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Factors for New Product Commercialization in Micro and Small Manufacturing Enterprises in Selected Towns in North-West and Gauteng Provinces, South Africa

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Abstract

The purpose of the study was to identify the important components and their linkages to support the development of a conceptual model to assist micro and small manufacturing firms with the successful marketing of new goods. The underlying determinants of these parameters and the interactions between these elements will have a considerable influence on new product commercialization. The study employed a cross-sectional descriptive quantitative design where 103 responses were obtained from manufacturing enterprises in selected towns from North-West and Gauteng Provinces, South Africa from a 25-item survey questionnaire. The study confirmed six factors that are important for new product commercialization, with structural equation modelling partial least square (PLS-SEM). All these factors have both convergence and discriminant validity and were reliable, based on the results of composite reliability (CR), rho'A and Cronbach Alpha (α). The relative importance index revealed that skills and knowledge (*RII* = 67.2%) and product relevance (*RII* = 54.1%) were the most important for new product commercialization in the manufacturing SMEs. All factors were medium to strongly statistically significant and positively correlated, based on the results of Spearman rank correlation. The outcome made it posible to develop a conceptual model for the commercialization of new products. This model is based on the guiding principles, primary drivers (product relevance, skills and knowledge) and enabling factors (marketing and promotion, financing of new products, prototype development, testing and product development). The success of new product commercialization in micro and

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small manufacturing enterprises is of the utmost importance to ensure the success and sustainability of companies.

Keywords: New product commercialization, micro and small enterprises, relative importance index, South Africa

Introduction

In the past few decades, small business enterprises have received increased prominence as economic growth drivers. Several recent studies have found that long-term economic growth and prosperity necessitates good small and medium enterprise activity (McKeever, Anderson, & Jack 2014; Ribeiro-Soriano; 2017, Lee, 2017). Government and society view entrepreneurship and the development of small enterprises as a suitable method for dealing with the consequences of the economic crisis as it is a catalyst for activating and stimulating business activities and job creation. This has the potential for activating the economy thus confronting unemployment and attempting to alleviate it. The economic spin off that comes with less unemployment can go a long way in reinvigorating the creation of jobs, thereby alleviating levels of poverty (Mckevitt & Marshall, 2015).

The importance of Small, Medium and Micro Enterprises (SMEs) is recognized by the world's largest financial institutions, such as the World Bank, which adopted a pro-SMME stance due to the ability of SMMEs to increase business leadership and competitiveness (World Bank, 2021). Furthermore, the SMMEs contribute more towards job creation than the larger enterprises since SMMEs are more labor-intensive (Okumu & Buyinza, 2018). Mutalemwa (2015) posits that despite the importance of the micro and small manufacturing enterprises, there are still challenges of a high failure rate of such enterprises. Among the causes, especially for manufacturing companies on the African continent, is the lack of competitiveness, both on the continent and abroad. Various factors have led to this, including rapid changes in technology; globalization and liberalization; failure to exploit export opportunities; lack of the necessary management skills; ineffective marketing; and weak infrastructure (Mutalemwa, 2015). It is therefore important for SMMEs to successfully develop and commercialize products.

Statement of the Problem

Due to rapid technology advancements, businesses now operate in a variety of markets that require more frequent innovation, higher product diversity and variety, shorter product life cycles, and a product of high quality and reliability (Tavares et al, 2016). For the survival, renewal and growth of manufacturing micro and small companies, product development is regarded as crucial; it is seen as a meta-competence because it is perceived to influence many other competences within the enterprise (Halila & Horte, 2008). This holds true for both micro, small, medium and large enterprises. Ebrahim, Ahmed and Taha (2010) substantiate that for micro and small manufacturing companies, new product development is an essential property for an enterprise (Chaochotechuang et al., 2015). With the current problem of very high failure rates, it is important for the SMMEs to leverage, among others, the meta-competences of new product commercialization to improve the chances of survival, renewal and growth (Alsaaty & Makhlouf, 2020). As such, it is crucial for a conceptual model for new product commercialization that highlights the prevailing factors and their interrelationships.

Scope of the Study

This research study is limited to micro and small manufacturing enterprises. Due to the level of the study, only one type of research method was followed, which is the quantitative research approach. The study is also limited to the commercialisation of new products and does not include other dimensions of meta competences such as strategy, process, and research and its project climate, company culture and metric performance (Nicholas et al., 2011).

Objectives of the Study

The purpose of the study was to identify the relevant factors and their relationships to facilitate the development of a conceptual model to assist micro and small manufacturing enterprises with the successful commercialisation of new products. The underlying variables of these factors and the relationships between these factors have a great influence on new product commercialization. This was investigated using the following objectives:

- To determine the prevailing factors needed by micro and small manufacturing enterprises to successfully commercialize new products to the market.
- Understand the relationships among the factors for the successful commercialisation of the new products by micro and small manufacturing enterprises.

Literature Review

Contextualization of New Product Development and Commercialization

The Product Development and Management Association (PDMA) has described product development as a strategy, organization, concept development, marketing and product planning and evaluation and the commercialization of the product development process. New product development is a process that begins with identifying an opportunity and ends with a set of information that adds value to the customer, which brings a return to the enterprise. One of the most important factors that assists manufacturers to be successful in launching new products is to design and develop new product quickly, effectively and efficiently.

Product Development and Commercialization

According to Trott (2018), contextualization of product development and commercialization of a new product development transforms business opportunities into a tangible product process. The Product Development and Management Association (PDMA) outlines new product development as a strategy, organization, concept development, marketing and product planning and evaluation and the commercialization of the new product development process.

Research results from studies that have been carried out on new product commercialization in New Zealand shed light on existing information. The shared information is based on similar surveys conducted in the United States, the United Kingdom and Ireland. Metikure and Sherkar (2011) found that there are seven factors related to new product development (NPD) best practices across six best practice areas, namely, strategy; portfolio management; process; market research; people; metrics;

and performance evaluation. NPD practices are the development practices that tend to deliver successes in new product commercialization in the marketplace (Chaochotechuang et al., 2015). NPD practices can be characterized as: the customer needs and the demand for new products, co-operation cross functional teams, senior management involvement, and involvement of new product development champions and the execution of defined quality processes with formal measurement (Salgado, et al., 2018).

New product commercialization involves a process for delivering a new product to the market. This ranges from identifying the product need to launching the product in the market. It has been seen to be a part of the process of commercializing new products, launching of new manufacturing products, and successful marketing of new products. The commercialization of new products is a complex and expensive process, and there is no single one-size-fits-all process that will guarantee the success of a product. Multiple studies have explored the successful commercialization of new products; most of these studies concentrate on large manufacturing companies with many resources at their disposal for new product commercialization (Manaczynski, 2018). However, there are not many studies that reveal the success factors for profitable commercialization of new products for Small and Medium Enterprises (SMEs). One setback for commercialization for SMEs is that they have less access to resources and finances. According to Manaczynski (2018), SMEs do not have the same resources available to mimic a larger organization's infrastructure and must find alternative ways of developing and commercializing new products successfully. It is therefore important for SMEs to research models and frameworks that can assist with successful product development and commercialization.

New Product Development Models

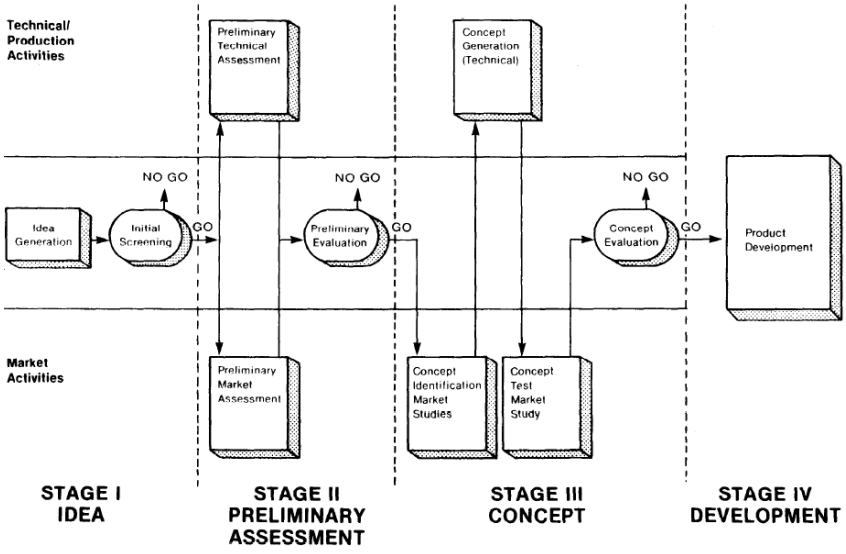
Organization and manufacturing companies are born by successfully commercialising one new product and remaining profitably in business over the long term requires the organization or manufacturer to continue to develop and commercialize additional successful products, or at a minimum, keep re-developing current products to better meet consumer needs and wants as technologies and competitors change and improve (Griffen, 1997).

Cooper's Model of New Product Development

Cooper (1988) explains the importance of understanding the process that differentiates new product successes from new product failures in the enterprise. His predevelopment steps in New Product Development are depicted in Figure 1.

Figure 1

Predevelopment Steps in New Product Development



The results showed that those enterprises which were successful in product development had done better with the initial screening of the products, marketing analysis, technical inspections, business and financial analysis, product development processes, testing in-plant, market testing and market launch. The main activities that did not make a significant difference between the enterprises which failed or succeeded in product development were customer testing of product, production trial and business analysis, as well as start-ups. Cooper's stage gate and road map processes has been used in many companies, to develop new product programs and has been accepted as the standard for new product development successes. There are five process stages involved. Each of the

stages are separated from one other by gates, and its role is like a pass-through that serves as a quality control before allowing the process to carry on to the next stage, and these are as follows:

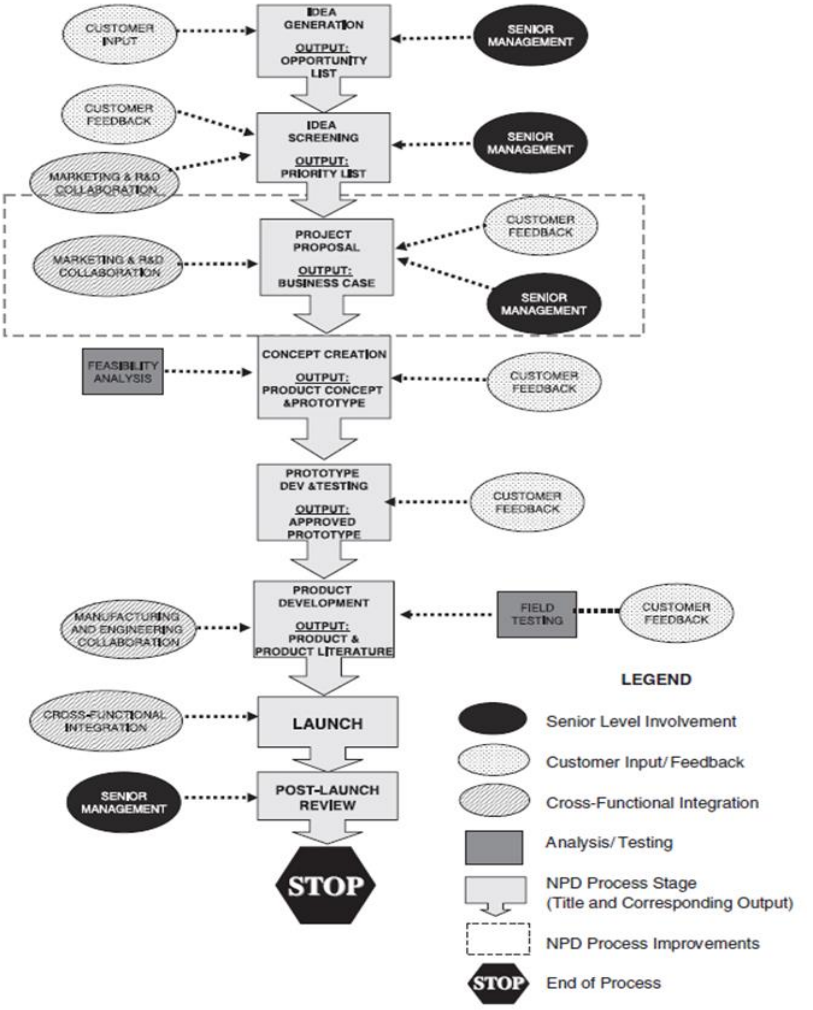
- **Stage 1: Scoping** - a rapid overview of new product; quick marketing analysis; technical analysis of the new product; business and financial assessments; a process action of the next stages.
- **Stage 2: B**usiness case study - definition of the product; justification of the business; planning details for the next follow-up stage; the needs and desires of the customer; competitive advantage studies; technical feasibility; defined plans for the next stages; defining the new product; and the financial analysis of the enterprises.
- **Stage 3: Development stage** - feedback from the customer; technical analysis; testing and prototyping; the development of operation processes; testing of the product in- house; full commercialization and operational plans.
- **Stage 4: Testing and validation of new product** - validating, verification; in-house testing process; field try-outs with customers; production tool requirements; production trials; marketing testing and trails; operational and launching process finalization and life cycle assessments and post launch processes.
- **Stage 5: Product launch** - full product commercialization; marketing roll–out and full launch; full production of the new product; selling of the product; monitoring of marketing and selling results and life cycle processes and post launch carried out.

Harmancioglu's Model

Harmancioglu et al. (2007:406) provide several new product development stages. Central to this work is that the new product development starts with idea generation where the opportunities are identified, flowing to the business case that requires marketing and collaboration, then concept creation for product concept and prototype (Figure 2).

Figure 2

Harmancioglu New Product Development Steps



Source: Harmanciogl et al. (2007)

It is followed by the prototype with customer feedback, as well as product development which ultimately culminates in product launch. This is done with the involvement of senior management in the enterprise.

Hauser and Dahan's Model

Hauser and Dahan (2007) point out that new product development consists of five stages.

Stage 1: Opportunity identification and idea generation. Ideas to innovate are generated and new opportunities are thus identified by looking at customer needs and desires. New product developers cannot be ignored. *Stage 2: Concept development*. The team must collate customer needs and generate a product concept to deliver a product that addresses these needs and new product development. A broad idea can lead to concepts that are sometimes useful and sometimes not so useful. *Stage 3: Concept testing*. Stage three refers to this concept as the "stretcher" concepts, each of which explores a different strategic need by emphasizing or "stretching" it. *Stage 4: Designing and engineering products*. The design and engineering processes that develop concepts into viable products are the lead user analysis, Kaizen and Teian analysis, set-based design, and Pugh concept selection. Each of these methods builds on the customer-needs identification and ideation that took place during the fuzzy front end of product development. *Stage 5: Prototype development and testing*. The last stage of commercialization is prototyping and testing. Here, the design and engineering of the concepts are evaluated, with the surety that the launch will be a success. Having conducted the required analysis to determine the engineering specifications with techniques, namely, House of Quality (HOQ) and Design for Manufacturing and Assembly (DFMA), several prototypes have been developed and tested. These are based on valuable input from potential customers using a technique called conjoint analysis. To stimulate product acceptance in the marketplace, the product developers need to do realistic tests.

New Products Commercialization Factors

Shi and Zhang (2016) identify a set of milestones for the successful commercialization of new products, prototype testing, in-house testing, and market testing and operation start-up. To successfully launch a new product to market (commercializing the product), the product needs to be relevant for the market. If not, it will be unsuccessful. The market may indicate that it needs the product, but if there are no applicable skills and knowledge in

the SME to design and manufacture such a product, it will not succeed in the market. Floren et al. (2017) pointed out that new projects of product development, either failed in this stage of the development process or later in the commercialization stages. According to Floren et al. (2017:412), "the underlying causes of new product development failures, can be tracked down to the beginning stages, what they call the front-end stage of new product development. They defined this stage as the initial new product idea stage and the decision to start or to abandon the development of a new product. Ghorbani and Azamni (2014) argued that the joint reward systems, knowledge sharing, people resources and market research are the key commercialisation factors for project success. They found that manufacturing companies have been attempting to sustain efforts to stimulate, facilitate and utilize companywide knowledge to gain a competitive advantage.

Relevance of the Product

The relevance of the product has to be established prior to its commercialization. This is done by conducting a survey on the need for the product, investigating the existence of similar products in the market and checking the market for the intention of potential customers to buy the product before development. It is important for micro and small manufacturing enterprises to acknowledge that there are some of these products that are similar to their products on the market and that they evaluate the competitive advantage of their products in relation to other existing products and work towards developing and improving new products (Ismail, Nor & Sidek, 2015).

Knowledge and Skills

Knowledge and skill factors represent the technical experience necessary to develop and commercialize new products. The experience and know-how to commercialize a new product are vitally important, and if insufficiencies do exit, new product manufacturers need assistance to commercialize those new products; if there are well-established processes and procedures in place, they need to follow these processes and procedures when developing new products.

New product manufacturers cannot expect to grow individually and

survive, as their performances are inextricably linked to the activities of other manufacturers (Pellikka & Virtanen, 2009). There are essential components to the commercialization of new products, such as networking of businesses and co-operation. Small businesses may widen their resource base by collaborating with, and by accessing additional assistance and sharing new product launch processes (Pellikka & Virtanen, 2009). Håkansson (1987) points out that there is a positive correlation between network relations, and the successful commercialization of new products. In contrast, commercialization will be constrained in the absence of sufficient financial and organisational support.

Product Development

Factors include the simulation of new products technologically (on computer) before physical development, the designing of products with full specifications during the design phase to test the feasibility of the product, whether there are research and development facilities available and whether available machinery and equipment is adequate for the manufacturing of new products. Zirger and Maidique (1990: 867) had earlier pointed out: "1) the quality of Research and Development teams, 2) the technical performance of the product, 3) the value of the product to the customer, 4) the synergy of the new product development with the company's existing competence, and 5) new product development process support systems. Factors such as 6) competence of the marketing and manufacturing organizations and market factors, 7) competitiveness and 8) the size and rate of growth of the target market, are also important but less significant".

Prototype Development and Testing

Prototype factors are whether the product is developed on a small scale on the owners' premises, whether any prototypes of products are developed before launching those products in the market, whether the prototypes are tested with selected customers in the market for suitability, and whether owners receive any feedback on prototype performance from potential customers to be incorporated into the final design. According to Kossiakoff et al. (2011:338), "prototyping is the process of designing and building a test model of a component, a subsystem, and sometimes the total system, for testing at an early stage in a realistic environment". Blanchard and

Farycky (2011:156), refer to "A prototype model represents the envisaged product in all aspects of form, fit and function except that it has not been subjected to full operational and environmental testing". The prototype is the result of processes that include the required prime equipment, technical, maintenance and support infrastructure. It has a specific amount of testing in order to evaluate the design before it is formally tested (Blanchard & Farycky,

Product Financing

Financing entails establishing whether a manufacturing enterprise can access all the funds necessary for the commercialization of new products; whether the business can ensure that there is a suitable budget for it, and when funds for commercialization are not adequate, whether the enterprise will seek a partnership with financial institutions or investors. This is to realize the commercialization rather than to abandon the project. Furthermore, whether financial challenges have resulted in relevant products that were needed by the market but are not being commercialized. Pellikka and Virtanen (2009) argued that to capture the market and become more cost-effective, sufficient financial capability is needed. The main sources for funding new product development, have been identified as external finance and new equity. A lot of small technology companies had to get financial support internally. For external finance, small technology companies may not have the required collateral for inves

Marketing and Promotion

Marketing and promotion factors represent branding of the new products to make them attractive to the market, ensuring a clear marketing plan for new products that all marketing efforts have a broad reach to cover all potential customers, and lastly, having a post-management system in place to stimulate potential customer adoption. Marketing being the process by which transfer of ownership of a need satisfying product or service is facilitated from a supplier to consumer within a chosen target market. Promotion is the need to introduce or to make known a product. In the commercialisation process, it has been shown that managers play a crucial role, since they are decision makers. Nevens et al. (1990) point out that there are other challenges and that they may have failed to identify and put

measure in place for skills development to launch new products. Managers must be committed to the commercialization process and make use of resources which are crucial for the development of new products. Resource allocation availability is very important when launching a new product (Pellikka & Virtanen, 2009).

Methodology

This study obtained ethical clearance from Tshwane University of Technology, Faculty of Management Science [REF#: FREC2017/FR/08/007-MS (3)].

Research Strategy

A quantitative research strategy, with a grounded approach on a post-positivist philosophical orientation, was employed in this study (Welman, Kruger & Mitchell, 2012; Mtotywa, 2019). In the study, the non-experimental form of research was utilized, where a descriptive research design was employed in a particular correlational design (Leedy & Ormrod, 2015). This is important to descriptive and association aspects of the research objectives.

Data Collection Method

In line with the objectives of the study, data was collected through a survey questionnaire. The questionnaire comprised two sections; the first section profiles the enterprise and the second section assesses the factors for new product commercialization using 25 items that are based on a 5-point Likert Scale (Appendix I). The population comprises all the micro and small manufacturing enterprises in South Africa, while the targeted population consists of the micro and small manufacturing enterprises in Brits and surrounding areas and includes certain towns in North-West and Gauteng Provinces. A sample was based on estimate 400 total enterprises on the selected areas using the Slovin formula:

$$n \frac{N}{Ne^2+1} \qquad 1$$

Where n = sample size, N = target population and e = error. This meant that the sample was 197, and the study distributed 200 questionnaires to the enterprises.

The survey questionnaire was paper based and self-administered after having been distributed in the main industrial quarters of the targeted areas. A printed copy of the survey questionnaire was given to business owners or managers to complete. The purpose of the study and the objectives of the survey were explicitly explained to respondents to ensure that their responses were both true and credible. The questionnaire was designed to take approximately 15 minutes to complete. In cases where there were queries from the respondents, the researchers clarified these queries. From these surveys, 103 responses were received, a response rate of 51.5%. A commendable response rate for small enterprises as it is generally low between general 20 to 35% (Newby, Watson & Woodliff, 2003; Dennis, 2003). This improvement can be attributed to knocking on the door which Agustini (2018) posits that it enhances the response rate.

Data Analysis

The empirical data collected was analysed using IBM Statistical Package for Social Science (SPSS) version 25 and SMART PLS 3.0. The descriptive statistics analysed the mean for central tendency of the data. Initially, the data was prepared to ascertain whether the missing values are within the acceptable 5% cut-off, as proposed by Schafer (1999).

Having established this, the data was analysed for extreme outliers and where those outliers were higher than three time's interquartile range, they were removed from the data. This was possible as the measurement model was a structural equation modelling partial least square (SEM-PLS) which allows for missing data. Structural equation modelling partial least square (PLS-SEM) was used to analyse the measurement model that was used for confirmatory factor analysis (Ringle, Wende & Becker, 2015). In this study, the main approximate model fit criterion used was standardized root mean square residual (SRMR) (Henseler et al., 2015:9). The SRMR was used to calculate the square root of the sum of the squared difference between the model-implied and the empirical correlation matrix. The convergence validity was analysed with AVE, while the discriminant validity was analysed with Fornell-Larcker criterion and the reliability with composite reliability, rho's A and Cronbach Alpha.

The Relative Importance Index (RII) was used to quantify the relative importance of specific factors for new product commercialization using the 5-point Likert scale. The important factor was highlighted by the larger value of the index of relative significance (RII):

$$RII = \sum \frac{W}{A\ x\ N} \quad 3$$

W =weighting given to each factor, A = highest factor and N = total number of respondents. Akadiri (2011) and Khatib et al. (2020) highlight the ranges of importance with ≤ 0.20 (L), 0.20 ≤ RII ≤ 0.40 (L-M), 0.40 ≤ RII ≤ 0.60 (M), 0.60 ≤ RII ≤ 0.80 (M-H), ≥ 0.80 (H). The relationship between the factors of the new product commercialization were analysed using Spearman rank correlation:

$$\rho = 1 - \frac{6 \sum d_i^2}{n\ (n^2-1)} \quad 4$$

ρ = Spearman's rank correlation coefficient, d_i= difference between the two ranks of each obesrvation, n = number of observations. Spearman's correlation (ρ) was employed to assess monotonic relationships between these factors, irrespective if there was a linear or non-linear relationship.

Results and Data Interpretations

The spread and central tendencies of all four variables for the knowledge and skills variables, had a mean (*M*) between 3.09 and 3.52. In the relevance of the product, the mean was between 2.67 and 2.78, while for marketing and promotion, the mean values were between 2.18 and 2.71. The mean values for product development were between 2.11 and 2.25 and prototype development (*M* = 2.21 to 2.31) and testing and financing of the new product were 2.06 – 2.71 (Table 1).

Measurement Model

There were six factors (constructs), with 24 variables utilized to find the commercialization composites. These were the factors (constructs) and variables that were identified to develop a conceptual model to assist micro to small manufacturing enterprises with product commercialization. Structural Equation Model Partial Least Square (PLS-SEM) was employed to analyse the measurement model (Ringle, Wende & Becker, 2015). In this

model, the optimum fit was found with 22 variables, where VAR20 was excluded in the Prototype development and testing (prototype) construct and VAR13 was excluded in the Knowledge and Skills construct, and VAR29 in marketing and Promotion as their loading was lower than 0.7 in their constructs. According to Henseler, Hubona and Ray (2015), the only approximate model fit criterion implemented for PLS path modelling is the standardized root mean square residual (SRMR). The SRMR is the square root of the sum of the squared difference between the model-implied and the empirical correlation matrix. The SRMR of the model is 0.057, which is better than the acceptable guidelines of Hu and Bentler (1999) for adequate fit for PLS path models. Though not always used as the indicator, an NFI of >0.7 (NFI=0.781) indicates an acceptable level of fit in SEM-PLS. A maximum likelihood discrepancy, the geodesic discrepancy dG1 (1.067), the unweighted least squares discrepancy dULS (0.829), and a Chi-square of 597.279, reported for model, and all six factors fitted well.

Table 1

Descriptive and Multivariate Statistics

Factor	Items	Mean (SD)	Factor loading	AVE	CR	rho'a	α	*RII*
Product relevance	V7	2.78	0.935	0.892	0.971	0.961	0.960	55.5%
	V8	2.67	0.943					53.4%
	V9	2.69	0.953					54.0%
	V10	2.67	0.947					53.4%
	Overall	-	-					**54.1%**
Skills & knowledge	V11	3.52	0.957	0.865	0.951	0.936	0.922	70.5%
	V12	3.46	0.952					69.3%
	V13	3.31	-					60.4%
	V14	3.09	0.881					61.7%
	Overall	-	-					**67.2%**
Product development	V15	2.11	0.865	0.791	0.938	0.917	0.911	42.1%
	V16	2.25	0.931					45.0%
	V17	2.11	0.91					42.1%
	V18	2.16	0.848					43.1%
	Overall		-					**43.1%**
Prototype	V19	2.31	0.947	0.925	0.974	0.961	0.959	46.2%

Factor	Items	Mean (SD)	Factor loading	AVE	CR	rho'a	α	*RII*
	V20	2.21	-					46.0%
	V21	2.25	0.972					44.3%
	V22	2.26	0.966					45.1%
	Overall	-	-					**45.2%**
	V23	2.16	0.918	0.775				45.2%
Product	V24	2.06	0.911		0.932	0.914	0.902	43.3%
financing	V25	2.71	0.915					41.4%
	V26	2.44	0.769					41.6%
	Overall	-	-					**42.9%**
Marketing	V27	2.71	0.882					48.0%
and	V28	2.44	0.858	0.788	0.937	0.914	0.910	52.4%
promotion	**V29**	2.62	-					51.6%
	V30	2.30	0.909					46.0%
	V31	2.18	0.899					43.5%
	Overall	-	-					**47.5%**

Bold *– excluded in the final measurement model*

To ensure the validity of the construct, both convergence and discriminant validity were tested. The dominant measure of convergent validity is the average variance extracted (AVE) (Henseler, Hubona & Ray, 2015:11). An AVE of 0.5 and above is deemed accurate; all variables measured more than 0.5 and therefore it was concluded that there was convergent validity. All the constructs in this model were found to have met the requirement of convergence validity with AVE ≥0.50. The Prototype development and testing construct has the highest average variance extracted (AVE) of 0.925, followed by Relevance of the product with 0.892. Knowledge and skills has an AVE of 0.865, Product development 0.791, Marketing and promotion 0.788 and Financing of the product (finance) 0.775.

With the confirmation of the convergence validity, the discriminant validity was analysed using the Fornell-Larcker criterion. The Fornell-Larcker criterion highlights that the factor's AVE should be higher than its squared correlation with all other factor models, with cross loading confirming if the variable is highly loaded on only one construct. Fornell-Larcker criterion indicates good discriminant validity with discriminant loading (Table 2).

Henseler et al. (2015:10) explain that the most important reliability measurement for PLS-SEM is composite reliability (CR) and and pA (Dijkstra & Henseler, 2015b). In this study, an internal reliability and consistency testing, Cronbach Alpha (α), rho_A and composite reliability were used (CR). All variables were subjected to internal reliability and consistency testing using the Composite Reliability measure. A composite reliability value of 0.7 or more indicates a good level of reliability. This is confirmed by the Cronbach Alpha coefficients higher than 0.7 (α = 0.902 – 0.960); rho A is also high, confirming the reliability.

Relative Importance Index of the New Product Commercialization Factors

Table 2

Fornell-Larcker Criterion for Discriminat Validity of the Factors

	Finance	Marketing and promotion	Product development	Product relevance	Prototype	Skills and knowledge
Finance	0.881					
Marketing and promotion	0.577	0.888				
Product development	0.580	0.642	0.889			
Product relevance	0.503	0.453	0.668	0.944		
Prototype	0.485	0.562	0.573	0.488	0.962	
Skills and knowledge	0.477	0.470	0.549	0.589	0.481	0.930

The results show that skills and knowledge and product relevance were the most important factors for new product commercialization, with RII = 67.2% and 54.1%, respectively. Based on the guidelines of Akadiri (2011) and Khatib et al. (2020), the skills and knowedge were in the M-H (medium to high) importance range, while product relevance was on the upper levels of medium importance. The other four factors ranged, $0.40 \leq$ RII ≤ 0.60 (M), with major marketing and promotion highest of the four, with *RII* = 47.5%, followed by *RII* = 45.2% for prototype, *RII* = 43.1% for product development and then *RII* = 42.9% for product financing.

Relationship between the New Product Commercialization Factors

The results of the correlation are presented in Table 4. Based on the guidelines of Pallant (2010), all these constructs show medium (0.30 – 0.49) or strong (≥ 0.50) correlation with each other (Table 3). The highest correlation is found between Product development and Product relevance, with the relationship being significant at 99% confidence levels, positive in nature and strong (ρ = 0.655, p <.001). The same pattern of strong correlation is also found between product development and five other constructs. The construct skills and knowledge had medium to strong statistically significant correlation with the other constructs (ρ = 0.419 to 0.548, p <.001).

Table 3

Spearman Correlation between the Constructs

	1	2	3	4	5	6
1.Product development	-					
2.Product relevance	.655***	-				
3.Marketing and promotion	.623***	.417***	-			
4.Finance	.613***	.487***	.608***	-		
5.Prototype	.622***	.480**	.541***	.507***	-	
6.Skills and knowledge	.533***	.548**	.442**	.419***	.463***	-

**- p <.05 ** p < .01 *** p <.001*

Discussion and Conclusion

Discussion

Nicholas et al. (2011) argued that there are meta competences in the commercialization of new products. These authors highlighted the seven dimensions of the model were validated for inclusivity following the Delphi methodology. The updated model adopted by Nicholas et al. (2011) is an indication of a dynamic and changing body of knowledge. The seven dimensions included strategy, process, research and its project climate, company culture, metric performance, and commercialization. Commercialization is critical as it comprises marketing processes, the

launch and post-launch management of new products which stimulate customer adoption and market diffusion (Krishan et al., 2011). The findings of the study highlight that the new products commercialization can be driven by six factors for the SMEs, and these include relevance of the product, knowledge and skills, product development, prototype development and testing, financing of the product and marketing and promotion.

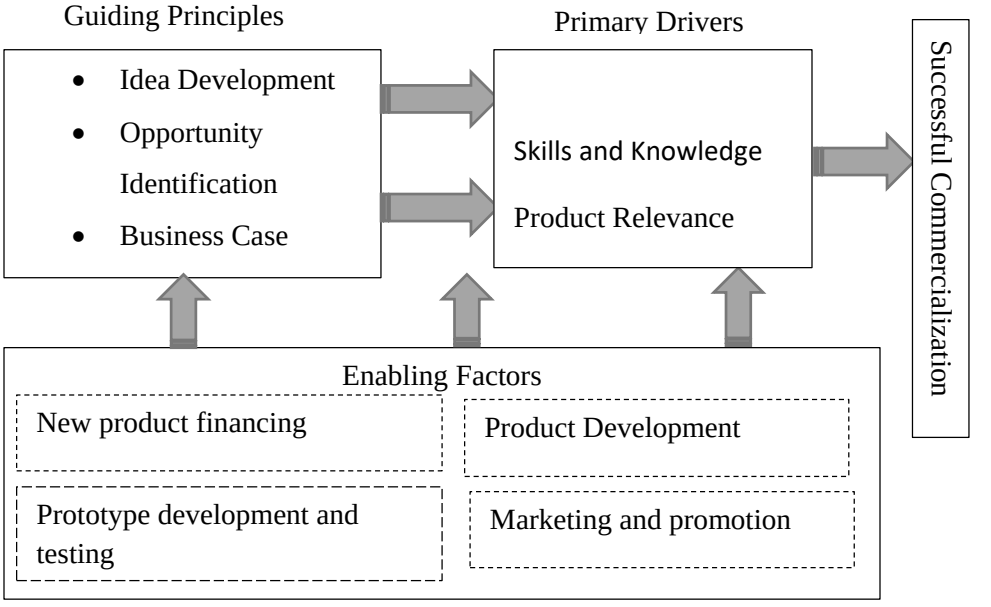
The factors form a model that incorporates the valid and reliable factors for the product commercialization, the relationship between these factors and perceived priority and importance in the product commercialization. The first stage is to present the components of the model as posited by Malhotra, Grover and Desilvio (1996). These components are Knowledge and skills, Financing for new product relevance, Product development, Prototype development and testing, and Marketing and promotion. These components were validated through interviews with 103 managers or owners of SMEs, and statistically confirmed with a measurement model. Critically, these components were confirmed with the empirical data. The dimensions have relationships with each other which are positive and medium to strong in strength. A conceptual model for the commercialization requires all six dimensions, with prioritisation of Skills and Knowledge, Product Relevance and Prototype Development and Testing. Figure 3 presents a model with the guiding principle, primary drivers and enabling factors of the commercialization of a new product. The critical step is the generation of innovative product based on what the customer desires, manufacturers also need to take into consideration the ability of the suppliers and their own workers with their vision and ideas, as valuable sources of opportunities (Hauser & Dahan , 2007; Tavares et al, 2016).

The development of new product ideas is driven by the identification of an opportunity that will make the new product thrive in the commercial market. These guiding principles have primary drivers, namely knowledge and skills, as well as product relevance. The relevance of the product factors are related to the investigation for relevance in the market for new product commercialization - conducting a survey on the need for a new product before development, so that there is evaluation of the competitive

advantages of the product in relation to other existing products and working towards developing and improving new products (Ismail, Nor & Sidek, 2015). Knowledge and skill factors represent the technical experience necessary to develop and commercialize new products, which in turn, leads to a need to market and promote the new product to make sure it is successfully commercialized. Shi and Zhang (2016) and Block and MacMillan (1995) identify enabling factors for the successful commercialization of new products: adequate finance to drive the production of the new product, testing the product before production and developing a high-quality product. These are congruent with the factors from this study, which included marketing and promotion, product development, prototype development and testing, as well as product financing.

Figure 3

Conceptual Model for New Product Commercialization in the Micro and Small Enterprises



Limitations

The study was not without limitations, the sample was not generalized for SMEs and used convenience sampling. As such, it is possible that the relative importance of the new product commercialization might change in different settings. Despite this, this effect was minimized by the diversity of the manufacturing enterprises across several industries. Furthermore, due to the level of the study, only one type of research method was followed. The study was limited to the commercialisation of new products, considering factors and variables, such as relevance of the product, knowledge and skills of the owners, and prototype testing of the product, financing, marketing and promotion.

Conclusion

The findings indicate that the six factors are important for commercialization, though the small enterprises have relied mostly on Product relevance, with Knowledge and skills as well Marketing and promotion ranked high as critical for sucessful product commercialization. This study addressed new product commercialization which is very important topic for discussion by all governments to encourage their countries to grow economically around the globe. Similar surveys have been conducted in the past in the United States, the United Kingdom and Ireland (Khan, Barczak & Moss, 2006). Metikurke and Shekar (2011) refer to a study that was done in New Zealand which pointed out the seven dimensions of NPD practice – the strategy, the process, the research, the project climate, company culture, metrics and commercialization. The survey measured the relative importance of each of the dimensions, and listed characteristics under each dimension for poor to best practices (Metikurke & Shekar, 2011).

This study addressed the commercialization factors of new product development. The following objective, which were presented earlier, was formulated to identify the processes and best practices to assist in the development of a conceptual model to assist micro and small manufacturing enterprises with the successful commercialization of new products. The underlying variables of these processes and best practices will have an influence on new product commercialization. The SME's ability to innovate

and successfully develop new products is crucial for both the recovery and continued development of economies (Nicolas, Ledwith & Perks, 2011). In conclusion, the factors that differentiated successful from unsuccessful new product commercialization in micro and small manufacturing enterprises is evident. It also clearly came to the fore that the commercialization of new products is an expensive and complex process with risky challenges, though not impossible to achieve. Based on the findings, there are strong relationships between variables that will definitely contribute to new product commercialization.

Future Directions and Implications

A conceptual model with set constructs and variables should be developed for the successful and effective commercialization of new products. These variables should have strong relationships with one another and have dependable and interrelated characteristics that needed to be considered equally. This can be a generic and dynamic conceptual model which can also be used in other parts of South Africa and the success of new products is critical to ensure viability and sustainability.

The relevance of the product has to be established prior to its commercialization. This is done by conducting a survey on the need for the product, investigating the existence of similar products in the market and checking the market for the intention of potential customers to buy the product. This must be done before product development. It is important for micro and small manufacturing enterprises to acknowledge that there are some products that are similar to their intended products already on the market. They must therefore evaluate the competitive advantage of their products in relation to other existing products and work towards developing and improving new products (Ismail, Nor & Sidek, 2015). This should then lead to micro and small manufacturing enterprises bringing relevant products to the market. Product development factors involve the simulation of a new product technologically (on computer) before physical development, the designing of products with full specifications during the design phase to test the feasibility of the product, the availability of research and development facilities, as well as whether available machinery and equipment are adequate for the manufacturing of new products. Prototype factors are critical to determine whether the

product is developed on a small scale on the owners' premises, whether any prototypes of products are developed before launching those products in the market, whether the prototypes are tested with selected customers in the market for suitability, and whether owners receive any feedback on prototype performance from potential customers to be incorporated into the final design.

It is important that the SMEs develop partnerships with financial institutions or investors, etc. to realize the commercialization rather than abandon the project; and lastly, whether financial challenges have resulted in relevant products, to capture the market and become more cost-effective, and sufficient financial capability is needed by manufacturing companies (Pellikka & Virtanen, 2009). The main sources for funding new product development have been identified as external finance and new equity. A lot of small technology companies had to obtain financial support internally. For external finance, small technology companies may not have the required collateral for investors.

The findings and recommendations of this study will greatly contribute to future research, to policy makers in particular, who are critical, as can been seen in the 2030 National Development Plan vision; this is the vehicle that will decrease inequality and poverty, alleviate unemployment and augment self-employment in South Africa.

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