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Technological Environment and Innovation Performance: A Study from Nigerian Consumer Goods Industry

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Abstract:
Securing a better innovation performance in the marketplace is necessary for any organization in the 21st century, noting that early adaptation to the technological environment holds greater opportunity for such a company. This study examines the effect of the technological environment on the innovation performance of the Nigerian consumer goods industry. Primary data were collected through purposive sampling technique from six (6) of the most valuable consumer goods companies based on their stock value. The technique was employed to select the required respondents for the study. Out of a population of 3394 middle and senior managers, 358 respondents constituted the study sample, generated using Taro Yamane's formula. Thereafter, a structured questionnaire was administered to elicit data from these crops of individuals. The data collected were analyzed using Partial Least Square – Structural Equation Model (PLS-SEM). The overall result of the study indicates that the technological environment has a positive and significant effect on innovation performance in the industry. The findings further expanded the main predictor by showing new technology development ($\beta = 0.286$, $p < 0.05$), new production process ($\beta = 0.242$, $p < 0.05$) and R & D activity ($\beta = 0.180$, $p < 0.05$) as having significant effect on innovation performance. The adjusted R^2 of 33% confirms that the technological environment is an important element in the achievement of innovation performance in the industry. The study concludes that a blend of the components of the technological environment promises a greater advantage for companies compared to when they are disaggregated. The implications for research and practice are discussed, and future research opportunities are outlined.

Keywords: *Environment, innovation, consumer, goods*

1. Introduction

Organizations need to be consistent with the direction of the environment; otherwise, the goals of such enterprises can be impinged on (Mitchell, Shepherd & Sharfman, 2011). The dimensions in the external environment call for regular scanning to avoid shocks and minimize environmental surprises (Olubodun, 2021). External dimensions are characterized as complex and dynamic; these features determine an organization's environment and behaviour in terms of structure and performance (Hough & White, 2003). Slow response to external circumstances can stiffen progress or cause strategy failure, while early and appropriate action to address environmental conditions holds a vintage position for organizations. The rate and level of technological advancement and breakthroughs in Internet, mobile technology, product, and process innovation are changing the competition in the marketplace. Product and process life spans are shortened in some cases. For instance, the internet has changed product life cycles, increased distribution speed, reduced entry barriers, and redefined industries and stakeholders' relationships (David & David, 2018). The external environment of business is mainly categorized into four forces, which are often labelled in a model called PEST (Porter, 1980). The PEST model is defined as a political, economic, socio-cultural, and technological environment. In light of this, technology is one pervasive and prevalent phenomenon in the human race that quickly and constantly reshapes human activities so often that companies from all sectors are expected to monitor the pace of changes in the environment. This is important to track opportunities ahead of rivals and monitor threats to avert being crumbled into a dormant player in the industry. This relates to Su, Mou, and Zhou (2023), who state that legitimate and diverse resources needed for enterprise operations

become realized when there is a continuous strategic connection between internal strategies and the external environment.

Past studies alluded to the pervasiveness of technology, which they recognized could pave the way for firms and give room for dominance, e.g., multi-products businesses. The condition in multi-product businesses leverages the use of available technologies in the technological environment for the achievement of efficiency and effectiveness in operations (Abdulsalam & Mustapha, 2013). The position of Kwon-Ndung, Kwon-Ndung and Migap (2014) confirmed that the environment holds the tenet of high productivity and quality products and services for companies. The relevance of the technological environment is pertinent to determining whether organizations will survive in the ongoing information age that has characterized human life. In light of this, the objective of the study was to develop a more comprehensive analysis of the impact of the technological environment on innovation performance. It is expected that the study's results will provide insights for decision-makers in the consumer goods industry on the disaggregated elements in the technological environment and how the elements relate and help managers interact with them to know their behaviour. The results of the study will build on the extant empirical and theoretical basis regarding the evidence in the technological environment by equipping scholars and professionals with more information to improve their knowledge about the environment. System theory forms the fulcrum of discussion in the study of this nature because more technological activities reside in the external environment. However, the diffusion of the activities relevant to individual organizations and industries shapes their operations. In this way, system theory is the theoretical perspective for this study (Bertalanffy, 1968). Theory noted that organizations are dependent on the external environment. The activities and forces in it affect how firms operate. On this basis, relating to the environment should be an important managerial choice to facilitate informed decisions and judgements on critical issues. Noting this fact, our review of the statements of chairmen of the companies under study, as captured in their annual reports, attests to the need for organizations to always interact with the external environment, particularly (Companies annual report). The study of Gado (2015) noted the environment where organizations operate as an open system, connoting that every firm usually would survive and thrive because no organization is self-sustaining and that managers' interaction with the environment should be consciously done.

2. Review of Related Literature

2.1. Technological Environment

Organizations' operational methods and production techniques can easily become obsolete, making organizations less competitive, and products run into obsolescence in a highly dynamic technological environment. This technological change is happening so rapidly that firms should be aware of it as it might influence the industry. Technological breakthroughs often have the tendency to engender sophisticated new products and markets. Possibly, the anticipated life span of manufacturing equipment could be shortened in this environment. Also, new methods of distribution and communication with customers have emerged through technological developments, e.g., the internet (Palmer & Hartley, 2009; David & David, 2018). The understanding of the changes in the technological environment where organizations look out for technological advances and probable effects on future products and services can be foreseen by engaging in technological forecasting. To grasp what is happening in the environment, organizations in the consumer goods industry should comprehensively analyze and study the expected effect of new technologies on competitive situations and the business-society relationship (Pearce & Robinson, 2011). Such is happening with the use of genetically modified organisms in the consumer goods industry, which calls for concern. However, it has potential benefits, as some people consider it a solution to global hunger (European Monitoring Centre on Change, 2006). Su, Mou and Zhou (2023) recognize that comprehensive analysis and systematic study of the environment is a technological innovation capability.

Su, Mou and Zhou (2023) confirm that the ability of any enterprise to integrate technology often creates an enduring impact on innovation performance. They extend that technology is the technical basis for customer solutions and value addition in the manufacturing outfit. To proxy this environment, literature pointed out key constructs discussed below.

2.1.1. Research and Development Activity

The level of competitiveness in any industry is increasing unimaginably as organizations compete for customers on the basis of the technology deployed. Research and development enable organizations to experience the game above the game in market activities over rivals, whether in product/service innovations or in new product offerings (Ireland, Hoskinson & Hitt, 2011). Su, Mou and Zhou (2023) support the idea that research and development intensity has the capacity to engender the development of new services in manufacturing firms. Investment in research and development (R & D) is a corollary for determining the level of activity in this important phenomenon. The investment in R&D could trigger better performance in organizations. R&D expenditures enable firms to create and maintain competitive advantage and enhance the future viability of firms' infrastructure (Lee, Kim, & Lee, 2011). R&D intensity enables organizations in the manufacturing sector to follow the pace of technology development all over the world. It further engenders the development and improvement of new and existing products, thereby making business ventures more profitable than before (Ehie & Olibe, 2010; Su, Mou & Zhou, 2023). Innovation is driven by increasing R&D activity in organizations (Cardoso & Teixeira, 2009). The country's investment in science, technology, and education signals the direction the government wants to follow in increasing its competitiveness, among others. Hence, this action tends to promote the industrialization drive of the nation in the long run.

2.1.2. New Technology Developments

Technology has become part of the tools that create an easy life for human existence and determines most of man's ways of life. Organizations, whether manufacturing outfits or service-providing firms, now embrace technology as a means to create a competitive edge over rivals. Technological developments that range from the automation of plants and processes to novel technologies are creating hallmark waves in the way organizations compete. This level of development is paving the way for new dimensions of competition in industries, creating new customers and causing even firms that are rigid to changes to close operations of whole or part of their businesses. However, new technological developments enable the creation of more effective forms of production processes and the development of new products. It is crucial that it can lead organizations to a relative change in cost position within a business (efficiency) and create new markets and new business segments (Kazmi, 2006).

In recent times, organizations in the consumer goods industry have experienced new technologies in key areas such as biotechnology, radio frequency identification (RFID), robotics and sensor technologies and information and communication technology (ICT) (European Monitoring Centre on Change, 2006). Further, this situation is changing the consumer goods industry outlook with innovative priorities that address issues in areas that bother food and health, food quality and manufacturing, food safety, sustainable food production and food-chain management (European Monitoring Centre on Change, 2006). Specifically, the future actions identified and highlighted are key areas in technology developments such as:

- New packaging technologies (edible coating, intelligent packaging, etc.)
- Reliable tracking and tracing systems to ensure product safety and guarantee product origin.
- Quick web-based analytical methods and techniques for measuring the required properties of supplied raw materials.
- Technologies for reducing sugar, salt, and fat content of new products and meal concepts for certain people, such as children, and for creating new food-product textures.
- Technologies for cutting down on by-products and waste and reducing processing costs.
- Convenience foods that encourage easy-to-handle, time-saving, ready-to-eat, heat-to-eat and ready-to-use solutions, including ingredients and processing equipment (European Monitoring Centre on Change, 2006).

The points mentioned above are changing the behaviour of firms irrespective of the industry. On this note, companies plan technological sophistication into their activities to avoid sudden shocks from the external environment through their engagement in technological forecasting activity.

2.1.3. New Production Processes

The thinking of managers in the 19th century is far different from that of managers in the 21st century. In the later period, the Industrial Revolution gave relief as it aided mass production of what the market required to meet its needs and wants at that time. The rate at which information gets to 21st-century customers is sporadic, and obsolescence has become faster than ever. This phenomenon puts managers on their toes to ensure that products and services that meet customers' requirements are available on time. This compels organizations to cut down the time between raw materials and the delivery of finished products. This confirmed the claim that process innovation is crucial for remanufacturing activities (Ozer, 2012). Hence, there is a need to embrace new production processes to save costs and promote efficiency in operational activities. These range from new equipment that is easy to couple to the ones that were not available to organizations many years ago. The advent of digitalization contributed immensely to the early birth of this phenomenon, and labour redundancy is now commonplace in our market space.

2.2. Innovation Performance

It is well-debated in the literature that the primary objective of a business organization is to make a profit for the shareholders and to use it to finance growth. The position extends to show that innovation is a very important concept that places organizations on a more strategic and vintage pedestal at meeting and satisfying the needs of customers better compared to competitors. This happens through involvement in the introduction of new products and new methods of production and distribution (Accounting Technicians Scheme West Africa, 2009). D'Cruz and Rugman (1992) opined that the need for organizations to be more competitive in designing, producing, and marketing products and services is crucial to engender superior offerings against those offered by rivals. Organizations become more relevant to market changes and needs and can secure a unique position if innovation is appreciated (Hurley & Hult, 1998). Investment in new developments, processes and technology is one driver in this direction. Innovation is a desirous outcome for any firm as it has the capacity to measure the level of competitiveness of organizations, irrespective of size. It is also a means to determine whether the organization is progressing compared to previous or past state of affairs. The manufacturing industry generally invests in innovation, which comes by acquiring new technology, equipment, and processes and implementing new procedures for efficient operations to satisfy customers' needs and expectations.

Previous studies measure innovation performance with administrative and technical innovations (Chen & Huang, 2009). This confirms that innovation performance connects to the internal organization of firms, given the activities within the technological environment where firms operate, which is often reflected in process, product, and marketing innovations (D'Cruz & Rugman, 1992; Laursen & Foss, 2003).

2.3. Empirical Studies

Njoroge, Ongeti, Kinuu, and Kasomi (2016) examined the influence of the external environment on organizational performance in Kenya and confirmed a direct and significant positive effect on the relationship. It was observed that

attention was more on environmental dimensions, which consisted of munificence, complexity and dynamism, though forces that are the sources of issues were identified. This study, however, recommended that managers engage in scanning activities to stay informed of the conditions and nature of the environment. The study sample was Kenyan State corporations, which are believed to have some level of connections with a government that placed them at better advantages over companies in the private sector, which are more open to competition.

Nwangi and Wekesa (2017) established that the technological environment has a significant influence on the performance of Kenyan airline companies in the area of efficiency and growth. The study recommended that there is a need for airline operators to embrace modern technologies in their activities. It is claimed that the adoption can make organizations more competitive and bring improved performance. The study used a case study approach, which limits the chance to generalize its findings, but it helps to gain insight into the relevance of the environment to the performance of firms.

The results of the study of Okechukwu and Okoronko (2018) were diverse in that there is a significant effect of the technological environment on the market share of small and medium businesses in Enugu State, Nigeria, and also revealed no significant influence on customer satisfaction. It is established in this study that organizations should prioritize the utilization of technological advancement in order to maximize the benefits therein. The research focused only on small and medium enterprises, which may not have the capacity to finance large-scale opportunities available in the environment. Abdulsalam and Mustapha (2013) affirmed that forces in the technological environment are capable of provoking listed manufacturing firms in the food and beverage industry to adopt multi-product marketing strategies. It concluded that the adoption of multi-product strategies could make it possible for firms to remain competitive in the market while keeping pace with the changes in technology. The study does not extend to know the performance implications of the multi-product strategy or the direct effect of technology environment variables on the performance of firms in the industry. However, it reveals that the environment contributes to the activities and operations of firms in this industry.

Kwon-Ndung, Kwon-Ndung and Migap (2014) confirmed the unrealized and full influence of the technological environment (research and innovation) on the Nigerian economy. The study found that technology, as an important tool, contributes significantly to business products and processes, thereby improving the enterprise's productivity and quality. It indicates further that continual research and knowledge (technology readiness) could engender competitiveness in any economy, among others. It is also observed that opportunities abound in Nigerian industrial organizations, and they can only be harnessed and transformed through activities in the technological environment. Radivojević, Krstić, and Stanišić (2018) reflected on the role of technology readiness as an important determinant of global competitiveness with a particular focus on the Serbian economy. The study realized that the Serbian economy had a negative trend in its technology readiness compared to nations in the European region and Balkan economies. The significant deviation in the result shows the relevance of technology readiness at national and global levels and how much contribution its capacity can yield to the socio-economic development of nations where necessary efforts are channelled toward each pillar. This study resembles the dynamic condition of the technology environment in Serbia. The study fails to connect to the minds of firms operating in the economy toward competition at a corporate level. The nation's deficiency in critical indicators and its weakness in its attractiveness potential also exposed the economy from a global perspective.

In the position of Wang and Quan (2017), it was revealed that diversity in R&D alliances has a positive effect on firms' innovation performance, and these effects are occasioned by the moderation influence of environmental factors and alliance network position. The moderating effects point to a divergence, which signifies that the relationship may not be direct. However, it is important to understand the connection that any component of the technological environment can have on innovation performance. Rather than holding to the thought that contingencies drive innovation performance better, thereby leading firms to ignore the direct link, which Wang and Quan (2017) did not account for. From the foregoing, it is hypothesized that:

- H1: Technological environment significantly influences the innovation performance of firms.

3. Methods

The consumer goods industry is the context for the study because technology requirements are important for the production and marketing of goods and the internal processes of the industry. In addition, the failure of any company to relate to the environment may lead to an inability to grasp customers' preferences and tastes due to its uncertainty. It may also become easy to relate quickly to the latest advances in technology. The study used a cross-sectional research design to establish current knowledge in the Nigerian technological environment. A purposive sampling technique was used to select the sector and six (6) most valuable consumer goods companies based on their stock value (Nigerian Bulletin, 2014). The technique was employed in selecting the required respondents for the study as they were in the best position to efficiently provide the needed information for the study. Out of the 3394 middle and senior managers extracted from the companies' annual reports, 358 respondents constituted the study sample size generated using Yamane's (1967) formula. After that, a structured questionnaire was administered to gather data from top and middle management levels. These are the personnel who relate more to the environment or can provide insight to management on strategic matters. Two hundred and fifty-four (254) copies of the questionnaire were retrieved, representing 70.9% of the sampled respondents. The data collection period spanned from early June to late August 2023 through the support of two research assistants. Permission was obtained from the management of the sampled companies before data collection activity was undertaken. The data collected were analyzed using Partial Least Square – Structural Equation Model (PLS-SEM).

To capture the technological environment, data were drawn from the questionnaire using proxies. Research and development were proxied using questions such as whether increased research and development activity causes organizations to engage in specific long-range activity – R&Dactv1, poor research and development activity in the economy

affect companies' interest in long planning engagement - R&Dpo2, among others. With regards to new production processes, this was proxied using questions such as the availability of new production processes in the economy leading an organization to adopt a new strategic move – NewPP3, availability of new production processes improving an organization innovation drive – NewPP4, among others. On the other hand, new technology development was measured using questions such as new technology development prompts our firm into a unique business direction – NewTD5 and new technology development improves our company's innovative capability – NewTD6. To obtain data on innovation performance, four items were addressed in the questionnaire. These included questions relating to the fact that companies experienced significant and improved methods of manufacturing or producing products in recent times – Innvtn1, organizations witnessed improved logistics, delivery and distribution methods for inputs and products in recent times – Innvtn2, improvements in supporting activities for organization's processes e.g., maintenance systems and operations facilitate procurement, accounting and marketing departments – Innvtn3, and organizations significantly improved their existing products recently – Innvtn4. These constructs were extracted from extensive literature reviews and empirical studies. The measure for innovation performance is the level of improvement experienced in the various areas represented in the questionnaire. The measure of the technological environment revolved around the proxies, which thus captured the level of activity in R&Dactv, the availability of NewPP, and the promptness and improvement of NewTD in the environment. All the constructs followed and used 5-point Likert scales (1 = strongly disagree, 5 = strongly agree).

The items are validated using face validity, whereby experts in strategic management are perused to check for consistency in the instrument. The instrument had a Cronbach alpha value of 0.81 for technological environment and 0.69 for innovation performance, while the values of research and development, new technology development and new production process are 0.72, 0.76, and 0.83, respectively. These values are within the acceptable threshold for determining the reliability of the instrument. Inferential statistics using partial least squares regression were employed. The path coefficient value of each proxy of the latent independent variable (technological environment) indicates the value of contribution each latent variable makes to the level of innovation performance because a change of 1 value in each latent variable coefficient shows how much the latent dependent variable increases or decreases. The significance level of $p < 0.05$ is maintained and accepted in PLS-SEM when the value of t-statistic with a threshold of 1.96 is used as a test of the hypothesis, considering the path coefficients of the model (Kock, 2016); otherwise, the results are not significant and rejected.

The model formulated for the study is thus:

INNVTPERF = f (technological environment) …….. Equation 1

$INNVTPERF = \beta_0 + \beta_1 RSHDVLAVT + \beta_2 NPP + \beta_3 NTD + Ce$…….Equation 2

Where:

INNVTPERF = Innovation Performance

$\beta_1 - \beta_3$ = Coefficients of all the technology environment variables

RSHDVLAVT = Research and Development Activity

NPP = New Production Process

NTD = New Technology Development

Ce = Error term

The model in Equation 2 captures the technological environment's proxies to determine how each of the proxies combines to explain innovation performance. Apart from that, the disaggregation helps to observe the specific contribution of each to the innovation performance of the firms. The significance of each of the elements was upheld at $p < 0.05$. The overall result was confirmed using hypothesis testing.

4. Results

The data were analyzed using the Partial Least Squares-Structural Equation Model (PLS-SEM) with Smart-PLS 3, and the results are hereby presented. In the study, reflective measurement scales were used in which items loading that manifest each latent variable are well-represented. The values of all the items loaded are significant at $p < 0.05$. Further, the demographic representation in figure 1 describes the relationship among the variables.

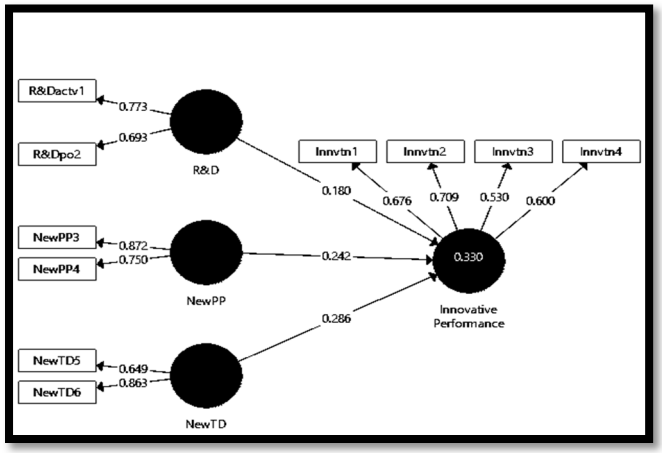

Figure 1: Path Coefficient for Technological Environment

Outer loadings in figure 1 depict the correlation of each item that proxy the latent variables, and these manifest their ability to predict the technological environment on innovation performance. All the values of the indicators are significant at p-value < 0.05. In this regard, research and development with R&Dactv1 and R&Dpo2 shows that the indicators are significant at p-value < 0.05 since they loaded properly in predicting the latent variable. In addition, a new production process with Newpp3 and Newpp4 as indicators to predict the technological environment loaded significantly at p < 0.05, demonstrating the ability to predict the latent variable. Apart from that, new technology development with indicators represented as NewTD5 and NewTD6 is well-loaded and significant at p < 0.05, showing that they have the ability to predict the latent variable. The above relates only to items that proxy the technological environment. Regarding the dependent latent variable (innovation performance) represented with Invtn1, Invtn2, Invtn3 and Invtn4, they also loaded significantly at p < 0.05 and confirmed their abilities to predict the latent variable.

In addition, the collinearity of the items loaded was tested, and the variance inflation factor (VIF) obtained for all items was established within the threshold of less than 3 and 5 (Hair et al., 2019; Ramayah et al., 2018). The range of values obtained is between 1.006 and 1.255 among the items, which confirms that there is no collinearity problem.

4.1. Measurement Model

Latent Variables	Composite Reliability	Average Variance Extracted (AVE)	Square Root of Average Variance Extracted (AVE)
Innovative Performance	0.725	0.502	0.709
NewPP	0.795	0.661	0.813
NewTD	0.732	0.583	0.764
R&D	0.705	0.539	0.734

Table 1: Construct Reliability and Validity
Source: Authors' Compilation, 2023

The assessment of the construct reliability and validity is shown in table 1 above, in which the values of the composite reliability presented indicated that 0.7 benchmark is met for each construct, which confirms that they are reliable. Cronbach's alpha is a less precise measure of reliability in PLS-SEM because the items are unweighted, as opposed to the composite reliability, which is preferred because the items are well-weighted based on the individual loadings of the construct's indicators (Hair et al., 2019). Thus, the internal consistency of the latent variables is established since all the composite reliability values are greater than the 0.7 thresholds. Average variance extracted (AVE) is employed to determine the construct validity. In light of this, AVE of 0.5 is considered a true measure of construct validity. In table 1, the AVE values are all above 0.5 baseline, which confirms construct validity (Bagozzi & Yi, 1988; Wong, 2013).

Latent Variables	Innovative Performance	NewPP	NewTD	R&D
Innovative Performance	0.709			
NewPP	0.462	0.813		
NewTD	0.505	0.538	0.763	
R&D	0.411	0.369	0.496	0.734

Table 2: Discriminant Validity
Source: Authors' Compilation, 2023

Table 2 shows the discriminant validity explaining the correlation of each latent variable. The values of the square root of the AVE (see Table 1) and diagonal values in table 2 are both the same. Each value is higher than other correlation values among the latent variable. Then, discriminant validity is confirmed (Fornell & Larcker, 1981). The square root of AVE for innovation performance (0.709) is greater than the correlation values of NewPP (0.462), NewTD (0.505) and R&D (0.411), respectively. In the same dimension, the correlation value of R&D (0.734) is higher than that of NewTD (0.496), NewPP (0.369) and innovation performance (0.411). Similarly, the correlation values of NewPP (0.813) and NewTD (0.763) are both higher than other correlation values, either in columns or rows. This indicates that there is discriminant validity among the latent variables and affirms the extent to which each construct is empirically distinct from others in the structural model.

4.2. Structural Model

4.2.1. Test of Multicollinearity

The first assessment entails a test of multicollinearity, which evaluates all constructs to determine whether there is a collinearity issue. In this regard, the variance inflation factor is used to establish whether there is collinearity among the constructs.

Latent Variables	Innovative Performance
NewPP	1.436
NewTD	1.646
R&D	1.353

Table 3: Inner VIF Values
Source: Authors' Compilation, 2023

Table 3 shows the variance inflation factor (VIF) of the latent variables (new production process (NewPP), new technology development (NewTD) and research and development (R&D) at 1.436, 1.646 and 1.353, respectively. These values confirm that there is no collinearity among the constructs, and all the values reported are below the threshold of less than 3 and 5 (Hair et al., 2019; Ramayah et al., 2018).

Path Coefficients	Original Sample (O)	Sample Mean (M)	Standard Deviation (STD.DEV)	T Statistics (|O/STDEV|)	P-Values
NewPP -> Innovative Performance	0.242	0.245	0.070	3.478	0.001
NewTD -> Innovative Performance	0.286	0.289	0.069	4.113	0.000
R&D -> Innovative Performance	0.180	0.181	0.080	2.254	0.025

Table 4: Bootstrapping Results Showing Path Coefficients for Structural Model
Source: Authors' Compilation, 2023

The results in table 4 above show the bootstrapping output of the path coefficients for the structural model. The results of the analysis depict the nature and response of the industry to the issues occasioned by the changes in the technological environment. In this study, the path coefficient of new technology development (NewTD) yields $\beta = 0.286$, $t = 4.113$, $p = 0.000$, indicating that a unit change in NewTD causes a 0.286unit increase in the innovation performance of firms in the consumer goods industry, and it significant at a $p < 0.05$. This result indicates that NewTD shows the highest path coefficient compared to other latent variables in the model. Again, the new production process (NewPP) provides $\beta = 0.242$, $t = 3.478$, and $p = 0.001$, explaining that a unit change in NewPP causes a 0.242 unit increase in the value of innovation performance and is significant with $p < 0.05$. Lastly, research and development (R&D) give $\beta = 0.180$, $t = 2.254$ and $p = 0.025$, which shows that a unit change in R&D activity accounts for a 0.180 unit increase in the innovation performance (INVTPERF) of firms in the consumer goods industry and significant at a p-value < 0.05.

4.3. Test of Hypothesis

Variable	R Square	R Square Adjusted
Innovative Performance	0.330	0.324

Table 5: Coefficient of Determination Score (R^2)
Source: Authors' Compilation, 2023

Table 5 shows an evaluation of the model's predictive quality, with a coefficient of determination score (R^2) of 0.330 for innovation performance. It reveals that the technological environment explains 33% of variations in the level of innovation performance of firms in the Nigerian consumer goods industry. The remaining value, however, is accounted for in the stochastic disturbance as specified in the model specification. In sum, the predictive power of the latent variables is established by demonstrating that the simultaneous combination of the variables in the model serves as a predictor of the industry's innovation performance. The null hypothesis is not supported, indicating that the technological environment has a significant effect on the innovation performance of firms in Nigeria's consumer goods sector. The finding is consistent with the study of Mwangi and Wekesa (2017).

Variables	Innovative Performance
NewPP	0.061
NewTD	0.074
R&D	0.036

Table 6: Assessment of Effect Size (f^2)
Source: Authors' Compilation, 2023

Table 6 shows the effect size (f^2), which explains the predictive relevance of each construct and the contribution of the construct to R^2. The magnitude of the relationship between the latent variables is assessed by the effect size of each construct. The NewTD reveals the highest effect size (0.074), which establishes the contribution of the construct to the R^2 value. Similarly, NewPP shows an effect size value of 0.061, and R&D with an effect size value of 0.036. The implication is that each construct contributes to the variation that the technological environment accounts for in the level of innovation

performance of firms in the Nigerian consumer goods industry. However, industry players need to focus more on new technology development to avoid technological shock that can surface from anywhere in the technological space. In this regard, technological forecasting will help provide succour in ameliorating the shocks.

5. Discussion of Findings

The analysis reveals unusual results because R&D, which is supposed to be the foundation of new ideas, has the least significant effect on the sector's innovation performance. The general belief is that R&D activity in the country, in particular, is expected to upscale more innovation outcomes in industries, but this is not the case. Observably, smartphone adoption, data usage, and internet users are increasing in our national lives on a daily basis despite the fact that there is no corresponding increase in the country's budget for education, science, and technology to match these phenomena. Within the seven-year period (2012-2018), the ratio of total federal government expenditure to education was 10.15% on average, compared to the UNESCO-recommended 26% (Budget Office of the Federation, 2018). The finding supports Odia and Omofonmwan's claim that the country's investment in education has been disappointing (Odia & Omofonmwan, 2013). The concern has long been a burning issue; even the lecture of a one-time TeTFund executive secretary attested to this when other nations were compared to Nigeria in this area to show there are several miles the nation needed to cover to address the gap (Bagoro, 2015). As a result, industry players are always looking for help by subjecting Nigerian university graduates to several training sessions for months before deployment. This occurs in order to close the skill gap. However, there is a pitfall in R&D activity, as revealed in this study.

New production processes accounted for a significant influence on innovation performance. However, there is limited evidence in extant literature that demonstrates the link. Ozer (2012) suggests that new production processes are required to reduce environmental impact, which he labelled remanufacturing. In general, organizations are expected to adopt new production techniques, methods, and skills to drive down high production costs in their industrial operations. The current study affirms this position, and the content analysis of companies confirmed the same as depicted in some annual reports reviewed. Specifically, firms now invest in capacity to ensure constant waste reduction and continued restructuring of route-to-market engagement (Nestle Nigeria, 2010). The demand and pressure on the natural environment also account for the quest to move in this direction. In this regard, cross-functional coordination among stakeholders such as new product development professionals, environmental specialists, and supplier involvement with clear attention to market focus and life-cycle analysis are important factors that influence greener products' market performance, according to Pujari (2006). This also resonates with the suggestion by Su, Mou and Zhou (2023) that comprehensive analysis and systematic study of the environment is a technological innovation capability.

Customers' tastes and preferences for products that are easy to carry, portable, and eco-friendly, with all due respect, are becoming more prevalent among consumers in general. The drive to adopt new production processes to reduce production costs could boost government initiatives to improve the value addition of some farm products, such as cassava, and facilitate diversification of its competitiveness as an important input for the consumer goods industry. The findings indicate that new production processes can increase capacity utilization in these organizations, which has been identified as a problem for small and medium-sized businesses because phenomenal success in the use of the processes will result in the easy transfer of knowledge, skills, and experience from these firms.

New technology development also reveals a significant effect on the innovation performance of firms in this industry. The development in telecommunication and entertainment industries lends credence to this finding. Moreover, many people in the economy now have access to one telecommunication gadget or another, from which they could benefit from events around the world. Generally, activities ranging from communication, information acquisition and knowledge sharing to entertainment now happen on the go. Furthermore, companies now have RFID (Radio-frequency identification) on their products to help customers confirm the identity and origin of products, differentiate fake and substandard products and help retail stores manage inventory. It has been established that RFID technology adoption emanates from identified social issues, such as fake, adulterated and substandard products common in this sector (Alqahtani & Wamba, 2012). However, government initiatives drive this a little more. For example, the Nigerian Agricultural Transformation Agenda (ATA), which created more access to farmers through technology, encourages companies in the sector to support avenues and link with farmers to develop seedlings that can provide high yields in raw materials. The concern arises when commodity prices surge, which necessitates the exploration of technology transfer to improve and encourage local input sourcing rather than relying on the international commodity market for critical raw materials. This confirms the need to invest more in education, science, and technology in a bid to strengthen the nation's industrial drive.

6. Conclusion and Recommendations

It is concluded that the technological environment has a significant effect on the innovation performance of companies in the consumer goods industry. This becomes more important when the elements of the technological environment are blended together as firms tend to benefit more substantially from innovation performance. However, more attention to new technological developments provides greater strength. This is because it represents a new trend that promises to industrialize national economies quickly and to motivate organizations to ride the wave. In the sector, new technological development has refined the manufacturing process and the factory-to-market path. The rate of new technology development, on the other hand, frequently challenged the status quo, which is why firms' innovation performance improved differently and also why industry trade partners must always align with the changes brought about by new technology development. This can contribute to the acquisition of external technology and knowledge available in the environment (Yun, Yang & Park, 2016). It is recommended that companies focus on the new technology development space to draw fresh insight and see how it can be leveraged early ahead of the competition.

7. Theoretical, Managerial Implications and Limitations of the Study

In the study, the contribution to knowledge is more pronounced in the unique result observed in new technology development that came top among the technological environment proxies. New technology development bridges the industry gap, increasing partner engagement by providing timely information for industry parties, such as technology that connects the market (RFID). Given the nature of industry activities, the combination of variables considered in this study warrants more inquiry to explain why research and development activity did not provide the largest effect as expected. The results of this study also have important managerial implications. First, the findings highlight the influence of the technological environment on innovation performance in the consumer goods industry. Consumer goods firms must not only be aware of technological factors but also pay attention to the effects on innovation performance. This is crucial because firms should be aware that the effect of the environment is significant to their logistics, marketing, and process innovations, among others. Second, new technology development holds greater attention from managers because of its capacity to contribute more to a firm's innovation performance. However, managers should make aggressive efforts to increase the impact of research and development and new production processes on innovation performance by regularly interacting with the environment.

The study examines the external environment as it affects the industry, but firms' characteristics may equally impact innovation performance. In addition, if the technology is not effective, management may limit the extent of benefits that are derivable. Future research can address shortcomings to determine how they can affect innovation performance.

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