Impact of Knowledge Management Process on Product Innovation in Manufacturing Firms

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The current study seeks to investigate the relationship between the dimensions of the knowledge management process and product innovation in manufacturing firms. Specifically, the study examines the autonomous effect of knowledge acquisition, knowledge sharing, and knowledge application on product innovation. 361 copies of questionnaire were sent out, with a 97.2% response rate. Using PLS-SEM, the survey data were checked for common error variance, validity, and reliability. Structural equation modeling was used to test the hypothetical framework. Results demonstrate empirical support for the model. Findings indicate a positive relationship between the knowledge management process (acquisition, sharing, and application) and product innovation in the manufacturing plants sampled. Therefore, each dimension of the knowledge management process plays a crucial role in product development and innovation. These findings serve as a useful guide for managers in designing and mainstreaming the knowledge management process into administrative action for better innovation performance.

Introduction

Knowledge Management processes have been identified as one of the critical organisational factors to promote firms' competitiveness, enhances superior performance, profitability, and innovation (Nascimento et al, 2017; Asrat-ul-haq & Anwar, 2016). Undoubtedly, knowledge is key to innovation (Lin & Rao, 2015), because the process of innovation depends on the intensity and availability of knowledge within the organisation (Obeidat et al, 2016). With the current technological advancement across divides, the knowledge size of an organisation is

more important in minimizing the complexity of innovation by harnessing what everybody knows, and the utilization of such know-how for improved performance (Lin & Rao, 2015). The complex nature of innovation occasioned by the fourth industrial revolution (4IR), and changing customers' expectations has pointedly altered the traditional innovation process, thereby emphasizing the prominence and importance of continued knowledge evolvement and effective management of firm intellectual asset as a valuable source(s) of firm innovativeness (Klafke et al, 2016). In the literature, knowledge acquisition, sharing and utilization have been identified as an important part of enterprise strategy to facilitate operational efficiency towards innovation (Ding, Liu & Huang, 2016).

Accordingly, an enterprise can only develop new insights, skills, products, services, and collaborative relationships through the generation, dissemination, and application of knowledge (Lin & Rao, 2015). As a result, firms need to identify, search, select, collect, organize, map, and capture knowledge in a useful form, and stored it for the use of the business (Obeidat et al, 2016). From the business perspective, innovation is a problem-solving activity in which employees from different backgrounds within the organisation interact to search for a solution using different factor-input (Akintelu et al, 2021). Consequently, firm innovation depends mostly on internal competencies such as business-own knowledge, organisational and technological base, and relationship with the business environment (Al-Husseini & Elbeltagi, 2015). Muniz et al (2019) in their study concluded that innovation occurs through the interaction of many players whose direct and indirect participation contribute and add specific knowledge, initiatives, and competency to the process of innovation. Based on the foregoing, scholars regarded knowledge management as the methodological way to enhance the firm capability to improve the decision-making process towards performance, including innovation performance (Hong, Snell & Rowley, 2017). As businesses continue to witness intense competition and struggle for survival resulting from the advancement in technology and frequent change in consumer preference induced by the 4IR paradigm, available evidence suggests that product innovation has been recognized as a crucial means to build a resilient and competitive business (Al-Husseini & Elbeltagi, 2015).

From the literature, there is evidence that the knowledge management process (KMP) has been noticed to improves performance in manufacturing businesses (Hong, Snell & Rowley, 2017). Nevertheless, these studies opined that the specific contribution of each part of the knowledge management process (acquisition, sharing, and utilization) to product innovation is complicated, especially in production and engineering firms where the process of innovation is cumbersome (Muniz et al, 2019). A study by Klafke et al (2016) posits that firms with better knowledge management practices will experience better product development performance compared with businesses with less organized knowledge architecture. In another study, Byukusenge and Munene (2017) concluded that the capability and flexibility of knowledge management practices and applications do increase the efficiency and speed of new product development in manufacturing businesses. Studies have also shown that there is a high

correlation between effective knowledge management process (acquisition, sharing, and application) and business outcomes in terms of new market penetration and retaining the existing market share (Nascimento et al, 2017; Ma et al, 2014). Although the importance of knowledge management practices in the area of product innovation and performance is well documented (Klafke et al, 2016), there is a need to examine the influence of each of these processes in product development and innovation in Nigerian manufacturing sector.

In Nigeria, the sustainability of manufacturing businesses has been questioned over the lack of product innovation (Waribugo, Ofoegbu & Akpan, 2016; Onuoha, 2012). Studies have reported that besides the emerging nature of manufacturing businesses, and other socio-economic challenges, the lack of effective knowledge management process and utilization in the entire manufacturing sector contributes to the ailing status of most businesses in the country. For instance, a study by the Nigerian Association of Chambers of Commerce, Industry, Mines, and Agriculture (NACCIMA) reported that almost a thousand manufacturing businesses wind up in Nigeria within three years - 2009- 2011 (NACCIMA, 2012). Further studies revealed that knowledge management and application are very low among Nigerian manufacturing businesses (Waribugo et al, 2016). A worrisome trend in knowledge utilization capacity by manufacturing business in Nigeria was also noticed in a study conducted by Olusanya (2013), in which businesses placed a premium on other organisational factors at the detriment of a knowledge asset. According to the literature, knowledge management utilization fluctuates between 30-40 percent within the last decade, a situation that resulted in low competitiveness and lack of new or improved products and services in many businesses in Nigeria (Waribugo et al, 2016; Olusanya, 2013).

Judging from Nigeria's economic indices as measured by the average industrial production in the manufacturing sector with the lowest performance (-6.60) during the half of 2015 (CBN, 2015), Waribugo et al (2016) reported that the low performance in manufacturing businesses may be attributed to lack of effective management of tacit knowledge resulting in the low capacity to innovate. This development has been raising concern about how manufacturing businesses manage their knowledge infrastructure and its processes, especially towards improved performance and innovation. Some studies have suggested that the manufacturing businesses in Nigeria may be suffering from contradicting views on the impact of knowledge management on product innovation (Cantobelli, Cerchione & Esposito, 2017). Despite the relative availability of evidence in the literature, specific research elaborating on the contribution of knowledge management within the Nigerian context is often focused on information management science in the health sector (Opele, Adepoju & Adegbite, 2020). The pace of knowledge acquisition and utilization is considered low among manufacturing businesses in this regard, hence, the attempt by this study to investigate how the process of knowledge management impacts product innovation using a sample from manufacturing businesses in Nigeria. This study, therefore, investigates the impact of knowledge acquisition (KA), knowledge sharing (KS), and knowledge application (KAP) on product innovation (PI).

In the following section, the study presents the literature review, followed by the theoretical model and research hypotheses. In the section that follows, the methodology, measurement, and statistical analysis are presented, while discussion of results and conclusion was presented thereafter. In the final section, theoretical and practical implications, limitations, and suggestions for further research are also presented.

Literature Review

The concept of knowledge management is being defined using different perspectives in the literature as most scholars described it as a management process designed to put the knowledge infrastructure of an organisation into effective use in other to enhance competitiveness. In the literature, several proposals have been made concerning the component of knowledge management. Some scholars see knowledge management as information processing that includes generation and information dissemination, while others suggest that the knowledge management process includes knowledge acquisition, retention, and exploitation (Ma et al, 2014). In conceptualizing knowledge management, Lin and Rao (2015) concluded that there are three major components: knowledge acquisition, knowledge dissemination, and knowledge responsiveness. Other scholars in their definition expand the scope of knowledge management and suggested that the process includes more than three components to include acquisition, creation, generation, storing, sharing, dissemination, and utilization (Bashir & Farooq, 2019). Using Nonaka and Toyoma's (2005) description, the knowledge management process has three sets of practices i) knowledge generation, ii) knowledge dissemination and iii) knowledge application. Accordingly, knowledge generation is to create or discover new knowledge, dissemination is the process of sharing, transferring and diffusion of the acquired knowledge, while application means the adoption and integration of acquired knowledge to create value for the organisation (Waribugo et al, 2016). From the perspective of knowledge and innovation management literature, three dimensions of practices are involved in the knowledge management process.

Over the years, the interaction between knowledge management and organizational performance which was merely informational and knowledge exchange has been redefined to include the overall firm operation involving the creation, diffusion, and refinement of knowledge for better performance including in innovation performance (Hong, Snell & Rowley, 2017; Ding, Lin & Huang, 2015). In the literature, creativity, learning, innovation, and change within organisation has been attributed to the creation and management of knowledge infrastructure (Nonaka & Toyama, 2005). Studies from innovation management literature have suggested that one of the important strategies and ways to generate new ideas and innovation is fundamentally through knowledge management practices (Klafke et al, 2016). Based on the foregoing, Bashir and Farooq (2019) concluded that effective knowledge management integration tailored towards the operation of the business will lead to sustainable competitive advantage and innovation.

As noted in the literature, knowledge management and its processes contribute significantly to product progress and development, employee innovativeness, and business innovation (Malik, Froese & Sharma, 2020; Liu & Rao, 2015). As demonstrated in the study of Asrat-ul-haq and Anwar (2016), organisation that values and apply knowledge are more successful with product and marketing innovation compared with firms that pay less attention. In the literature, effective management of knowledge is identified as a sustainable pathway to innovation, thus, paying attention to the knowledge management process has been said to be of importance to the innovation process (Malik et al, 2020). Skills development, knowledge flow, acquisition of internal knowledge, transfer, dissemination, and the application of earned knowledge increases the knowledge capability of organisational members and firm innovativeness (Nascimento *et al*, 2017). According to Darroch (2005) cited in Asrat-ul-hap and Anwar (2016), the relationship between knowledge management process and innovation is close and positive, therefore, sustainable firm innovation is partly a function of continuous creation and application of new and existing knowledge.

The purpose of an effective knowledge management strategy in the manufacturing firm is to expand the scope for better products and services for sustainable competitive advantage. Centobelli et al (2017) noted that knowledge management is one important key organisational factor needed for firm innovativeness, hence, the need to closely study the construct more deeply. Technological advancement occasioned by continuous emerging knowledge has now made product innovation a source of competitiveness more than before. As such, acquisition, sharing, and application of knowledge has therefore become more important to the development of new product and services in the 21st-century fourth industrial revolution workplace. The innovation management literature in the last few years has progressively related the importance of knowledge management as the main source of long-term competitive advantage and innovation (Adegbite et al, 2020). A study conducted by Onuoha (2012) noted that one of the many benefits of knowledge management to an organisation is in the area of increasing capacity to innovate; and that firms with high capability in knowledge management are more likely to innovate than the one with low capability. For positive contribution to innovation, knowledge must be reorganized through a process that guarantees effective sharing and utilization. In the study of Malik et al (2020), the speed of innovation depends on the knowledge infrastructure and how such knowledge is being processed in line with the business objectives.

The rise of networks and technological tools that facilitate the coding, storing, and sharing of certain knowledge cheaply within and outside the organisation has further enhanced the essentiality of knowledge management (Opele et al, 2020). Ma et al (2014) described knowledge as the formalization of experience and expertise that creates new capability which enables superior performance and encourages innovation. Studies have noted that the three-man components of knowledge management (acquisition, sharing, and application) need to be properly embedded in firms' operations to enhance innovation (Nascimento et al, 2017).

According to the literature, the knowledge management process contains three components: acquisition (creation), sharing (transfer), and utilization (application). In this, Ding et al (2016) advised that organisations need to monitor and ensure optimal exploitation of each of the three components in their operations for creativity and better innovation performance.

Theoretical Model and Research Hypotheses

While the universality and generalizability of multiple concepts and scales of knowledge management are acknowledged in the literature, this study adopted the conceptualization that there are three dimensions of knowledge management following previous studies which include knowledge acquisition, knowledge sharing, and knowledge application (Obeidat et al, 2016; Liu & Rao, 2015; Darroch, 2005). The argument of this study is premised on the assertion that the knowledge management process affects product innovation, and therefore proposes a theoretical model to establish the relationships as presented in figure 1. The model essentially treats product innovation as depending on the effectiveness of the three dimensions of the knowledge management process. Specifically, the research model depicts the impact of the knowledge management process and its dimensions (acquisition, sharing, and application) on product innovation. It is expected from the model that each dimension of the knowledge management process will have a different effect on product innovation, hence, three research hypotheses are proposed.

Figure 1: Conceptual Model for Studying Knowledge Management Process and Product Innovation
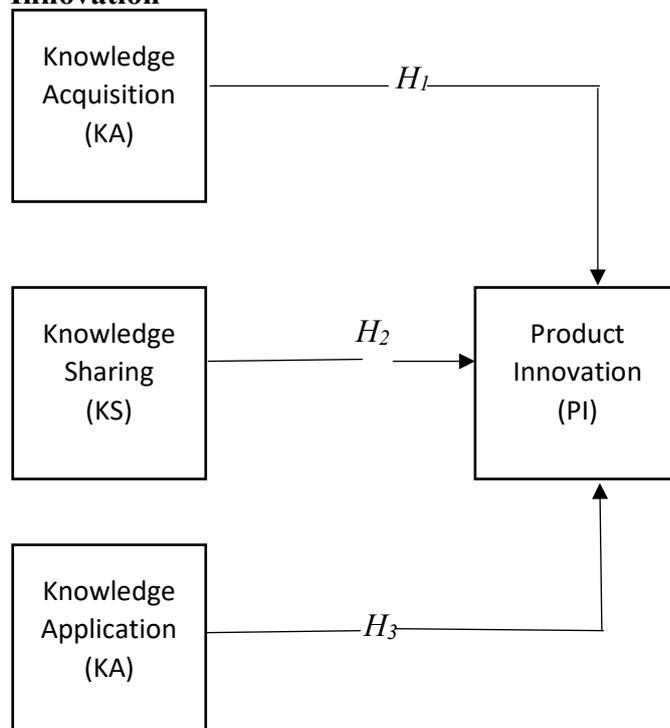
Knowledge Acquisition and Product Innovation

Decades after the proposition that knowledge will replace factors of production as the key element in the production process, literature has shown that the more an organisation absorb knowledge through acquisition and creation of new knowledge, the more innovation and competitive the business become in the face of changing business uncertainty (Lin & Rao, 2015; Ma et al, 2014). The multiple benefits of knowledge acquisition to business are not only related to firm competitive advantage. Evidence from the literature revealed that knowledge acquisition influences the adaptation of a firm to an emerging environment, facilitates new product development, increases sales, and also improves innovation processes (Hong et al, 2017). The claim that businesses need to acquire knowledge from both internal and external sources for product development and innovation is not new in the literature. Over time, studies have documented that the three components of the knowledge management process (acquisition, sharing, and application) play important role in product development and innovation (Klafke et al, 2016). Although, there are contradicting views in the literature concerning the direct impact of knowledge management process on product innovation (Muniz et al, 2019), however, certain views submitted that knowledge acquisition and creation may not impact product innovation positively except when it is moderated with strategic orientation (Asrat-ul-haq & Anwar, 2016). On the other hand, a study conducted by Waribugo et al (2016) found that knowledge acquisition, conversion, and application had a significant and direct positive impact on product innovation.

The stock at which firm knowledge increases through the hiring of new individuals, creating an R&D unit that is dedicated to new knowledge capturing does important to innovation. The positive impact of knowledge acquisition on product innovation was noted by Obediat et al (2016), in the study, continuous gathering of information and knowledge (internal/external or implicit/explicit) in relevant areas related to firm operation will enhance product innovation. Other studies emphasized that gathering knowledge from an effective source for recombination help firm to come up with innovative ideas especially in terms of new product (Klafke et al, 2016; Lin & Rao, 2015). In a related study, knowledge acquisition was found to have a significant positive effect, and play an important role in organisational learning, which is the hallmark of innovation activities (Adegbite & Okafor, 2018; Asrat-ul-haq & Anwar, 2016). For this study, the above description of the impact of knowledge acquisition is very relevant and thus provide the basis for the proposition that:

H[1]: Knowledge acquisition has a positive and significant effect on product innovation

Knowledge Sharing and Product Innovation

The process of innovation entails information transformation in which information is gathered, (acquisition), transferred (sharing), and applied (utilization) to create a way for unique

outcomes (Akintelu et al, 2021; Ma et al, 2014). In this, a sophisticated amount of data is required by the firm to design, develop and integrate customers' requirements, ideas, and preferences for a better and acceptable product. To successfully implement product development for innovation, the right and accurate information in the right format that area accessible must be made available to the right people for the right decision to be taking on product development. Also, business knowledge acquired and processed must be transferable from one functional area to another, especially between the relevant players in the product innovation chain.

Today, businesses consider and focus on innovation as the key factor to business success and competitive advantage due to its uniqueness and enduring influence on product and service acceptance and organisational sustainability (Adegbite et al, 2020; Ma et al, 2014). Because product innovation is imbued with the ability to positively increase productivity and profitability, enterprise considers it as a critical factor to increasing firm growth and profitability (Al-Husseini & Elbeltagi, 2015). In the innovation process, the literature noted that it is important to create a culture of knowledge sharing which includes activities that aim at the exchange of skills, information, and insights among organisational members (Nonaka & Toyoma, 2005). In several studies, the importance of knowledge sharing in promoting adaptative, sustainable, and innovative organisation; improving team and firm innovation performance; and most importantly enhances product development and quality service delivery has been highlighted (Asrat-ul-haq & Anwar, 2016). The benefits of knowledge sharing to innovation have been documented in previous studies across diverse cultures and organisations. As a valuable input for innovation, knowledge sharing is viewed as a resource with characteristics such as firm-specific, socially complex, and path-dependent features of innovation (Al-Husseini & Elbeltagi, 2015). Moreover, to benefit from more innovative tasks, and create a new product, employees often have to borrow skills and experience (tacit knowledge) of their counterparts during operational tasks. Therefore, a firm that promotes a knowledge-sharing culture among its members is likely to generate new ideas for developing new business opportunities, thus facilitate new product development and innovation (Klafke *et al,* 2016).

Evidence from the literature indicated that knowledge sharing fosters customer requirement at a lower cost to the business, and facilitate learning and market orientation resulting in improvement in market sensing and innovation (Hong et al, 2017). Knowledge management remains a critical activity for business growth because the overall effectiveness and efficiency of the knowledge management process depend on how well the existing know-how is shared and transferred among members of an organisation (Muniz et al, 2019). A process where members of a team or individual share ideas, information, and suggestions that are relevant to operational tasks for better performance – knowledge sharing (Asrat-ul-haq & Anwar, 2016). In a study conducted by Ding et al (2015), knowledge sharing was reported as being the basis for product innovation. The study which was conducted within the industrial hub in china noted

that knowledge sharing had some significant positive effect on product innovation. The challenge with knowledge management and innovation research in most developing and emerging economies is that most studies do not unpack the knowledge management process during the investigation, thereby assuming that each dimension of the knowledge management process makes an equal and positive contribution to the innovation process. A comparative study conducted by Muniz et al (2019) reaffirms the critical role of knowledge sharing in continuous improvement and incremental innovation in a shop floor operation. The study established that sharing of knowledge minimizes production error, encourages workers to utilize the know-how and experience from the previous task, thus, promote mastery and creative tendencies in the production plant. Based on Muniz et al (2019) and other findings as discussed above, this study proposed that:

H_2: Knowledge sharing has a positive and significant effect on product innovation

Knowledge Application and Product Innovation

The role of knowledge application in the manufacturing business has been recognized based on the benefits knowledge delivers in sustaining businesses. Knowledge application help to minimize the complexity involved in the process of interaction involving large numbers of employees and teams due to competition in resource utilization within the knowledge flow system (Obeidat et al, 2016). Opele et al (2020) described knowledge application as the process in which organisation and its members use and apply knowledge for operational purposes in business processes to achieve a set goal. The process of engaging in vigorous and appropriate information management with the view to creating a competitive advantage and satisfying customers' demand through existing knowledge in the organisation is what knowledge application depicts (Darroch, 2005).

Practically, when an organisation process information collected about customer needs and market trends and show responsiveness with the view to create an opportunity resulting in process and product innovation – knowledge application (Adegbite & Okafor, 2018; Ma et al, 2014). To improve the process of product development and innovation, organisation must utilize already acquired knowledge (Kuo, 2011). Evidence from the literature suggested that knowledge application is an essential factor for firm innovation (Darroch, 2005). A study conducted by Bashir and Farooq (2019) found that knowledge application assists to convert existing and new skills, and organisational knowledge into valuable output in the form of goods or services. As note by Centobelli et al (2017) knowledge application serves as an enabler for businesses to produce acceptable products in line with consumer and market demand. Creating new capability through harmonization and utilization of new knowledge is an indication of performance improvement and this often results in a breakthrough in product development or new ways of service delivery (Hong et al, 2017; Klafke et al, 2016). Documented evidence in the literature emphasized that effective application and utilization of knowledge (intellectual assets) of the organisation enhances the decision-making process, improves the level of

efficiency in operation, and also encourages involvement and commitment in creative activities (Adegbite et al, 2020).

According to Opele et al (2020) knowledge application entails creating more values through the utilization of knowledge resources of the firm through knowledge adjustment, integration, and absorption. It involves a constant review of new innovative efforts to facilitate the application of technical knowledge, and quick response to the change in product or service as demanded by the market (Akintelu et al, 2021; Klafke et al, 2016). Knowledge application help organisation modularise technical knowledge and make the innovation process more orderly and accelerate the realization of innovation activities in the organisation (Bashir & Farooq, 2019). According to Byukusenge and Munene (2017), the effective application of knowledge in the organisation is instrumental to the process of creating new product and services, and facilitate a better response by organisation to consumer and market demand. From the above discussion and evidence from the literature, this study proposed that:

H_3: Knowledge application has a positive and significant effect on product innovation

Methodology

Design, Population, and Sample

The primary purpose of this study was to identify the influential relationship among variables, hence the use of a quantitative approach as suggested by Creswell and Creswell (2017). This study is cross-sectional; data was collected using a self-administered questionnaire. The population was drawn from employees in two manufacturing plants in Nigeria. A survey questionnaire was designed and administered to respondents. More than 360 respondents were approached, out of which 351 copies of the questionnaire were duly completed and returned for analysis. This represents a 97.2% response rate which is considered good for the study.

Instruments and Measures

This study adopted scales used to measure knowledge management process and product innovation from previous studies with minor modifications to ensure contextual consistency. For all constructs, a five-point Likert scale response option ranging from 5-1 'strongly agree' to 'strongly disagree' was used to rate all items in each construct. The three-dimension of knowledge management process was measure using 15-item statements drawn from Darroch (2005). In the Darroch study, the knowledge management process was categorized into acquisition, sharing (dissemination), and application. Five items were used to measure knowledge acquisition (KA), respondents were asked to rate their opinion on questions such: how long it takes the organisation to respond to customer's preferences, and change. For knowledge sharing (KS), this was measured by 5-item statements in which respondents were

asked to rate how often the organisation engages employees in knowledge transfer activities such as coaching and training sessions. Similarly, knowledge application (KAP) was measured using 5-item statements focusing on how quickly the organisation responds to change in technology and its adaptation. Furthermore, product innovation was measured using 5-item statements adapted from the study of Tan and Nasurdin (2010). The benchmark for measuring innovation by OECD (2005) was followed, therefore, products that were introduced within three years and/or improved upon within the same period were considered as innovations in the study.

Data Analysis

Data collected in this study were analyzed using IBM Statistical Package for Social Science (SPSS), and SmartPLS version 3.2.8. The partial least squares structural equation modeling (PLS-SEM) was used in line with the recommendation of Roldan and Sanchez-Franco (2012). Since the focus of the study was to predict and explore the dependent variables to explain the maximum variance, PLS-SEM is an appropriate technique because of its predictive-oriented approach. Also, the inner and outer of the models (measurement and structure) can be measure simultaneously using this technique. Most importantly, this study used the PLS-SEM method because the technique can provide more accurate results with the use of a relatively small sample size, hence its appropriateness for the study (Hair et al, 2016).

Common Method Variance Bias Test

As suggested in the literature, conducting a common method variance (CMV) test is an important step in a survey study (Podsakoff, MacKenzie & Podsakoff, 2003). In this study, a modern and more reliable approach as recommended by Kock (2015) was adopted by executing a full collinearity assessment test in Smart PLS. This is a departure from the commonly known single-factor test often used to determine whether the latent constructs used in a study are causally related and are truly distinct from each other (Ab-Hamid, Sami & Mohmad-Sidek, 2017). All variance inflation factors (VIF) for this study are less than the threshold value of 3.3 as recommended by Koch (2015). This is an indication that the model is devoid of common method bias issues.

Reliability and Validity Measurement

The internal consistency, reliability as well as convergence, and discriminant validity of all constructs were tested using the outer model (measurement) as stated above (Sarstedt, Ringle & Hair, 2017). The composite reliability index (CRI) and Cronbach alpha (CA) results showed that all values were above 0.60 recommended by Cohen (1988) suggesting that the values are above the critical value threshold recommended in the literature. For the standard factor loading, all items of the constructs are above 0.70, with the average variance extracted for all constructs also above 0.50. Table 1 presents the results of the reliability and validity.

Table 1: Reliability and Validity of Constructs

Latent Construct	AVE	Composite Reliability	Cronbach's alpha
Knowledge Management Process			
Knowledge Application (KA)	0.692	0.935	0.915
Knowledge Sharing (KS)	0.665	0.917	0.877
Knowledge Application (KAP)	0.743	0.927	0.901
Innovation			
Product Innovation (PI)	0.684	0.928	0.905

According to Sarstedt et al (2017), discriminant validity described a situation when constructs used in a model are divergent from one another. For a better and consistent outcome, the heterotrait-monotrait (HTMT) ratio and Fornell and Larcker criterion methods were used to evaluate the discriminant validity of the constructs. In line with Henseler, Ringle, and Sarstedt (2015), the ratio of all correlation was calculated and the results of the HTMT ratio is below 0.85, indicating a no discriminant validity issue. Also, using the Fornell and Larcker (1981) criterion, the square root value of average variance extracted must be larger than the correlation value of that construct. Tables 2 and 3 show the detailed results of the discriminant validity using both methods.

Table 2:   Heterotrait-Monotrait (HTMT) Discriminant Validity

Constructs	PI	KA	KS	KAP
PI	-			
KA	0.154	-		
KS	0.199	0.748	-	
KAP	0.224	0.484	0.472	-

Notes: PI= Product innovation; KA=Knowledge acquisition; KS=Knowledge sharing; KAP=Knowledge application

Table 3:   Discriminant Validity (Fornell-Lacker Criterion)

Constructs	PI	KA	KS	KAP
PI	0.787			
KA	0.066	0.816		
KS	0.089	0.427	0.833	
KAP	0.097	0.431	0.441	0.871

Notes: PI= Product Innovation; KA=Knowledge application; KS=Knowledge sharing; KAP=Knowledge application

Structural Model Analysis

The inner model (Structural) as indicated in the previous section show the causal association between the exogenous and endogenous constructs of the study (Hair et al, 2016). In this, the explanatory power (R^2), predictive relevance (Q^2), and path coefficient (β-values) were assessed. The results show that the explanatory power (PI= 0.392) of the model was adequate. Also, the model has a decent predictive relevance for the dependent construct as the outcome of the blindfolding procedure for Q^2 value was larger than zero. Further, the standard root means square residual value (0.053) is under the threshold value of 0.080, hence, the overall fitness of the PLS path model is affirmed (Sarstedt et al, 2017). The significance of the three hypotheses was tested as presented in table 4. All the hypotheses' paths (H_1=0.128; H_2=0.136; and H_3=0.417) of the knowledge management process to product innovation were significant. The above results imply that the knowledge management process and its dimensions (Knowledge acquisition, Knowledge sharing, and knowledge application) have a positive effect on product innovation in the sampled organisations. See table 4 for a detailed assessment of the results.

Table 4:   Hypotheses Assessment

Hypotheses	Paths	B	T	Decision
H_1	KA – PI	0.128**	2.847	Supported
H_2	KS – PI	0.136**	2.876	Supported
H_3	KAP – PI	0.407***	8.865	Supported

Notes: PI= Product innovation; KA=Knowledge acquisition; KS=Knowledge sharing; KAP=Knowledge application; **$p<0.05$; ***$p<0.01$

Figure 2: Structural Model Results
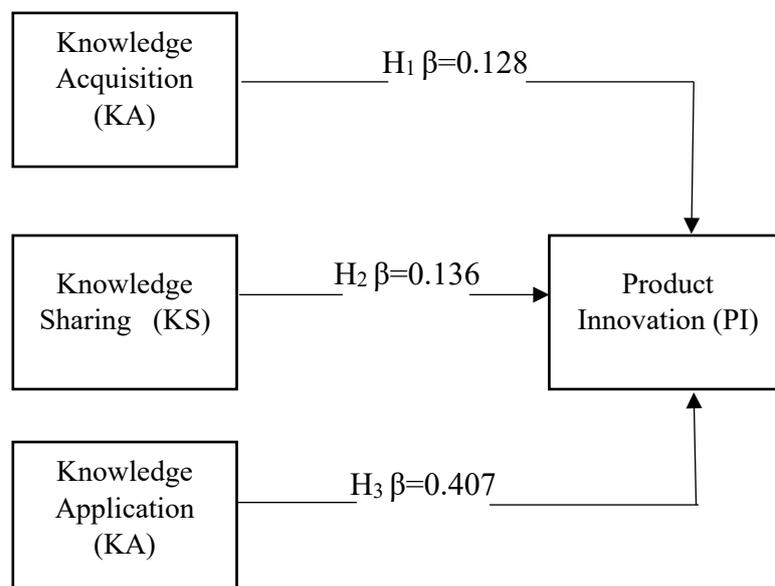
Discussion of Findings

This study examines the effect of the knowledge management process (KMP) on product innovation (IP) and elucidates the specific impact of each dimension of the knowledge management process on product innovation in the manufacturing sector. The results from this study revealed that the knowledge management process has a positive and significant effect on product innovation. This study found that the three dimensions of knowledge management practices: knowledge acquisition ($\beta=0.128$), knowledge sharing ($\beta=0.136$), and knowledge application ($\beta=0.407$) have a positive relationship with product innovation. The foregoing provides support and affirmed findings from previous studies in a broader context where knowledge management has been found to have significantly enhanced product innovation (Adegbite *et al*, 2020; Muniz *et al*, 2019; Al-Husseini & Elbeltagi, 2015). It is important to emphasize that the outcome of this research is in contrast with the study of Waribugo et al (2016) whose findings conclude that out of the three dimensions of the knowledge management process, knowledge acquisition is more crucial and important than the other two dimensions in terms of their contribution and impact on product innovation. Although the findings (Waribugo et al, 2016) showing more strength between knowledge acquisition and product innovation is crucial, however, in this study, the three dimensions of the knowledge management process have a strong and positive relationship with product innovation in the manufacturing plants.

In a broader sense, advanced knowledge posits that knowledge acquisition, sharing, and application (KMP) are important tools to promote collaborations among employees; enhance operational, economic, and non-economic performance aspect of the business; and help to improve the attitude and ability of workers which will, in turn, lead to performance growth and innovation. As stated by Kuo (2011), for improved performance and innovation that will achieve the highest level of customer satisfaction and business growth, organisations must apply existing knowledge efficiently and responsively. The knowledge management process has been described in the literature as an important resource to empower the organisation to produce innovative products through digital manufacturing technology (Klafke et al, 2016). The results from this study further strengthen the position of previous studies on the impact of the knowledge management process on innovation. According to Bashir and Farooq (2019), Adegbite and Okafor (2018), and Nonaka and Toyoma (2005) when knowledge is generated, share, and applied in the organisation, learning occurs which often changes behaviours resulting in creativity and innovation. Furthermore, this research demonstrates that in the manufacturing plants surveyed, while the organisations ensure the availability of knowledge, employees are also willing to share their skills, insights, experience, and expertise among members which enable the organisation to improve on the existing product and/or generate fresh ideas resulting in a new product.

Conclusion

This study aimed to investigate the effect of the knowledge management process on product innovation using a sample from manufacturing plants in Nigeria. The results indicate that knowledge acquisition, knowledge sharing, and knowledge application are important factors to enhance product innovation in the manufacturing business. Based on the findings and discussion above, it can be concluded that the knowledge management process and its dimensions do play a crucial and important role in product development and innovation especially at this time that the only sustaining resource that can guarantee and provide a competitive advantage for organisation in the current era is knowledge capital. It is therefore important for manufacturing businesses to design and adopt an effective knowledge management process system in which each dimension focuses on how to improve the operational efficiency of the organisation towards better performance including innovation.

Theoretical and Practical Contribution

This study extends the existing body of knowledge by examining and validating a conceptual framework that incorporates specific dimensions of the knowledge management process to measure product innovation within the manufacturing organisations. The knowledge management literature regarding the manufacturing business in Nigeria often considered the construct as a bundle of resources without a rigorous investigation into the specific contribution of each dimension of the knowledge management process to product innovation. Practically, the findings of this research can serve as a useful guide for practitioners and managers in manufacturing organisations. It can help in mobilizing the design and mainstreaming of the three-core knowledge management dimension into the administrative actions to transform knowledge management practice in the organisation for better innovation performance. On the strength of the foregoing, there could be a recommendation that management dedicates additional resources and support in developing the workforce through the knowledge management process (acquisition, sharing, and application) as an essential tool to enhance product innovation.

Limitation and Suggestion for Further Research

The circle of this research is time-bound with restrictions in terms of resources and access to the entire production plants of the sampled organisations, thus, the study has some limitations that may prompt future studies. The first and major limitation was that the study was restricted to firms within an industry in the manufacturing sector in one country. It is suggested that the boundaries of this typology of research be extended to cover the entire manufacturing sector with a rigorous methodology aimed at providing comprehensive information about the relationship between the knowledge management process and product innovation. Furthermore, a similar study can be conducted in other sectors (i.e., service, telecommunication, government, agriculture, etc.). The results from other sectors can be

compared with that of the manufacturing sector to enhance the generalizability of the effect. Secondly, the cross-sectional nature of this research was not without shortcomings as only causal connections were possible from the results. Future research could attempt a longitudinal or experimental study in other to generate a more conclusive outcome.

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