-technology driven processes.

Thus, the study's purpose is to ascertain how technological innovation (TI) affects Airtel Nigeria Network Ltd.'s corporate sustainability (CS) in Ilorin, Kwara state.

The main objective of the study is to examine the impact of technological innovation on corporate sustainability. The specific objectives of the study are to:

- i. Examine the effect of product innovation on the environmental sustainability of Airtel Nigeria.
- ii. determine the influence of process innovation on the economic sustainability of Airtel Nigeria.
- iii. examine the impact of marketing innovation on the social sustainability of Airtel Nigeria.

2. Literature Review

2.1 Technological Innovation

A broader interpretation of innovation extends to technological innovation, which involves the application of concepts in practical scenarios to generate novel products or services, or to improve existing ones. Innovators often introduce more efficient goods, processes, services, technologies, artistic creations, or business models to consumers, governments, and society as a whole. Opazo-Basáez et al. (2021) differentiate between invention and innovation, emphasizing that while invention refers to creating something new, innovation involves successfully implementing and utilizing these novel ideas in the marketplace or society.

Particularly when it comes to the development of inventions and their dissemination, technology is a potent catalyst for innovation. Technology is inherently scalable, with a steady tendency toward new breakthroughs emerging from the improvement of existing ones. Product life cycles illustrate how economic returns move through phases of rapid exponential development and ultimate stabilization, which encourages companies to use technology to develop novel ideas (Blichfeldt & Faullant, 2021).

However, technical innovation does not encompass the entire organization's business strategy; rather, it concentrates on product or service elements related to technology. Vitaly, innovation is not only a product of technology. Technological innovation deals with how firms ready themselves to explore new innovation questions and enhance market competitiveness. "Technological innovation" is a better term to use than "technology innovation." Working on technology for its own sake is what is meant to be understood by "technology innovation" (Yankovoy, 2023).

"Technological innovation" more accurately captures the business idea of increasing corporate value via technology improvements to products or services. Furthermore, the bulk of products do not possess stand-alone technology. The product or service is successful because of its integration, combination, and interaction of several components. The goal of technical innovation is to make a product better or to provide a novel product and/or process that has novel tech features that differentiate it from substitutes. During its market emergence, it assumes an innovative form and provides advantages to the relevant firm as well as the broader public (Plinta & Radwan, 2023).

2.2 Dimensions of Technological Innovation

2.2.1 Product Innovation

Product innovation refers to the development of new or significantly improved goods or services that offer enhanced features, functionalities, or performance. This concept is vital in a rapidly evolving technological landscape as organizations strive to meet changing consumer demands and preferences. For instance, advancements in artificial intelligence and machine learning have led to the creation of smarter products, such as AI-driven personal assistants and smart home devices, which provide convenience and efficiency. Companies like Apple and Tesla exemplify product innovation by continually releasing updated versions of their products that incorporate cutting-edge technology (Keskin et al., 2020).

2.2.2 Process Innovation

Process innovation involves the implementation of new or significantly improved production or delivery methods. This can include techniques, equipment, or software changes that enhance efficiency, reduce costs, or improve quality. Process innovation is crucial for organizations aiming to optimize their operations in the context of technological innovation. For example, the adoption of automation and robotics in manufacturing has transformed traditional production lines, allowing for higher precision and faster output. Companies that embrace process innovation can achieve competitive advantages by streamlining operations and responding more swiftly to market changes (Wang et al., 2021).

2.2.3 Market Innovation

Market innovation refers to introducing new marketing methods that significantly change how products or services are promoted, priced, or distributed. This can include novel approaches to customer engagement, sales strategies, or market segmentation. With the rise of digital marketing and social media, businesses can now reach target audiences more effectively and efficiently than ever before. For instance, companies leveraging data analytics to understand consumer behavior can tailor their marketing strategies to enhance customer experiences and drive sales. As a result, market innovation plays a critical role in shaping how organizations connect with consumers and respond to market dynamics (Susiati et al., 2023).

2.3 Corporate Sustainability

Corporate sustainability aims to create enduring value for stakeholders by integrating ethical values, cultural values, social and economic considerations, and environmental considerations into business operations and strategies. The objective is to ensure the organization's long-term viability while contributing positively to society and the environment. The solutions developed aim to promote longevity, openness, and appropriate staff growth in corporate settings.

Although they are not the same, business sustainability and corporate social responsibility (CSR) are sometimes conflated. According to Shahzad et al. (2021), the concept of "time" distinguishes sustainability from corporate social responsibility and other related ideas. Sustainability requires companies to make intertemporal trade-offs to protect intergenerational justice, whereas ethics, morality, and standards are ingrained in CSR. The antithesis of sustainability is short-termism (Shahzad et al., 2021).

While environmental protection is a fundamental component of corporate sustainability, it is not the only one. It is considered sustainable when a firm aligns itself with societal and environmental goals instead of working against them (Liang et al., 2020).

2.4 Dimensions of Corporate Sustainability

2.4.1 Environmental Sustainability

Environmental sustainability refers to the responsible management of resources and the ecosystem to preserve natural resources for future generations. In the context of technological innovation, this concept emphasizes the development of technologies that minimize environmental impact, such as renewable energy sources, waste reduction systems, and sustainable materials. Innovations like solar panels, electric vehicles, and biodegradable products illustrate how technology can reduce carbon footprints and promote a circular economy. Companies that prioritize environmental sustainability comply with regulations and appeal to a growing segment of environmentally conscious consumers (Geissdoerfer et al., 2018).

2.4.2 Economic Sustainability

Economic sustainability focuses on the ability of an economy to support a defined level of economic production indefinitely. Technological innovation plays a crucial role in enhancing economic sustainability by increasing productivity, creating jobs, and fostering economic growth. For instance, automation and artificial intelligence advancements can lead to more efficient production processes, reducing costs and increasing output. Additionally, the development of new markets and industries, such as the green technology sector, can create employment opportunities while addressing environmental challenges. By investing in sustainable technologies, businesses can ensure long-term profitability and resilience in an ever-changing economic landscape (Dahlstrom, 2019).

2.4.3 Social Sustainability

Social sustainability emphasizes the importance of social equity, community development, and overall quality of life in the context of technological innovation. This concept involves ensuring that technological advancements benefit all segments of society, particularly marginalized groups. Innovations in technology can enhance social sustainability through improved access to education, healthcare, and information. For example, telemedicine and online learning platforms have made essential services more accessible, especially in underserved areas. Moreover, companies that prioritize social sustainability often engage in corporate social responsibility (CSR) initiatives, fostering a positive relationship with communities and contributing to social well-being (Brammer & Millington, 2020).

2.5 Product Innovation and Environmental Sustainability

Guthrie Georgina (2021) Alterations that enrich the capability, usefulness, impression, appearance, design, resources, as well as experience of those that use it are product innovations (PI). An enrichment might look ethereal (software/services) or tangible. PI is a more visible kind of innovation for the customer and is associated with improving an organization's previous goods, developing new products based on cutting-edge technology, or meeting unmet customer requirements. Products like computers, cell phones, watches, cars, and so forth are examples of innovative products. PI deals with development as well as launching a brand-novel product or cogent improvement on existing products. It deals with modified parts, materials, and other creative, creative-friendly features.

PI is the cornerstone of the remarkable commercial triumphs that companies such as Apple and Tesla witnessed. It is imperative for every business to grasp the significance of soliciting customer feedback and to understand why their opinions are highly valued by the company. Leveraging consumer insights on a product

serves as a valuable instrument for businesses seeking to innovate. This fosters PI and provides the business with invaluable insights into enhancing the quality of its goods. Businesses listen to and gather input from their customers in order to ensure innovation, enhance their goods and services, and provide innovations that address customer needs. Gaining insight into the perspectives of customers through their feedback guarantees that they receive the finest services possible, resulting in increased customer satisfaction (Georgina Guthrie, 2021).

The process of sustaining advancement out of jeopardizing future settings relates to environmental sustainability (ES). The planet's resources mustn't be reduced by material misuse, tech-development, infrastructural improvement, or many various kinds of changes. Conversely, present materials extraction has led to a planetary emergency. Internationally, environmental considerations continue to mount. Every day, many firms provide you with innovative goods and services that simplify life. Despite the fact that these businesses derive some of their resources from nature, their primary focus is on financial matters such as earnings, market value, turnover, and shareholder value. The government is left to handle ecological issues (Damico, Aulicino, & Pasquale, 2022).

The product is environmentally relevant due to its packaging and other elements that have an impact on the environment. Thus, the first hypothesis was developed:

H01: Product innovation has a significant effect on the environmental sustainability of Airtel Nigeria.

2.6 Process Innovation and Economic Sustainability

Mary and Pratt (2015) define process innovation as the integration of new technologies or methodologies to meet consumer demands and sustain a company's competitive advantage. This occurs when novel solutions are devised for existing challenges or when conventional business procedures are executed to yield significant benefits for the stakeholders involved. Examples of process innovation include the incorporation of new steps into a manufacturing process to double output while reducing costs and time. In contemporary business practices, organizations frequently leverage new information technologies or discover innovative ways to maximize the efficiency of existing ones in their pursuit of process innovation.

The value generated by process innovation can be directed towards both external and internal stakeholders. External beneficiaries may include business partners, end users, or consumers, while internal beneficiaries could be employees or the organization itself. Noteworthy advantages of process innovation encompass faster task completion, increased productivity, cost reduction, and enhanced quality of goods or services. A meaningful process innovation is typically characterized by a significant improvement in key performance indicators (KPIs) (Mary & Pratt, 2015).

Regarding sustainability, firms often perceive themselves as secure, with profitability being a crucial factor. However, it's important to note that economic success should not come at the expense of other sustainability pillars. The economic aspect encompasses activities such as governance, risk management, and compliance, which are considered standard operating procedures for many North American corporations but may vary across different businesses. Effective corporate governance, sometimes referred to as the "governance pillar," ensures alignment of interests between shareholders, value chains, end users, and the community with those of the company's boards of directors and management.

Investors are keen on understanding a company's transparent accounting practices, shareholder involvement in major decisions, adherence to ethical standards, preventing conflicts of interest in board appointments, and avoiding utilizing political donations for preferential treatment (Jabnoun, 2019).

Process innovation is important because it lowers the organization's economic costs by getting rid of pointless service procedures that raise costs and make manufacturing more efficient. Thus, the second hypothesis was developed:

H02: Process innovation has a significant influence on the economic sustainability of Airtel Nigeria.

2.7 Marketing Innovation and Social Sustainability

When a new marketing strategy is implemented, the marketing mix—which includes product design or packaging, distribution, communication, and pricing—must be significantly altered. This is known as marketing innovation. Its goals are to increase competitive advantage and provide value to the consumers. Marketing innovations are pivotal for enhancing a company's sales by effectively addressing client needs, exploring new markets, or repositioning products. What distinguishes a marketing innovation from other adjustments to marketing tools is the adoption of a previously unused marketing strategy, constituting a novel component within the company's marketing approach. This innovative strategy may be internally developed or borrowed from other entities but must notably diverge from the company's current marketing techniques. Both new and existing products benefit from implementing innovative marketing strategies (D'Attoma & Ieva, 2020).

Social license, a concept closely linked to social sustainability, refers to the community's endorsement and acceptance of a sustainable business and its stakeholders and employees. Various strategies can be employed to garner and maintain this support, primarily revolving around fair treatment of staff and active engagement as a

responsible community member on local and global scales. Businesses increasingly prioritize employee retention and engagement through initiatives such as flexible scheduling, enhanced parental leave policies, and opportunities for professional development.

Community involvement strategies range from sponsorship and fundraising to scholarships and investments in local public initiatives. Practices aimed at advancing the health, safety, and well-being of workers, clients, and communities collectively contribute to social sustainability. According to Stankevičiūtė and Stankienė (2018), this encompasses fostering a robust safety culture, providing consumers with necessary product information for safe usage, and ensuring access to essential resources.

Innovation in marketing is essential because it makes it easier to leverage businesses' social connections with their clients, boosting sales growth. Thus, the third hypothesis was developed:

H03: There is a significant impact of marketing innovation on the social sustainability of Airtel Nigeria.

2.8 Theoretical Review

Since technological innovation and organizational sustainability are strongly intertwined, this study incorporated Everett Roger's (2003) Theory of Innovation Diffusion. According to this belief, in order for a business to survive, a person or organization must embrace new concepts or offerings. Within a social framework, the acceptance of novel concepts or products unfolds gradually, with some individuals showing a greater propensity to embrace the innovation than others. According to Rogers' theory of innovation diffusion, when new technology is progressively adopted by consumer groups (shown in blue), its market share (yellow) will finally achieve saturation. There are segments of adopters on the blue curve.

Rogers outlines five key elements that contribute to the dissemination of a new concept: the innovation itself, adopters, communication channels, time, and social structure. The social capital inherent in this process is paramount, as universal acceptance is necessary for sustained innovation. Critical mass is reached within the adoption curve at a certain point, a transition theorized by Geoffrey Moore in his 1991 book "Crossing the Chasm" as the shift from early adopters to early majorities. The term "the chasm" refers to this transitional phase between widespread (self-sustaining) acceptance and specialized appeal (Ahn, & Kim, 2017).

2.9 Empirical Review

Ronald Rojas, Jose-luis Hervas, Sofia Estelles, and Francisca Sempere (2020) Examine innovative approaches focused on sustainability in the financial sector of 11 Central and Eastern European (CEE) nations that are only now catching up. In this study, a large sample of 1574 financial industry enterprises are empirically analyzed using data from the Community Innovation Survey (CIS) for the years 2012–2014. According to their findings, innovation and corporate sustainability are strongly correlated, highlighting the favorable relationship between innovative skills and sustainability. In terms of methodology, they support the data analysis with factor analysis, ANOVA tests, and Ordinary Least Squares (OLS) regressions. The findings indicate a favorable relationship between corporate sustainability and a firm's level of creativity. By demonstrating that these countries' financial industries are not particularly innovative or focused on sustainability, this study helps to shed light on these topics. However, companies that prioritize innovation can better meet their sustainability-related objectives.

Research on the impact of innovation on corporate sustainability in the global banking sector was carried out in 2019 by Francisco, Elisa, and Fernando. From 2003 to 2016, they employed a sizable sample consisting of 168 banks across 14 nations. The findings imply that the banking sector's corporate sustainability is improved by service innovation performance. Furthermore, we make a contribution by putting out a theoretical framework that clarifies the connection between innovation performance and corporate sustainability in the banking sector.

Research by Bob-Alli and Irikefe (2021) used the Area 3 Branch of Guaranty Trust Bank Plc in Abuja to investigate the impact of innovation on company sustainability. A survey research design was used in the study. The complete workforce of Guaranty Trust Bank Plc, Area 3 Branch, Abuja, Nigeria, was included in the study; this corresponds to a sample size of 192. Staff personnel of the branch provided the respondents with the data for the survey. A five-point Likert scale was used to transform the basic qualitative data used in the study into quantitative data. The statistical software program SPSS version 25.00 was utilized in the study to perform regression and correlation analyses. The results demonstrated a strong correlation between Branch's business sustainability and innovation. This suggests that Branch's company sustainability (or business survival) is greatly influenced by innovation (process, organizational, and technical innovation).

Samwel Macharia Chege and Daoping Wang (2020) investigated how technological innovation affected the performance of SMEs in Kenya by implementing environmental sustainability measures. The investigation explores the interplay among environmental sustainability, technological advancement, and the performance of small businesses. The study delves into this relationship by utilizing hierarchical regression models and a sample comprising 204 small firms. Results from the survey reveal that small business owners with a focus on environmental responsibility experience enhanced organizational performance through technological innovation. Furthermore, businesses that actively engage in promoting social justice and environmental initiatives beyond

their core operations may achieve heightened financial success. Management creativity and staff involvement in environmental conservation initiatives may boost the business's output and improve its reputation among stakeholders.

3. Methodology

The research was conducted using a descriptive design. The purpose of this research design was to facilitate the researcher's ability to conduct comprehensive studies that would shed light on the technological innovation strategy employed by Airtel Nigeria Network Ltd. and its effects on the degree of organizational sustainability practiced by telecommunication companies. According to the Nigeria Communication Commission (2023), there are 140 employees working at Airtel Nigeria Ilorin. Selected by simple random sampling, the sample size of 103 was established using the Taro Yamane sample size determination algorithm. The main data source was employed, and a structured questionnaire was used for the study. The instrument's reliability was assessed using composite reliability, Cronbach alpha, and average variance extracted (AVE). In order to guarantee that all robustness tests are verified by sampling and resampling, measurement, and structural model evaluation are done critically, the data was analyzed, and hypotheses were evaluated using the PLS algorithm and bootstrapping.

3.1 Model Specification

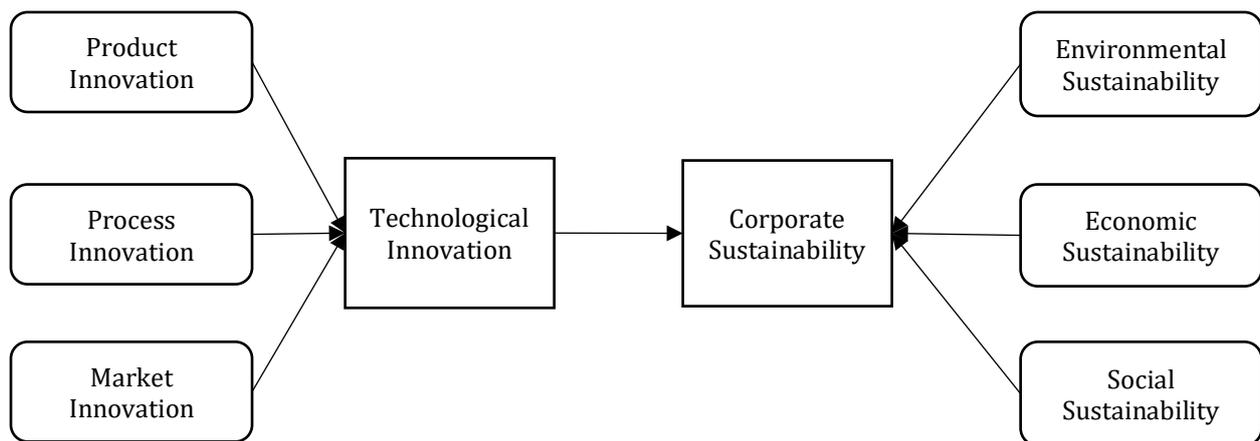


Fig. 1 *Technological innovation and corporate sustainability model*
Source: Researchers' Design, (2024)

Figure 1 shows the model of how different innovation dimensions link with the concept of corporate sustainability. It is organized into two main categories: innovation dimensions and sustainability measures. The innovation dimensions include product innovation, process innovation, and market innovation, all of which come together to predict corporate sustainability. Corporate sustainability is further divided into three measures, which are environmental sustainability, economic sustainability, and social sustainability. In general, this shows how various innovation dimensions are able to affect sustainability within a corporate environment.

4. Data Analysis

4.1 Descriptive Statistics and Normality Test

According to table 1, the means of the questions ranged from 2.551 to 3.377, which is relatively high. This indicates that the respondents believe technical innovation is strongly related to company sustainability. The study's results are further supported by the low standard deviation values below 1, which show that there has been little variation or change from the mean. These highlight the significance of business sustainability via a fruitful technical advancement. All of the variables fell within the absolute value of ± 1.0 for skewness and the absolute value of ± 3.0 for Kurtosis, according to the normality results. All of the data entered for the analysis are regularly distributed, as indicated by the results of the normality test, and this information may be utilized to draw additional conclusions and conduct more research.

Table 1 Descriptive statistics and normality results

	Mean	Standard Deviation	Excess Kurtosis	Skewness	Number of Observations Used
Corporate Sustainability	3.169	0.031	-0.033	-0.185	103.000
Economic Sustainability	2.551	0.012	-0.415	-0.279	103.000
Environmental Sustainability	3.124	0.020	0.259	-0.349	103.000
Market Innovation	3.178	0.065	-0.426	-0.147	103.000
Process Innovation	3.173	0.025	-0.567	-0.020	103.000
Product Innovation	3.377	0.017	-0.534	0.056	103.000
Social Sustainability	3.201	0.117	-0.332	-0.073	103.000

Source: Authors compilation (SmartPLS 3.3.3 Output) 2023

4.2 Assessment of Measurement Model

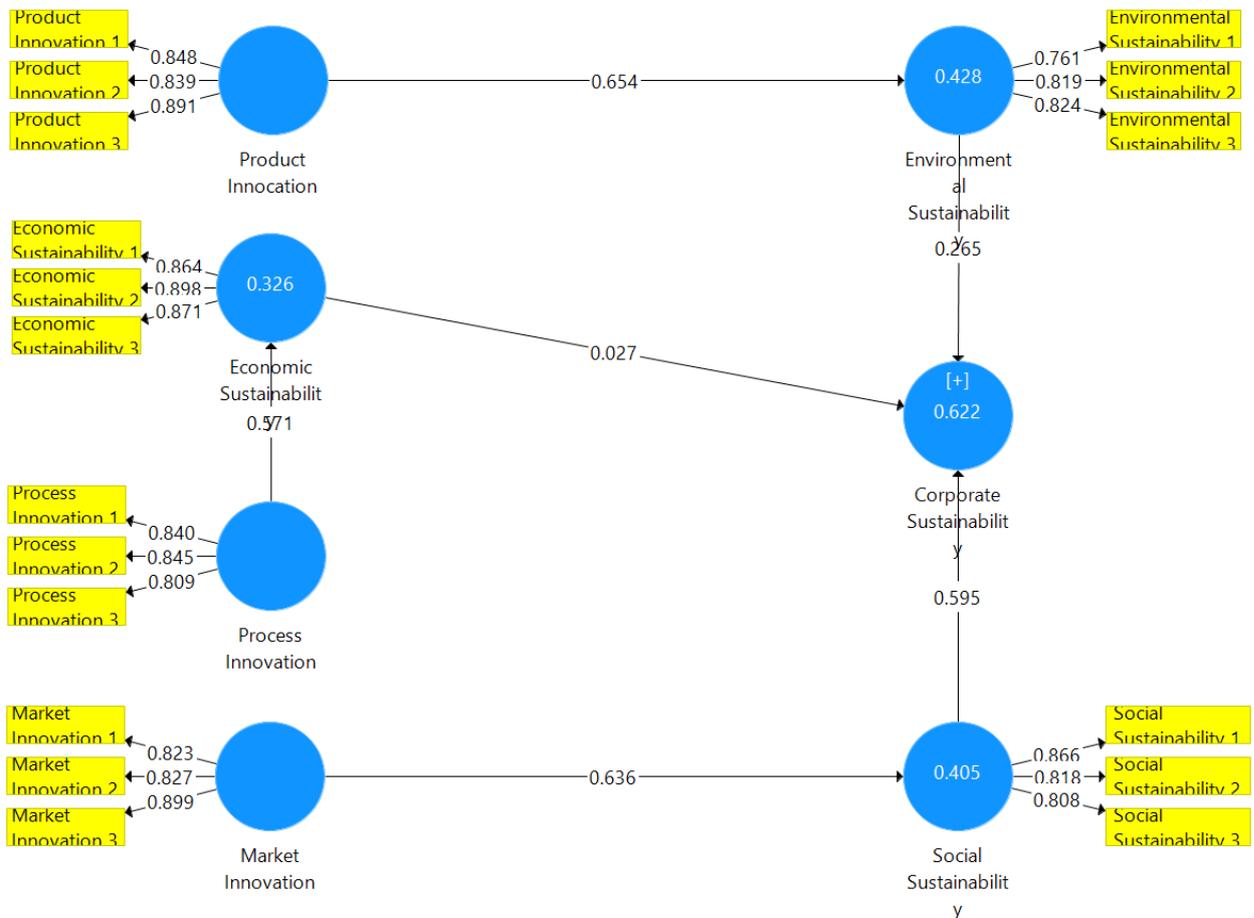


Fig 2 A path model of technological innovation and corporate sustainability

Source: SmartPLS Output, 2023

The link between business sustainability and technical innovation is depicted by the route model in Fig. 2. In this model, the external weight ranges from zero to a maximum value that is marginally less than 1. An increasing number of indicators for a latent variable has been found to be associated with a decreasing maximum outer model weight and a decreasing average outer model weight.

Table 4 Factor loading, discriminant validity, construct reliability and validity

Indicators	Factors Loadings	1	2	3	4	5	6	7
Corporate Sustainability 1	0.824							
Corporate Sustainability 2	0.846	0.838						
Corporate Sustainability 3	0.816							
Economic Sustainability 1	0.854							
Economic Sustainability 2	0.888	0.543	0.878					
Economic Sustainability 3	0.861							
Environmental Sustainability 1	0.771							
Environmental Sustainability 2	0.829	0.611	0.672	0.802				
Environmental Sustainability 3	0.834							
Market Innovation 1	0.833							
Market Innovation 2	0.837	0.738	0.561	0.612	0.850			
Market Innovation 3	0.889							
Process Innovation 1	0.830							
Process Innovation 2	0.835	0.743	0.561	0.613	0.736	0.832		
Process Innovation 3	0.819							
Product Innovation 1	0.838							
Product Innovation 2	0.849	0.734	0.612	0.644	0.656	0.777	0.860	
Product Innovation 3	0.881							
Social Sustainability 1	0.856							
Social Sustainability 2	0.828	0.742	0.570	0.524	0.626	0.664	0.686	0.831
Social Sustainability 3	0.818							
Cronbach's Alpha		0.779	0.842	0.738	0.820	0.767	0.834	0.767
Composite Reliability		0.867	0.920	0.833	0.876	0.860	0.885	0.860
Average Variance Extracted (AVE)		0.705	0.772	0.642	0.724	0.690	0.738	0.690

Source: Authors Compilation (SmartPLS 3.3.3 Output) 2023

Note: Corporate Sustainability (1), Economic Sustainability (2), Environmental Sustainability (3), Market Innovation (4), Process Innovation (5), Product Innovation (6), Social Sustainability (7)

Each indicator is legitimate if its value exceeds the benchmark of 0.5, which should be removed for any indication below it. Table 2 displays the factor loading of the indicators on their latent variable. It is clear from Table 2's divergent validity analysis that each variable's diagonal values—that is, its correlations with itself—are significantly greater than its off-diagonal values, which represent the correlations between other variables. In support of the notion that the latent variables are unique and assess various parts of the overall construct, this implies that each latent variable has a stronger relationship with itself than with the other constructs.

Furthermore, Cronbach's Alpha values for all latent variables are higher than the generally recognized cutoff point of 0.7. These findings imply that each variable's items accurately measure the corresponding components and compare favourably to the benchmark. When compared to the benchmark, every variable shows exceptional composite dependability, with all of its values ranging higher than 0.7. These high values validate that the latent variables successfully function as trustworthy markers of the constructions they stand for. Furthermore, all of the AVE values in the table are higher than the suggested cutoff of 0.5. This shows that each latent variable's items are convergent well and measure the corresponding constructs when taken as a whole.

Table 3 Bootstrapping results, R square, F square, and multicollinearity

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics ((O/STDEV))	P Values	Hypotheses Decision	R Square (R Square Adjusted)	F Square	VIF
Market Innovation -> Social Sustainability	0.635	0.637	0.044	14.057	0.000	Supported	0.405 (0.401)	0.671	1.000
Process Innovation -> Economic Sustainability	0.570	0.573	0.051	10.894	0.000	Supported	0.326 (0.321)	0.473	1.000
Product Innovation -> Environmental Sustainability	0.653	0.656	0.039	16.193	0.000	Supported	0.428 (0.424)	0.738	1.000

Source: Authors Compilation (SmartPLS 3.3.3 Output) 2023

A thorough understanding of the statistical connections between different latent variables and the hypotheses that go along with them is provided by the bootstrap path coefficient analysis that is shown in Table 3. The beta value in the first association, "Product innovation -> Environmental sustainability," indicates a strong positive link, the T statistic is over 1.96, and the p-value is less than 0.05, all of which support the relationship's statistical significance. The hypothesis is therefore "Supported," suggesting substantial evidence for a noteworthy relationship between product innovation and environmental sustainability.

The statistical significance of the second link, "Process innovation -> Economic sustainability," is confirmed by the beta value, which displays a high positive association, a T statistic over 1.96, and a p-value less than 0.05. Consequently, the hypothesis is deemed "Supported," signifying substantial proof of a noteworthy correlation between Process innovation and Economic sustainability.

The beta value in the third connection, "Market innovation -> Social sustainability," indicates a strong positive correlation; the T statistic for this relationship is over 1.96, and the p-value is less than 0.05, all of which support the relationship's statistical significance. Consequently, the hypothesis is deemed "Supported," signifying substantial proof of a noteworthy correlation between market innovation and social sustainability.

The assessment of multicollinearity is conducted by comparing the variance in fit (VIF) values of each predictor variable to the benchmark of 10. The VIF value is much less than 10 for each predictor variable. This suggests that there isn't any noteworthy multicollinearity between these variables.

The impact size, also known as the f-square, indicates that market, process, and product innovation all have significant effects on their dependent variables because the f-square values are all higher than 0.35. This demonstrates the significant influence each independent variable has on the dependent variables on their own.

An estimated 42.8%, 32.6%, and 40.5% of the variability in the dependent variables (environmental, economic, and social sustainability) is explained by the independent or latent variables included in the model, according to the R-squared values of 0.428, 0.326, and 0.405 for the environmental, economic, and social sustainability models, respectively.

4.3 Discussion of Findings

According to the first hypothesis's outcome, there is a substantial correlation between product innovation and environmental sustainability. Furthermore, it was noted that every proxy utilized in the investigation provided positive weights, and every weight in the route analysis did not drop below the threshold. These results are consistent with what Francisca, Sofia, Ronald, and Jose-luis submitted (2020). On the other hand, Airtel Nigeria's environmental sustainability is impacted by KPIs related to product innovation.

The results of hypothesis two suggested that there was a substantial correlation between process innovation and economic sustainability. It was observed that every proxy used in the investigation provided a positive weight; none of the weights in the route analysis were below the cutoff. These outcomes agree with Francisco, Elisa, and Fernando's (2019) findings. On the other hand, Airtel Nigeria's economic sustainability is impacted by process innovation measures.

According to the third hypothesis's outcome, there is a substantial correlation between market innovation and social sustainability. All proxies included in the study, it was noted, gave positive weights, and in the route analysis, no weight fell below the threshold. It's interesting to note that the results agree with those of Bob-Alli and Irikefe (2021). Nonetheless, Airtel Nigeria's social sustainability is impacted by market innovation measures.

5. Conclusion and Recommendations

Numerous noteworthy conclusions were drawn from the study on corporate sustainability and technical innovation in the Nigerian telecommunications sector. According to the study's findings, the telecommunications

industry's environmental sustainability is positively impacted by product innovation. The study also found that process innovation and economic sustainability in Airtel Nigeria have a favorable link that eventually supports corporate sustainability. The study also found that Airtel Nigeria's social sustainability was significantly influenced by market innovation, which raised corporate sustainability. The following suggestions are given to Airtel Nigeria and other stakeholders in light of these findings;

- i. In order to increase their environmental sustainability, Airtel Nigeria and other stakeholders should embrace boosting product innovation. This may be accomplished by continuously innovating the product as frequently as feasible.
- ii. Airtel Nigeria should encourage process innovation by streamlining the process of subscribing to its goods and utilizing and engaging with its services to increase corporate and economic sustainability.
- iii. To improve its social sustainability, Airtel Nigeria and other stakeholders should encourage market innovation. This may be achieved by utilizing cutting-edge technology-based marketing techniques that can help it get a competitive advantage in its industry and place it in a strategic position within the market.

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Conflict of Interest

We declare that there is no conflict of interest regarding the publication of the paper.

Author Contribution

We confirm contribution to the paper as follows: **study conception and design:** Olawale, Balogun; **data collection:** Balogun; **analysis and interpretation of results:** Balogun; **draft manuscript preparation:** Balogun. All authors reviewed the results and approved the final version of the manuscript.

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