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ANALYSIS OF MANUFACTURING METHODS USING MARKET DEMAND DYNAMICS

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ABSTRACT

This study analysed manufacturing strategy based on market dynamism. It showed how the knowledge of price and demand changes of products can be used as a tool to identify appropriate manufacturing processes and strategies for production. Using a qualitative methodology, specifically, a case method, the plausible alignment between the different product categories, manufacturing process and strategies are established. The contingency theory and the perspective of the theory of swift, even flow (TSEF) are used as the theoretical bases for this study. The result shows an alignment of the product type with the process and strategy types for the functional-necessity product category and some deviations for the innovative-functional product category.

JEL: M1, L1, L6

KEYWORDS: Manufacturing method, Product-Process Matrix, Functional-Necessity Products, Innovative-Luxury Products, Price Elasticity of Demand

INTRODUCTION

Manufacturing methods in this context denote the production process and strategy alignment or combination of products. This study assessed manufacturing methods in the context of the product life cycle and the manufacturing process in relation to price elasticity of demand. In essence, this study links the concept of manufacturing strategy with the concept of price elasticity of demand. This work builds on the works of Hayes and Wheelwright (1979a) and Fisher (1997). Hayes and Wheelwright introduced the concept of the product-process matrix (PPM) as a tool for analyzing the relationship between the product life cycle and the manufacturing process. Fisher, on the other hand, classified products into two major categories; functional and innovative products.

The attribute of demand certainty or uncertainty of goods could be applied to functional and innovative products respectively and this could serve as a good tool for manufacturers in planning production. This could also help in determining the kind of production strategy or in general the supply chain strategy to employ. This study emphasizes the use of the TSEF which is related to the productivity of plants, the concept of price elasticity of demand from the microeconomic theory of supply and demand and the concept of "fit" in contingency theory in determining manufacturing strategy choices of firms.

While this study builds on existing research in manufacturing strategy, it deviates from prior research based on several critical dimensions. First, this study adds to existing literature because it incorporates the economic concept of price elasticity of demand in the manufacturing processes. Hull (2005) provided a theoretical justification for the use of elasticity concept from microeconomic theory for analysing supply chain performance. Second, this study helps to bridge the gap between the fields of operations management and economics by making use of the concept of price elasticity of demand and its implications in manufacturing strategy. Okhuysen and Bonardi (2011) emphasized the need for researchers to use combinations of ideas or blends of theories to advance new insights and develop novel hypotheses that can ultimately be tested empirically. Similarly, in order to achieve a more coherent and progressive body of knowledge, it has been suggested that researchers should develop inter-or-intradisciplinary perspectives in research studies (Cornelissen and Durand, 2014, Hillman, 2009). This study thereby integrates the two fields of operations management and economics. Third, this study further analyses the framework of the product-process matrix (Hayes and Wheelwright, 1979a) by incorporating the concept of price elasticity of demand and the product types (Fisher, 1997) to develop a new framework.

One of the objectives of this study is to help operations/production managers to establish the link between the knowledge of economics' concept of price elasticity of demand and its implications in determining efficient manufacturing strategies for products. In addition to the aforementioned, this study helps to bring more insight into how the knowledge of market demand and product characteristics can help in determining manufacturing strategies suitable for different product types. Hence, it is important for firms to make complementary market-manufacturing choices (Hayes and Wheelwright, 1979a, Mellor, Hao and Zhang, 2014; Sardana, Terziovski and Gupta, 2016, Stavrulaki and Davis, 2010). Another objective of this study involves building on the already established link between the product types, relevant production strategy and production process while introducing the concept of price elasticity of demand. Hence, the performance implications of the different linkages are also analysed.

Product-process matrix has been a useful tool for product-process alignment in extant literature (Gualandris and Kalchschmidt, 2013, Helkiö and Tenhiälä, 2013). Furthermore, another objective of this work is to use the product-process matrix concept to further analyze the effect of product attribute in the context of "price elasticity of demand" on the production process. This leads to the establishment of a "product-process-price elasticity matrix (PEM) " to account for product type-price elasticity of demand link. The work is a build upon the already well-established framework of the product-process matrix which has already been validated in extant literature (Safizadeh, Ritzman, Sharma, and Wood, 1996).

Subsequently, this study provides a theoretical justification for the relationships between innovative and luxury goods also functional and necessity goods. That is, the link between innovative products and luxury goods likewise the relationship between functional products and necessity goods are theoretically established. Also, this study developed research propositions that were qualitatively analysed based on the case study. Hence, the research questions, First, "what are the relationships between the product types and manufacturing strategies' choices? Second, " what are the performance implications of these choices?"

The remainder of this study concentrates on some other critical aspects such as the literature review, theoretical foundation, methodology, and analysis. Finally, the study concludes with implications for managers, research limitations and future research directions.

LITERATURE REVIEW

It has been emphasized in extant literature how manufacturing processes provide strategic roles to support companies' competitive advantage by giving an edge in the market place (Hill 1993, Voss 1995). Manufacturing strategy has attracted the attention of many scholars, different research methodologies and has been defined in different ways by various scholars (Chatha, Butt and Tariq, 2015, Hayes and Wheelwright, 1979a, Helkiö and Tenhiälä, 2013, Safizadeh et al.,1996; Skinner,1969)

One of the interesting works in the area of manufacturing strategy is the work by Hayes and Wheelwright (1979a,1979b) on the product-process matrix. The authors suggested in their landmark work on the product-process matrix, that product plans and process choices should be linked together and that this linkage ensures better production performance and competitive advantage. Similarly, several extant literatures have asserted that the choice of the type of manufacturing strategy has impact on performance (Jayaram et al., 2014, Safizadeh et al.,1996, Safizadeh, Ritzman and Mallick., 2000, Safizadeh and Ritzman, 1997, Kim et al., 2013, Ward and Duray, 2000).

According to Spenser and Cox (1995), many researchers have used the product-process matrix to postulate relationships among physical characteristics, policy and procedures, and production planning and control systems in the study of the product lifecycle. The product-process matrix shows a movement from the jumble flow (job shop) with a low volume-low standardization product structure to a continuous flow with a high volume-high standardization product (Helkiö and Tenhiälä, 2013, Safizadeh et al., 1996). Hayes and Wheelwright (1979b, p.129) proposed that the "product-process matrix was an excellent vehicle for understanding why manufacturing problems occur and how they can be minimized". Moreover, the distinction of the product lifecycle concept from the process lifecycle aspect elaborates the different product-process options available to manufacturing outfits (Hayes and Wheelwright, 1979a). Product-process matrix helps in investment decisions, new market entry decisions and market opportunities that are consistent with different product-process options (Hayes and Wheelwright,1979a, Stark, 2015).

This study builds on the foundation that product-process matrix accounts for the production strategies that suits the different product categories. This exposition is an interesting approach to the usefulness of the matrix. Products have been categorised into two major classes which are functional and innovative products (Fisher, 1997). Functional products are staple products that people buy in a wide range of retail outlets, characterised by relatively predictable demand, they satisfy basic needs and are otherwise classified as necessity goods in this study. Necessity goods are goods characterized with low responsiveness of demand to changes in price because they are needed anyway (Arnold, 2007, Baumol and Blinder, 1979, Mankiw, 1998, McConnel, Brue and Barbiero, 2005) and have high demand predictability. The aforementioned attributes of functional products are however in contrast to those of luxury goods or innovative products because they are goods you can do without (Arnold, 2007, Wagner, Grosse-Ruyken and Erhun, 2012). In extant literature, it has been emphasized that the knowledge of price elasticity of demand could help managers to find the optimal product-mix solution (Guo and Ma, 2014, Tsai et al., 2010).

Theoretical Foundation

This study makes use of the contingency theory and the TSEF to analyse the relationships between product types, process types and the concept of elasticity of demand. With the combination of the concepts of fit in contingency theory and the degree of variability from the TSEF, an efficient manufacturing strategy's choice can be made by managers in manufacturing firms.

Contingency Theory

According to Van de Ven (1979), the fit notion which originated from the contingency theory and the population ecology theory has become an important abstraction for other management theories. The concept of fit has served as an important building block for theory construction in several areas of research (Sousa and Voss, 2008, Venkatraman, 1989). Venkatraman (1989) established a conceptual framework and identified six perspectives of fit as fit as moderation, fit as mediation, fit as matching, fit as gestalts, fit as profile deviation and fit as covariation.

The perspective of fit as matching and moderation are the perspectives we are interested in this study. This matching and moderation perspectives are otherwise known as the selection and interaction approaches respectively (Drazin and Van de Ven, 1985, Venkatraman, 1989). The interaction approach sees "fit as the interaction of pairs of organisation context and response variables which affects performance" (Souza and Voss, 2008, p.703). These perspectives are important in this study because the goal is to align different manufacturing strategies with product types and to also analyze their performance implications.

From extant literature, the concept of fit can be found to be embedded in the product-process matrix which signifies that congruence between the product types and the production process results in the ideal manufacturing process (Hayes and Wheelwright,1979a). Safizadeh et al. (1996) in their study on 144 manufacturing plants in the U.S empirically established that there is an improvement in performance of on-diagonal plants as they progress from job shops to continuous flow shops and that manufacturing performance suffers when there is a mismatch between product plans and process choices. Pekka and Antti (2013) using survey from 151 manufacturing plants analysed the product-process matrix model from the contingency theory perspective and its performance implications. Similarly, Sohel and Schroeder (2002) empirically verified and found a significant relationship between the product and process structure using data collected from 1287 plants.

Theory of Swift, Even Flow

TSEF by Schmenner and Swink (1998, p.102) states that "the more swift and even the flow of materials through a process, the more productive is the process". This theory implies that productivity rises with the speed by which materials flow through a process and falls with increase in variability in demand and process's operations (Schmenner and Swink, 1998).

Schmenner and Swink (1998) proposed a variant of the product-process matrix with the implication of TSEF based on the productivity of plants. Schmenner and Swink (1998) argued that TSEF redefines the horizontal axis of the product-process matrix as demand variability by moving from high variability to low variability (from highly customized products with irregular demands to commodities with steady demands). This theory also redefines the vertical axis of the matrix as the speed of flow, from slow to swift. This redefinition implies that the lower right portion of the matrix represents those operations that combine low demand variability with swift materials flow, a combination that according to TSEF is the most productive and has the most output per unit of input resource (Schmenner and Swink, 1998). This confirms the study by Schmenner (2004) that the variability of a process affects performance in quality, quantities and timing.

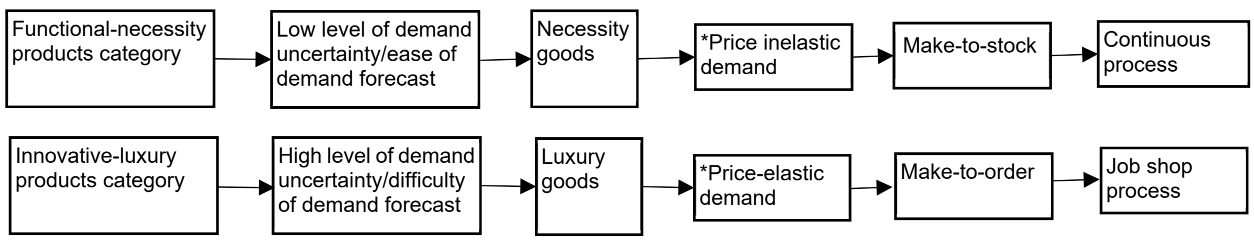
The perspective of TSEF has been used in several studies both theoretically and empirically (Bendoly and Keafer, 2004, Frendendall et al., 2009, Schmenner, 2001, Seuring, 2009). TSEF has been used to analyse the impact of variability from the perspective of risk to performance (Chen, Sohal and Prajogo, 2013). TSEF has also been used to access the effect of information technology on streamlining health operations (Dewaraj, Ow and Kohli, 2013).

Functional and Innovative Products

Fisher (1997) divided products into two categories namely; functional and innovative products. Functional products are the staples that satisfy basic needs with stable predictable demand. The predictable demand of these products makes market mediation to be easy because the nearly perfect match between supply and demand can be achieved. Innovative products, on the other hand, are products characterized by short lifecycles, many varieties, high customization, low volume and volatile demand (Mankiw, 1998, McConnel, Brue and Barbiero, 2005, Mellor, Hao and Zhang, 2014).

The supply chain for the functional products have attributes such as efficiency, inventory minimization and high average utilization rates (Fisher, 1997). However, innovative products require supply chains that are characterized by responsive processes coupled with strategic stocks for meeting fluctuating demand (Fisher, 1997). In essence, functional products require efficient processes while innovative products require responsive processes (Fisher, 1997). Hence, the efficient production process for functional products is the continuous process combined with the make-to-stock strategy (Figure 1) as its corresponding production strategy (Fisher, 1997). Figure 1 shows the link and the expected alignment between the product types, the microeconomic classification of goods, the price elasticity of demand, the production strategy and the production process. The process choice for innovative products is a responsive process which is the job shop or jumbled flow process (Figure 1) with a corresponding make-to-order strategy (Aitken, Childerhouse and Towill, 2003).

Figure 1: Theoretical Model



This figure shows the link and the expected alignment between the product types, the microeconomic classification of goods, the price elasticity of demand, the production strategy and the production process. Source: Author

The extension of the product-process matrix (Table 1) with the incorporation of the concept of price elasticity of demand based on the concept of "fit'' can be used for analyzing the two product types (functional and innovative products) with the respective production strategies. Table 1 shows the addition of the price elasticity of demand in the product-process matrix without the inclusion of the intermediate columns for the assembly lines for higher volume, standardized products and batch process for low volume, multiple products. Lee (2002) emphasized that the characteristics of functional products include; low demand uncertainty, stable demand, long product life, low product variety, high volume per stock keeping units among others whereas the innovative products exhibit contrasting attributes of the functional products.

Table 1: An Extension of the Product-Process Matrix to create the Product-Process-Price Elasticity Matrix (PEM)

Types of Products	Price Elasticity of Demand	Process Structure & Process Lifecycle Stage	Low Volume, Low Standardization, One of A Kind Commodity	Very High Volume, Very High Standardization Commodity (Commodity Products)
Innovative-luxury products category	**Ep>1**	Jumbled flow (Job Shop)	Product A	-
Functional-necessity products category	**Ep<1**	Continuous flow	-	Product B

Adapted from Hayes and Wheelwright (1979a) This table shows the incorporation of the price elasticity of demand in the product-process matrix without the inclusion of the intermediate columns for the assembly lines for higher volume, standardized products and batch process for low volume, multiple products.

Similarly, Safizadeh et al. (1996) segregated process types suitable for products based on the demand characteristics. The use of job shop process for standardized or homogenous products is characterised as a misalignment (Safizadeh et al., 1996). These authors categorized the job shop process as a suitable option for products with demand characteristics that are uncertain, heterogeneous, with high variance, low volume, frequent supply changes and shorter lifecycle. Emphasis is placed on flexibility and quality for job shop process (Hayes and Wheelwright, 1979a). On the contrary, the continuous process is proposed viable for products with demand characteristics which are certain, homogenous in nature, with low variance, high volume, slow design change and longer life cycle. Reliability, predictability and cost are the focus for a continuous process (Hayes and Wheelwright, 1979a). Interesting inferences and linkages could be drawn from the attributes of the functional products, innovative products, job shop processes and continuous processes.

Hull (2005) quantified the impact of economic forces on the performance of a supply chain using the concept of elasticity by adapting a supply chain to the market characteristics of its products. He proposed that the supply and demand considerations create a direct link to economics. Furthermore, using the concept of elasticity, a high elasticity is associated with flexible manufacturing, short lead times and strategic uses of inventory. However, low elasticity is associated with long lead times, fixed manufacturing schedules, and operating near capacity with limited ability to expand or store inventory (Hull, 2005).

The alignment of the product types, process types and elasticity concept (Figure 1) based on the discussed attributes from extant literature is the basis of the links made between products-process-strategy in this study. Therefore, functional products that are characterized by a stable and predictable demand aligns with the economic concept of price inelastic demand (low elasticity) while innovative products which are characterized by unstable and variable demand exhibit price elastic demand (high elasticity). Price inelastic demand based on the degree of necessity means that product's demand by consumers does not really change with changes in price (Arnold, 2007, Baumol and Blinder, 1979, Cai, Chen, Xiao, Xu and Yu, 2013, Li, Zhu and Huang, 2009, Mankiw, 1998). This translates into a kind of predictable demand for the producer while the contrast, unpredictable demand is the attribute of innovative products. This distinguishing attributes of stability and predictability of demand for functional products make it possible to establish a link between necessity goods and functional products. In contrast, the unpredictable demand characteristics of innovative products align with the concept of luxury goods.

The elasticity measure, specifically the price elasticity of demand establishes a link between manufacturing strategy and the existing microeconomic theory (Hull, 2005). Necessity goods as defined by nature of the goods or based on the degree of necessity have inelastic demands and luxury goods have elastic demands (Baumol and Blinder, 1979, Mankiw, 1998, McConnel, Brue and Barbiero, 2005). In view of these extant literature studies, the researcher proposes the following:

Proposition 1: A functional product that is characterised by price inelastic demand is a necessity good, hence, the functional-necessity product category.

Proposition 2: An innovative product that is characterised by price elastic demand is a luxury good, hence, the innovative-luxury product category.

Similarly, the relationship between the product and process life cycles indicates a path from the jumble flow (job shop) with a low volume-low standardization product structure to a continuous flow with a high volume-high standardization product (Hayes and Wheelwright, 1979a). Aitken, Childerhouse and Towill (2003) established a link between the continuous production process and make-to-stock production strategy while a job shop process is linked to the make-to-order production strategy. Safizadeh et al. (1996) established an alignment between the job shop process as a viable production process for products characterized by high level of uncertainty of demand, short life cycles, low level of standardization (heterogeneous nature) while the continuous process is viable for the category of products that are characterised by high demand certainty. This unique attributes of "standardization" in volume production and the "demand pattern" of a product could be used to determine the production strategy and the production process of each category of goods based on the knowledge of the price elasticity demand. This leads to the research propositions that:

Proposition 3: The functional-necessity products category are best produced using the continuous production process and make-to-stock production strategy.

Proposition 4: The innovative-luxury products category are best produced using the job shop production process and make-to-order production strategy.

Wagner, Grosse-Ruyken and Erhun, (2012) have analysed the impact of supply chain-fit on financial performance. According to Safizadeh et al. (1996), a mismatch between a production process and strategy will reduce manufacturing performance. Similarly, using the idea of TSEF, increased variability between processes will affect performance in quality, timing and quantity (Chen, Sohal and Prajogo, 2013, Schmenner, 2004).

Previous studies have emphasized quality, cost efficiency, delivery and flexibility as the major competitive capabilities for manufacturing firms (Ferdows and De Meyer, 1990, Wong, Boon-itt S. and Wong, 2011). These measures of operational performance are the four traditional competitive capabilities required by manufacturing firms in determining their performance levels (Ferdows and De Meyer, 1990). Hence, a mismatch between production processes and strategies will affect cost, quality, delivery and flexibility of a manufacturing firm negatively. The traditional perspective of operational performance cuts across four indicators, in the order delivery, cost, quality and flexibility (Daniel et al., 2012, Wong, Boon-itt. and Wong, 2011). The first criterion for determining operational performance which is the order delivery is the focused operational performance indicator in this study. Therefore, the researcher proposes the following:

Proposition 5: A match between functional-necessity products, continuous production process and make-to-stock production strategy will improve operational performance.

Proposition 6: A match between innovative-luxury goods, job shop production process and make-to-order production strategy will improve operational performance.

METHODOLOGY

The case study design is used for this study. Specifically, a single case is adopted for in-depth analysis of this study since situational representativeness is more important than demographic representativeness (Dorothy, 2003; Eisenhardt and Graebner, 2007; Eisenhardt, 1989; Siggelkow, 2007; Yin,1994; Yin, 2009). The case study method fits the exploratory nature of this study by giving a rich and robust analysis of the research subjects (Miles and Huberman, 1994, Yin, 1994, Yin 2003). The case is analysed by using pseudonyms (Creswell, 2009). The product SANFUNC is the pseudonym given to the functional-necessity product in SAN manufacturing firm. The product SANINNOV is the pseudonym given to the innovative-luxury product category in SAN manufacturing firm. There are two types of SANINNOV products named SANINNOV 1 and 2.

Firm SAN is an indigenous manufacturing firm which is into the production of feminine hygiene products. Specifically, the firm is into the production of women and baby products. The indigenous brands are popular in the country and are of high quality. This firm is chosen as the case study because it is one of the rare firms in Nigeria that is into the production of both functional and innovative products.

The informants from firm SAN include the operations/production manager, sales/marketing manager, assistant marketing manager and the quality assurance manager. Each informant was interviewed for an average of one hour. The informants were allowed to express themselves when interrogated. However, the interview guide (Appendix 1) contains the open-ended questions used for carrying out the interviews (Kotzab, 2005). Also, an archival data which showed prices and quantity demanded from the year 2013 to 2017 of SANFUNC, SANINNOV 1 and 2 is given as an additional document by sales/ marketing manager in SAN firm for the purpose of triangulation (Eisenhardt, 1989). Several observations were made during the visit to the factory with the operations/production manager.

RESULTS AND DISCUSSIONS

Functional products are staples required by the majority of people for personal use or consumption. The operations/production manager emphasized the following attributes of the product SANFUNC which includes:

"the demand is relatively constant, highly predictable and it is available everywhere nationwide because it is demanded by regular people".

Innovative products are highly customised products characterised by unpredictable demand and short life cycle. The operations/production manager emphasized the following attributes of the products SANINNOV 1 and SANINNOV 2 which include:
" the products are not for everybody and used mostly among elites and younger women"
"……..they are not for general public"

Based on the established proposition, the case study shed more light on whether the research propositions in this study should be accepted or refuted.

Linking Products to Price Elasticity of Demand

The price elasticity of demand attribute is analysed based on the proxy that shows the level of demand reduction based on price increase (Baumol and Blinder, 1979, Mankiw, 1998, McConnel, Brue and Barbiero, 2005). A product is inelastic when the price elasticity of demand coefficient is less than 1. That is, the percentage change in price is more than the percentage change in quantity demanded. This shows that the good is a necessity good and the price elasticity of demand is inelastic. Hence, the demand is relatively predictable. On the other hand, a product is elastic when the price elasticity of demand coefficient is greater than 1. That is, the percentage change in price is less than the percentage change in quantity demanded. This shows that the good is a luxury good and the price elasticity of demand is elastic. Hence, the demand is highly unpredictable. The propositions 1 and 2 are analysed based on the archival data on the percentage reduction in demand given a price increase.

Proposition 1: A functional product that is characterised by price inelastic demand is a necessity good, hence, the functional-necessity product category.

The result showed that there is no significant reduction in demand for SANFUNC when there is an increase in price. The marketing manager confirmed these statements:
" we have about an average of 7.5% reduction in the demand for SANFUNC whenever there is about 30% increase in price"
"……it is a necessity good because people need it"

Hence, we had the price elasticity of demand coefficient of 0.25 which is lower than 1. The low percentage reduction in demand for SANFUNC because of increase in price showed that this product is a necessity good. The degree of responsiveness to changes in price is very low. Hence, SANFUNC's price elasticity of demand is inelastic. SANFUNC combines the attributes of a functional product and necessity good which include high demand predictability and low price elasticity of demand. This analysis supports the established proposition that a functional product that is characterised by inelastic demand is a necessity good.

Proposition 2: An innovative product that is characterised by price elastic demand is a luxury good, hence, innovative-luxury product category.

The result showed that there is a significant reduction in demand of SANINNOV 1 and SANINNOV 2 when there is an increase in price because of the high coefficients of price elasticity of demand of 2.5 and 1.5 respectively. The marketing manager confirmed this in his statements:

" we have up to an average of 75% reduction in the demand for SANINNOV 1 whenever there is about 30% increase price"
"we have up to an average of about 45% reduction in demand for SANINNOV 2 whenever there is about 30% increase in price because it has local substitutes that are relatively cheaper as such only the elite customers still purchase it when the price goes up"

Other attributes of these products that align with the characteristics of innovative products are given by the sales manager such as:

"……it is not for everybody"
" SANINNOV 1 and SANINNOV 2 are not necessity goods and we do not have much demand for them compared to SANFUNC"
"both SANINNOV 1 and SANINNOV 2 are sometimes prescribed by doctors to users"
" when the price of SANINNOV 2 increases a lot of buyers go for substitutes"

This high percentage reduction in demand for SANINNOV 1 and SANINNOV 2 because of the increase in price showed that these products are luxury goods. The degree of responsiveness to changes in price is high. Hence, SANINNOV 1 and SANINNOV 2 have their price elasticity of demand as elastic. SANINNOV 1 and SANINNOV 2 combine the attributes of innovative products and luxury goods which include low demand predictability and high price elasticity of demand. This analysis supports the established proposition that an innovative product that is characterised by elastic demand is a luxury good.

Linking Price Elasticity of Demand to Production Process and Production Strategy

It is pertinent that the price elasticity of demand concepts in the forms of necessity goods and luxury goods should be linked to the production strategy and production process. Since the scope of this research is focussed on the two extremes of the product-process matrix, the job shop process and continuous process in alignment with the make-to-order strategy and make-to-stock strategy respectively. These alignments between the processes and strategies were analysed based on the case and the propositions.

Proposition 3: The functional-necessity products are best produced using the continuous production process and make-to-stock production strategy.

It was confirmed that SAN manufacturing firm used a continuous process for the production of SANFUNC. The production unit is one with continuous production process from the time the raw materials are added to the machinery and the movement from one sub-unit to another. The finished good is accessed at the end of the line with little or no human intervention. The entire production process is automated. The operations/production manager's statement supported the aforementioned:

"we have only one SKU for SANFUNC and we produce in large quantities continuously"

This characteristic of SANFUNC as stated by the operations/production manager aligned with the high volume per SKU for necessity good-functional product form. The availability of only one SKU for SANFUNC also aligns with the low product variety and high standardization of functional-necessity product form. SANFUNC product is demanded by people even if the price is increased and excess production can be made since there will always be demand for the product. This is the rationale for the make-to-stock strategy for SANFUNC. Hence, the use of continuous process and make-to-stock strategy for the production of SANFUNC is verified based on the previous analysis. The high demand certainty of necessity-functional product form aligns with the continuous production process and make-to-stock strategy (Aitken, Childerhouse and Towill, 2003, Safizadeh et al., 1996). Therefore, the proposition that functional-necessity product should be produced using the continuous process and make-to-stock strategy is verified based on SANFUNC's demand predictability and standardized feature.

Proposition 4: The innovative-luxury products are best produced using the job shop production process and make-to-order production strategy.

SAN firm used a continuous process per batch for the production of both SANINNOV 1 and SANINNOV 2. Just like SANFUNC, the production unit is one, continuous and automated for SANINNOV 1. However, SANINNOV has seven production units. The operations/production manager's statement supported the aforementioned:

"we have seven strategic key units (SKUs) for SANINNOV 2 whereas SANINNOV 1 has only one strategic key unit"

"we produce in small quantities per-ordered batch using a continuous process for both SANINNOV 1 and SANINNOV 2.

The attributes of SANINNOV 1 given by the operations/production manager do not align with the low volume per SKU for innovative-luxury product form. However, only SANINNOV 2 had seven SKUs which aligns with the product varieties, low volume per SKU and low standardization attributes of innovative products. SANINNOV 1 had one SKU just like SANFUNC and this does not align with the high product varieties and low standardization of functional-necessity product form. There is also a misalignment of the production process for SANINNOV 1 and SANINNOV 2. The production strategies for SANINNOV 1 and SANINNOV 2 are make-to-stock and make-to-order respectively. Although SANINNOV 2's production strategy is aligned with the make-to-order strategy, there is a misalignment of production strategy for SANINNOV 1 due to the use of make-to-stock instead of the make-to-order strategy by SAN firm. This is because the low demand certainty of luxury-innovative product form is supposed to align with the job shop production process and make-to-order strategy based on extant literature (Aitken, Childerhouse and Towill, 2003, Safizadeh et al., 1996).

However, the archival data obtained from SAN firm showed that the percentage efficiency is high for the 5-year period reviewed from 2013-2017 with 89.6% and 90.3% for SANINNOV 1 and SANINNOV 2 respectively. This measure is based on the ratio of actual output to the standard output required for delivery to customers (Bozarth, Handfield and Chandiran, 2013). This result showed that despite the misalignment of the production process and strategy for SANINNOV 1, the efficiency level is still relatively high. Likewise, SANINNOV 2 despite the deviation from the job shop process by using the continuous process, the efficiency is also high. Therefore, the proposition that innovative-luxury products should be produced using the job process and make-to-order strategy is not verified. This means that there are certain instances when the views of Aitken, Childerhouse and Towill (2003) and Safizadeh et al. (1996) about certain process-strategy fit do not hold. Specifically, this situation could arise when the products of interests are consumables, not bulky types of machinery or furniture (Bozarth, Handfield and Chandiran, 2013) that have many different small to heavy parts that require independent fabrication.

<u>Linking Price Elasticity-Process- Strategy Alignment With Performance</u>

Based on the archival data from SAN firm, the proxy which shows the efficiency of the percentage quantities delivered given the ordered quantities as at when due to customers is used. Therefore, the result is analysed based on the highlighted propositions below.

Proposition 5: A match between functional-necessity products, continuous production process and make-to-stock production strategy will improve operational performance.

SANFUNC product had the effectiveness of 54.8% which showed a good average percentage efficiency of quantities of goods supplied given the ordered quantities for the 5-year period, 2013-2017 considered in this study. This means that the demands for SANFUNC are met 54.8% of the standard time. This result showed that the alignment of the necessity good type with the continuous production process and make-to-stock production strategy is good for the operational performance of consumables such as the body products examined in this study. Therefore, it is established in this study that goods that have inelastic demand, should be produced using the continuous production process and make-to-stock strategy.

Proposition 6: A match between innovative-luxury product, job shop production process and make-to-order production strategy will improve operational performance.

The data showed that the performance of SANINNOV 1 and 2 are high based on the 89.6% and 90.3% average percentage quantities of products supplied given the ordered quantities respectively for the five-year period analysed. This result showed that the use of the other production strategy and process apart from make-to-order and job shop process respectively for the production of innovative-luxury products is still effective based on the result. This is because orders from customers were met 89.6% and 90.3% of the standard time for SANINNOV 1 and SANINNOV 2 respectively. The feasible explanation for this is that the full compliance to the product-process-strategy type linkage could be strictly for some products such as the production of machinery or furniture with several small to bulky components. Hence, deviations from the proposed link between luxury goods, production strategy and production process are acceptable for certain products. Especially, this deviation could still be effective in the production of less bulky products which include body hygiene products such as those identified in this study. The reason for this is that some innovative-luxury products that are not machinery with smaller parts are easier to coordinate by using the continuous production process despite having elastic demand. That is, production could be carried out using a continuous process by batch based on the different SKUs. One practical way of doing this is to accommodate orders of different SKUs of the innovative-luxury product on a weekly or monthly basis for the purpose of continuous production in order to meet the orders collectively.

CONCLUSION

In this study, the link between product types, process types, production strategy types and the price elasticity of demand has been established empirically. However, for products characterised by inelastic demand, some deviations for innovative-luxury products forms were observed. Based on extant literature, the fit concept of the contingency theory and TSEF have been used for the integration of the product-process-price elasticity framework for functional-necessity products. Specifically, functional products that are characterised by predictable demand (Wagner, Grosse-Ruyken and Erhun, 2012) would exhibit price elastic demand just as necessity goods. Hence, there exists a link between functional products also referred to as necessity good from the microeconomics theory, continuous production process and make-to-stock production strategy from extant literature. Therefore, a misfit in any of the links established will increase variability and impede flow, thereby reducing operational performance, that is, the timely delivery of products based on the scope of this study.

Furthermore, there are deviations between the links comprising of innovative-luxury product form, job shop production process and make-to-order production strategy. However, the use of the continuous production process and make-to-order production strategy for the innovative-luxury products are also found to be effective. This exposition is based on the fact that the innovative-luxury products examined in this study are consumables, not heavy types of machinery or furniture. Hence, the production of innovative products that are consumables could still accommodate the deviations from the established link in theory but may not be so for bulky products, equipment or heavy machinery with many components because of the difficulty of coordination.

The theoretical implication of this work includes the use of the TSEF as part of the theoretical perspectives of this study. This study fulfils the call for more use of TSEF in empirical studies (Schmenner, 2004). In addition, the product-process matrix has been extended to incorporate the microeconomic concept, price elasticity of demand. Hence, the product-process matrix extension known as the product-process-price elasticity matrix has been established.

The major goal of this study is to help operations/production managers understand how the price elasticity of demand could be used as a viable tool in determining effective manufacturing strategies for products. The establishment of the links between the necessity good and functional product likewise luxury good and innovative product respectively has made this possible. Hence, this study has been able to integrate operations management and economics concepts in this area of manufacturing strategy.

The implication of this for managers is that they can now use their knowledge of market demand to determine the efficient manufacturing strategy for their respective products. This study has emphasized the fact that different manufacturing strategies are suitable for different products. Therefore, the nature of the market demand could help in determining the suitable manufacturing strategies for products and this has performance implications. The relationships between the links have been established for functional-necessity products category while there are some deviations for innovative-luxury products category.

The limitation of this study includes the use of only a manufacturing firm in Nigeria. The use of multiple cases that feature diverse products apart from those used in this study would be interesting. Future research studies should carry out the research in other countries for the purpose of comparison. Also, further studies should consider the use of a mixed method which contains both the case and research methods.

APPENDIX

Appendix 1: Interview Guide

Interview Guide
Brief Introduction
Please introduce yourself Informants were asked to give a brief introduction of themselves.
Questions
What are the attributes of SANFUNC, SANINNOV 1 and 2? What happens to the demands of these products when prices increase? Are these products demanded by different classes of people? How many SKUs do you have for each product? Do you always know the quantities of each product to produce based on trend? How are the products produced? Are the demands of these products met as at when due?

REFERENCES

Aitken J., P. Childerhouse and D. Towill. (2003) "The Impact of Product Lifecycle on Supply Chain Strategy", *International Journal of Production Economics*, Vol. 85(2) p.127-140.

Arnold R.A. (2007). *Concise Edition. Economics.* Thomson Higher Education. Instructor's Edition.

Baumol W. and A. Blinder (1979). *Economics Principles and Policy*. Third edition.

Bendoly E. and F. Kaefer (2004) "Business technology complementarities: impacts of the presence and strategic timing of ERP on B2B e-commerce technology efficiencies". *Omega*, vol. 32(5) p. 395-405.

Bozarth, C. C., R.B. Handfield, and P. Chandiran (2013), *Introduction to operations and supply chain management* (p. 387). Harlow: Pearson.

Cai, X., J. Chen, Y. Xiao, X. Xu and G. Yu (2013). "Fresh-product supply chain management with logistics outsourcing". *Omega*, Vol. *41*(4) p. 752-765.

Chatha, K. A., I. Butt and A. Tariq (2015) "Research methodologies and publication trends in manufacturing strategy: A content analysis based literature review". *International Journal of Operations & Production Management*, Vol. *35*(4) p. 487-546.

Chen J, A.S. Sohal and D.L. Prajogo (2013) "Supply chain operational risk mitigation; a collaborative approach". *International Journal of Production Research*, Vol. 51(7) p. 2186-2199.

Cornelissen J.P. and R. Durand (2014) "Moving forward: developing theoretical contributions in management studies". *Journal of Management Studies*, Vol. 51(6) p. 995-1022.

Creswell J.W. (2009). Research Design. *Qualitative, Quantitative and Mixed Methods Approaches*. Third Edition. SAGE Publication Limited.

Daniel P., M. Chowdhury, A. Yeung and T.C. Cheng (2012). The relationship between supplier management and firm's operational performance: A multi-dimensional perspective *International Journal of Production Economics*, Vol. 136 p. 123–130

Dewaraj S., T.T. Ow and R. Kohli (2013) "Examining the impact of information technology and patient flow on healthcare performance: A theory of Swift and Even Flow (TSEF) perspective". *Journal of Operations Management*, Vol. 31(4) p. 181-192.

Dorothy H. (2003). Evaluation of Qualitative Research. *Journal of Clinical Nursing*, Vol. 12 p. 307-312.

Drazin R. and A.H. Van de Ven. (1985) "Alternative Forms of Fit in Contingency Theory". *Administrative Science Quarterly*, Vol. 30(4) p. 514-539.

Eisenhardt K.M.(1989). Buildingtheoriesfromcasestudy research. *Academy of Management Review*, Vol. 14(4) p. 532–550.

Eisenhardt K. M. and M.E. Graebner (2007)"Theory building from cases: opportunities and challenges". *Academy of Management Journal*, Vol. 50(1) p. 25–32.

Ferdows K. and A. De Meyer (1990) "Lasting improvements in manufacturing performance. In search of a new theory". *Journal of Operations Management*, Vol. 9(2) p. 168-184.

Fisher M. (1997). "What is the right supply chain for your product?" *Harvard Business Review,* p. 105-116

Frendendall, L.D., J.B. Craig, P.J. Fowler and U. Damali (2009) "Barriers to swift, even flow in the internal supply chain of peri operative surgical services department:a case study". *Decision Sciences*, Vol. 2 p. 327-349.

Gualandris, J. and M. Kalchschmidt (2013) "Product and process modularity: improving flexibility and reducing supplier failure risk". *International Journal of Production Research*, Vol. *51*(19) p. 5757-5770.

Guo P. and X. Ma (2014) "Newsvendor models for innovative products with one-shot decision theory". *European Journal of Operations Research*, Vol. 239(2) p. 523-536.

Hayes R.H and S.C. Wheelwright (1979a) " Link Manufacturing Process and Product Lifecycles" *Harvard Business Review* p.133-140.

Hayes R.H and S.C. Wheelwright (1979b) "The Dynamics of Process-Process Lifecycles". *Harvard Business Review* p. 127-136

Helkiö, P. and A. Tenhiälä (2013) "A contingency theoretical perspective to the product-process matrix". *International Journal of Operations & Production Management*, Vol. *33*(2) p. 216-244.

Hill T.J. (1993). *Manufacturing's Strategy. The Strategic Management of the Manufacturing Function*. Second edition. Macmillan, London.

Hillman A. (2009). Editor's comment. *Academy of Management Review* p. 34:7-10.

Hull B. (2005). "The Role of Elasticity in Supply Chain Performance". *International Journal Production Economics*, Vol. 98(3) p. 301-314.

Jayaram, J., A. Oke, A. and D. Prajogo (2014) "The antecedents and consequences of product and process innovation strategy implementation in Australian manufacturing firms" *International Journal of Production Research*, Vol. 52(15) p. 4424-4439.

Kim M., N.C. Suresh and C. Kocabasoglu-Hillmer (2013) "An impact of manufacturing flexibility and technological dimensions of manufacturing strategy on improving supply chain responsiveness: Business environment perspective", *International Journal of Production Research*, Vol. 51(18) p. 5559-5611.

Kotzab H. (2005). *The Role and importance of survey research in the field of supply chain management*. In Research Methodologies in Supply Chain Management (Herbert Kotzab, Stefan Seuring, Martin Müller and Gerald Reiner, 2005). Physica-Verlag HD p.126-137.

Lee H. (2002) "Aligning supply chain strategies with product uncertainties" *California Management Review*, Vol. 44(3) p. 105-118.

Li, S., Z. Zhu and L. Huang (2009) "Supply chain coordination and decision making under consignment contract with revenue sharing" *International Journal of Production Economics*, Vol. *120*(1) p. 88-99.

Mankiw G. (1998). *Principles of Economics*. The Dyder press Harcourt. Brace college publishers.

McConnel C.R., S.L. Brue and T.P. Barbiero (2005). *Microeconomics*. McGraw-Hill Ryerson Limited.

Mellor, S., L. Hao and D. Zhang (2014) "Additive manufacturing: A framework for implementation", *International Journal of Production Economics*, Vol. *149* p. 194-201.

Miles, M. B. and A.M. Huberman (1994) Qualitative data analysis: An expanded sourcebook, 2nd edition, Sage: London and Thousand Oaks, California.

Okhuysen G. and J.P. Bonardi (2011) "The challenges of building theory by combining lenses". *Academy of Management Review*, Vol. 36 p. 6-11.

Pekka H. and T. Antti (2013) "A contingency theoretical perspective to the product-process matrix". *International Journal of Operations and Production Management*, Vol. 33(2) p. 216-244.

Safizadeh H., P. Ritzman, D. Sharma D. and C. Wood (1996) "An Empirical Analysis of the Product-Process Matrix". *Management Science*, Vol. 42(11) p.1576-1591.

Safizadeh H. and L.P. Ritzman (1997) "Linking performance drivers in production planning and inventory control to process choice". *Journal of Operations Management*, Vol. 15(4) p. 389-403.

Safizadeh M, L. Ritzman and D. Mallick (2000) "Revisiting alternative theoretical paradigms in manufacturing strategy". *Production and Operations Management*, Vol. 9(2) p. 111-127.

Sardana, D., M. Terziovski, M. and N. Gupta (2016). The impact of strategic alignment and responsiveness to market on manufacturing firm's performance. *International Journal of Production Economics*, Vol. *177* p. 131-138.

Schmenner R.W. and M.L. Swink (1998) "On theory in Operations Management". *Journal of Operations Management*, Vol. 17(1) p. 97-113.

Schmenner R.W. (2001) "Looking ahead by looking swift, even flow in the history of Manufacturing" *Production and Operations Management*, Vol. 10(1) p. 87-96.

Schmenner R.W. (2004) "Service business and productivity". *Decision Sciences*, Vol. 35(3) p. 333-347.

Seuring S. (2009) "The product-relationship-matrix as framework for strategic supply chain design based on operations theory". *International Journal of Production Economics*, Vol. 120 (1) p. 221-232.

Siggelkow N. (2007). "Persuasion with case studies". *Academy of Management Journal*, Vol. 150(1) p. 20–24.

Skinner W. (1969) "Manufacturing–missing link in corporate strategy" *Harvard Business Review*, Vol. 43 p. 136-145.

Sohel A. and R.G. Schroeder (2002) "Refining the product-process matrix", *International Journal of Operations and Production Management*, Vol. 22(1) p. 103-125.

Sousa R. and C.A. Voss (2008) "Contingency research in operations management practices". *Journal of Operations Management*, Vol. 26(6) p. 697-713.

Spencer M.S. and J.F. Cox (1995) "An analysis of the product-process matrix and repetitive

Manufacturing". *International Journal of Production Resources*, Vol. 33(5) p. 1278-1294.

Stark, J. (2015). Product lifecycle management. In *Product Lifecycle Management Vol. 1* (pp. 1-29). Springer, Cham.

Stavrulaki, E. and M. Davis (2010) "Aligning products with supply chain processes and strategy". *The International Journal of Logistics Management*, Vol. *21*(1) p. 127-151.

Tsai W., L. Kuomintang, T.W Lin, Y. Kuomintang and Y Shen (2010) "Price elasticity of demand and capacity expansion features in an enhanced ABC product-mix decision model" *International Journal of Production Research*, Vol. 48(21) p. 6387-6416.

Van de Ven, A. H. (1979) "Organizations and environments". *Administrative Science Quarterly*, Vol. 24 p. 320-326.

Venkatraman N. (1989) "The Concept of Fit in Strategy Research: Toward Verbal and Statistical Correspondence", *Academy of Management Review* Vol. 14 p. 423-444.

Voss C.A. (1995) "Alternative paradigms for manufacturing strategy". *Journal of Operations and Production Management* Vol. 15(4) p. 5-16.

Wagner, S. M., P.T. Grosse-Ruyken and F. Erhun (2012) "The link between supply chain fit and financial performance of the firm" *Journal of Operations Management*, Vol. *30*(4) p.340-353.

Ward, P.T and R. Duray (2000) "Manufacturing Strategy in Context: Environment, Competitive Strategy and Manufacturing Strategy" *Journal of OperationsManagement*, Vol. 18(2) p. 123-138.

Wong C., S. Boon-itt and C.W. Wong (2011) "The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance". *Journal of Operations Management*, Vol. 29(6) p. 604-615.

Yin, R.K. (1994). Case study research: *Design and Methods*, 2nd edition, Sage Publications Inc., Thousand Oaks.

Yin, R.K. (2003). Case study research: *Design and Methods*, 3rd edition, Sage Publications Inc., Thousand Oaks.

Yin R.K. (2009). *Case Study Research Design and Methods*. Applied Social Research Methods Series. Fourth Edition. Volume 5. SAGE Publications, Inc.

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