Assessing best practices for new product development in organisations

WJS Claasens
12530603

Mini-dissertation submitted in partial fulfillment of the requirements for the degree Master of Business Administration at the Potchefstroom Campus of the North-West University

Supervisor: Prof RA Lotriet

October 2016
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ABSTRACT

New product development (NPD) is increasingly being recognised as a critical factor in ensuring the continued sustainability of organisations. For companies to compete in the market place, they have to keep up with market and technological changes that have accelerated in the last decade. To introduce new products successfully to the market place, new methods and techniques are inevitable. Starting with innovation and using NPD best practices, a product can be delivered to the market successfully. Assessment of best practices for NPD in organisations can help understand the dimensions of developing new products and being competitive. Implementation of NPD best practices within each dimension could vary in accordance with the size of the organisation due to company policies, management and structure of the organisation. This study will investigate best practices for NPD in organisations.

A survey was conducted and the sample was randomly taken from the target population located in the Vaal Triangle and neighbouring towns. Participants were business owners or management-level employees involved in the NPD process of the business. The literature study that was conducted elucidates the concept of a product, models of NPD and NPD best practice dimensions. In managing the NPD process, a few important points were raised to understand the complexity of NPD. An assessment of the empirical investigation was done to find practical answers to NPD best practices.

The relative importance of NPD best practices compare with previous research in literature. By comparing NPD best practices of SMEs and large enterprises, it was found that they do not have similar opinions regarding the relative importance of the seven dimensions of NPD. Strategy is the most important dimension, while metrics and performance measurement are the least important of the total of seven NPD dimensions that had been assessed. The ranking of company culture with a strong presence suggests that local organisations understand the need and urgency to embrace innovation.
Findings of best and poor NPD practices indicated that practitioners reflect quite evenly over all the practices, but slightly less over NPD best practices of the dimensions of commercialization and project climate. A general consensus among practitioners existed to what constitutes a best and a poor NPD practice on the seven dimensions. Additional work - that was not part of the objective, but nevertheless complemented the survey - was done. This included the assessment of structural relationships of NPD dimensions in organisations, as well as identification of the differences in NPD best practices between SMEs and large enterprises.

The contribution of the study is firstly to better understand NPD best practices by means of the assessment and structural equation modelling that will fill gaps in literature. Secondly, the study can help managers to improve their capabilities of NPD in practice.

Recommendations include the need for organisations to invest in opportunities and an environment that promote innovativeness. This includes skilled innovative human resources and financial resources to support NPD. Senior management has to encourage and provide for NPD in the organisation. The co-ordination of managers at different levels that involves the bigger picture of departments and achieving the mission and vision of the organisation has a final influence on NPD sustainability.

**Keywords:** New product development (NPD); assessing NPD; NPD best practices; organisations; new products; SMEs.
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ABBREVIATIONS

DTI - Department of Trade and Industry
NPD - New product development
NSD - New service development
NWU - North-West University
PDMA - Product Development & Management Association
SME - Small and Medium Enterprise
SEM - Structural equation modelling
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CHAPTER 1

NATURE AND SCOPE OF THE STUDY

1.1 INTRODUCTION

South Africa is one of the mineral rich countries in the world, with very rich deposits of gold, diamonds, iron core, platinum and coal spread across the country. It has an ideal climate for the production of wheat and maize and the climate also provides good conditions for making wine. South Africa has the second largest economy in Africa and is one of the largest producers and exporters of gold and platinum in the world (Maynhard, 2016).

South Africa’s average economic growth per year has been steadily declining the last six years from 4.1% to -1.2% (based on the quarter on quarter growth rates). Unfortunately South Africa did not diversify away enough from commodities during the good times with the economy still very much linked to revenue of resources and commodities (Maynhard, 2016).

According to the South African Reserve Bank (SARB), economic growth forecasts will be maintained at 0.4% for 2016, rising to 1.2% and 1.6% respectively over the next two years (SARB, 2016). SARB governor, Mr Kganyago, has announced that interest rates will remain unchanged at 7%, citing the continued volatility of financial markets and the high degree of uncertainty around policy changes globally. The decision comes after the latest inflation reading by Statistics South Africa that revealed consumer inflation to be 6.4% year-on-year in October 2016 (SARB, 2016).

Stimulation of the South African economy through development and growth of enterprises and creating jobs is crucial. Clearly South Africa has to solve problems such as Gross Domestic Product (GDP) growth, unemployment and employment skills levels among many other challenges. South Africa’s formal corporate employment (excluding informal and agricultural employment) level has grown by 11.8% from 2010 to 2016, but the population of South Africa has grown by a similar margin that means that South Africa is not creating enough new jobs to reduce unemployment (Maynhard, 2016). The unemployment rate
in South Africa reached its peak since 2004 at 27.1% in the third quarter of 2016 (Taborda, 2016). It seems that the South African economy is just drifting along without positive continuous trends giving hope of a strong economic recovery.

In context of a globalised economy and the integration of South Africa in the world economy, the competition is even higher with regard to building a competitive advantage and prosperity at local level. International companies also compete at national level. The South African manufacturing sector contributes more than 13% of the GDP of South Africa (Small Enterprise Development Agency (SEDA), 2016:12-31). When looking at the manufacturing production and utilisation figures after the 2008 worldwide financial crises, the manufacturing industry has not yet recovered and is rated at 82% utilisation. The main reason for underutilisation of manufacturing capacity in the economy was stated as “insufficient demand”. Other reasons include unskilled labour, raw materials and other unspecified reasons (Maynhard, 2016:3).

The manufacturing production and utilisation of available capacity are a good reflection of a country’s economic performance, currently indicating a desperate need for recovery as well as growth to help sustain the South African economy. Recovery of the manufacturing industry and continued development of organisations in a competitive economy are strongly influenced by innovation and the successful development of new products (Barczak & Kahn, 2012:1).

For organisations to be competitive, they have to effectively manage new product development (NPD) practices and processes. There is, however, limited research available on NPD practices in organisations in South Africa. To better understand the product development practices, this study will investigate best practices for NPD in organisations, including both the manufacturing and services sectors.

This paper starts with defining NPD best practices in organisations. The research instrument is discussed and the methodology and the results are then presented. New insights into NPD best practices are expected while various
observations of previous studies will be reaffirmed. The chapter will conclude by providing an overview of the rest of the dissertation to follow.

1.2 PROBLEM STATEMENT

Research on NPD best practices is mostly done for large organisations (Cooper et al., 2004a) and research by Nicholas et al. (2011) concludes that there are still weak areas of activity regarding NPD best practices of organisations that need to be investigated. More effective and efficient delivery of a new product could mean the difference between failure and success of sustainable organisations (Barczak & Kahn, 2012:293). Specific implementation of NPD best practices could vary in accordance with the size of the organisation due to company policies, structure and management (Gray & Maybey, 2005).

To contribute to the knowledge of NPD, best practices for organisations need to be assessed to confirm the relative importance of the dimensions being used. Characteristics of NPD best practices also need to be assessed in relation to what entails a “best” and a “poor” practice in organisations in order to ensure the most effective management of NPD projects. Organisations are continually aiming to improve their NPD processes by benchmarking their practices against those of other organisations. It is therefore essential to evaluate the NPD practitioner’s actual awareness of currently accepted NPD best practices.

Product development requires human and financial resources which are normally limited in organisations and may lead to insufficient implementation of the NPD process. Small organisations such as SMEs have to overcome significant disadvantages such as the lack of economics of scale and access to resources in order to be competitive in the market (Bartlett & Bukvi, 2001). Negative external and internal organisational factors have to be managed to secure sustainability of the NPD process.
1.3 RESEARCH OBJECTIVES

Objectives for the research are set out as follows:

1.3.1 Primary objective

The primary objective of this research is to assess best practices for new product development in organisations.

1.3.2 Secondary objectives

To achieve the primary objective, the secondary objectives of this research include the following, namely to:

- obtain insight into NPD best practices by means of a literature review;
- identify a best practice framework for NPD in organisations;
- assess the relative importance of NPD dimensions in organisations;
- assess comparisons between demographic variables and NPD dimensions in organisations; and
- categorise best-poor NPD practice characteristics as a best or a poor practice.

1.4 RESEARCH METHODOLOGY

1.4.1 Literature review

More specific background information on the formulated research will be collected via a broad literature review to provide direction on how to proceed with the research, comparing conclusions to the findings of previous studies. Various publications will be consulted, including textbooks, previous research studies and journals. The literature review will also extrapolate the issues that the research instrument needs to incorporate.
Through the broad literature review, several dimensions for NDP best practices will be investigated and put together to constitute an NDP best practice framework for the study. To compile a proper literature review, challenges have to be overcome towards finding appropriate literature on the topic of NPD, managing the information and presenting the knowledge in a logical, synthesised and reader-friendly way.

1.4.2 Empirical investigation

1.4.2.1 Participants and data collection
The research approach will be quantitative, using structured methods to evaluate objective data (Welman et al., 2005:10). The target population in this study comes from drawing representative data by selecting people because of their availability (i.e. convenience sampling described by Welman et al., 2005:69), with support being rendered by the local chamber of business. The sample is randomly taken from a selected group of businesses of the target population located in the Vaal Triangle. The participants are business owners or management-level employees who are involved in the NPD process of the businesses.

1.4.2.2 Measuring instrument
The constructs were measured by means of a structured questionnaire. The first section - section A - measures the demographic information and section B measures the NPD dimensions, namely strategy, research, commercialization, NPD process, project climate, company culture, metrics and performance measurement.

1.4.2.3 Procedure
The research aims to measure best practices of NPD in organisations. The survey questionnaire was sourced from the literature review.

At first a pilot-questionnaire was administered after which some minor adaptations had been made to the draft. The survey questions were clear and convenient to answer and the relevance of the survey participation was evident.
The questionnaire consists of demographical information, close-ended statements on the researched NPD dimensions and an open-ended question.

The questionnaire uses a five-point Likert scale as measurement tool and participants have to indicate their degree of disagreement or agreement with the specific statement (the scale ranges from 1 to 5 where 1=strongly disagree, 5= strongly agree).

The sample was randomly selected and questionnaires were made available to each participant of the target population. The research purpose was explained to the participants by means of a verbal explanation and in a cover letter. The questionnaires took approximately 30 minutes to complete. Participants were requested to complete and submit the questionnaires to the representative. The collection of data took approximately seven weeks.

1.4.2.4 Statistical analysis
The collected data was analysed as follows:

- Demographic data and business information were statistically analysed using the IBM SPSS predictive analytics software.
- Data was analysed to measure the relative importance of the seven dimensions of NPD best practices in respect of NPD success.
- Reliability of the questionnaire measuring the dimensions determining Cronbach alpha and maintaining that a reliability coefficient of 0.70 and higher is acceptable and was therefore used as a cut-off point for reliability.
- Comparisons between specific demographic variables and the seven dimensions for NPD best practice were analysed.
- Data was analysed to categorise the NPD dimension characteristics in respect of best and poor practices.
- Open-ended questions in the questionnaire were addressed.
- Structural equation modelling was used to draft the dimensions for organisations.
- The difference of NPD best practices between SMEs and large enterprises was evaluated.
The North-West University (NWU) Vaal Triangle Campus’ statistical consultant for Optentia Research Focus Area was consulted to statistically analyse the data collected in the survey.

1.4.2.5 Ethical considerations
Ethical dilemmas that the researcher could have encountered during his research were carefully addressed. Participation was voluntary and participants were informed about the research objectives. Communication between the researcher and the participants was confidential and participants were assured of anonymity regarding their participation. The research also complied with the ethical requirements of the NWU’s Faculty of Management and Economic Sciences.

1.5 SCOPE OF THE STUDY

The target population sample was randomly taken from businesses in the Vaal Triangle. The participants were management-level employees. The study was conducted amongst SMEs and large enterprises from different economic sectors.

1.6 LIMITATIONS OF THE STUDY

The widespread field of the subject and limited information makes it difficult to find specific literature on this topic. To find appropriate literature was time consuming during the period available to do the survey.

To further find an appropriate person in the organisation that would complete the questionnaire was also time consuming and entailed a lot of effort.

Participants’ responses were not as expected and many of the questionnaires were incomplete, influencing the size of the sample to be much smaller than anticipated.
1.7 CONTRIBUTION OF THE STUDY

A limited amount of research on NPD in South Africa has been done. The study will contribute towards the understanding of best practices for NDP in organisations.

The study can help managers improve their skills and capabilities of NPD, focusing on the dimensions and best ways of implementation that will enable them to respond to uncertainties and maintain successful NPD performance.

1.8 LAYOUT OF THE STUDY

Figure 1.1 visually indicates the chapter outline of each chapter.

Figure 1.1: Graphical representation of the study

The dissertation will be divided into chapters as follows:

Chapter 1: Scope and nature of the study

Chapter one started with an introduction to the study and explained the problem to be investigated. The primary and secondary objectives for the study were identified and the research methodology was broadly explained. The chapter addressed the need to assess the selected dimensions and best practices of NPD in organisations. The limitations and contribution of the study were highlighted and chapter one elaborated on the structure of the dissertation.
Chapter 2: Literature review

A literature overview will be given in order to understand the specific environment of NPD and how it relates to the theoretical aspects and investigations that have been done in the past.

The chapter will define the appropriate terms that are being used in the study. Chapter two will identify and discuss the dimensions for NPD and the associated characteristics of best-poor practices.

Chapter 3: Empirical investigation

Chapter three presents a comprehensive explanation of the research methodology and methods that will be followed to complete the study. The data collection process, statistical analysis and findings will be presented.

The empirical results will outline the demographic profile of the respondents (descriptive frequencies and histograms), the relative importance of the seven dimensions for NPD (relative mean values of dimensions), reliability of the questionnaire measuring the dimensions (Cronbach’s alpha), correlations of the NPD dimensions, NPD best and poor practices (rating of best practice characteristics) and comparison of various demographic items versus the seven dimensions for NPD (comparisons, significance and effect sizes), structural relationship of the dimensions for an organisation and difference of NPD best practices between SMEs and large enterprises.

Chapter 4: Conclusion and Recommendations

Chapter four draws conclusions of the findings from the statistical analysis and includes the relative importance of the dimensions for organisations, comparisons between demographic variables and NPD dimensions, NPD best and poor practices, structural relationship of the dimensions for an organisation and differences of NPD best practices between SMEs and large enterprises will be discussed.
The objectives set for the study will be evaluated to confirm whether they have been met. The chapter concludes by making recommendations and suggestions for further research.

1.9 SUMMARY

This chapter concluded the nature and the scope of this study and identified the different aspects. The purpose of this investigation has been made clear. The problem statement and the need to measure best practices of NPD were formulated. The primary and secondary objectives were identified, based on the problem statement. The research methodology was explained, including a broad literature and an empirical review; the limitations were also presented. Furthermore, the structure of the dissertation with a brief overview of each chapter as well as the areas of research conducted in each was presented. The literature review is presented in the next chapter.
2.1 INTRODUCTION

Literature emphasizes the importance of new products to be introduced to the market for continuing business success. Ulrich and Eppinger (2011) documented the contribution of new product development (NPD) to the growth of organisations, profit performance and its role in business planning.

Development of new products or modifying products to appear new or with new attributes is crucial to the prosperity of modern organisations. According to a benchmarking study, new products can account for as much as 27 percent of annual organisational sales on average (Cooper, 2012:45, Edgett, 2011). Enhancing innovative abilities for corporate growth and prosperity has become the number one driver of organisational success (Arthur, 2005:6).

As much as 53% of new products do not succeed the initial development process to being launched into the market (Cooper & Scott, 2012:45). Managing the NPD process has become a challenge for organisations and is time sensitive, requiring human and financial resources. Smaller enterprises such as SMEs are put under a lot of pressure by lack of human and financial resources.

Table 2.1 includes criteria for different enterprise sizes in terms of number of employees. SMEs employ between 6 and 200 employees and have an annual turnover of less than R51 million, whereas large companies exceed the limit of 200 employees and R51 million annual turnover. For the purpose of this study, the common classification of organisations via employee numbers was chosen.
Table 2.1: Classification of micro, small, medium and large enterprises in terms of employees

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of employees</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>South Africa</td>
</tr>
<tr>
<td>Micro</td>
<td>0 – 5</td>
</tr>
<tr>
<td>Very Small</td>
<td>6 – 20</td>
</tr>
<tr>
<td>Small</td>
<td>21 – 50</td>
</tr>
<tr>
<td>Medium</td>
<td>51 – 200</td>
</tr>
<tr>
<td>Large</td>
<td>201+</td>
</tr>
</tbody>
</table>

(Source: Adapted from Metikurke & Shekar, 2011; South Africa. National Small Business Amendment, Act 26 of 2003)

Despite extensive research on NPD and how to achieve success, NPD is risky and expensive. Many uncertainties and challenges throughout the NPD process calls for research on the use of best practices to optimize new product development (Bhuiyan, 2011:747). A good understanding of the nature of market and customer needs and wants and the competitive environment that all contribute to the required factors for the success of NPD is essential.

This chapter introduces NPD, starting with innovation and its influence on new product development. The concept of new products is discussed, followed by the stages and models of NPD that have been developed by previous researchers. The literature survey includes management of the NPD process to effectively execute new products. The seven dimension best practice framework for NPD is introduced and the characteristics of each dimension are discussed. The NPD best practice gaps are explained and the chapter concludes describing the importance of NPD as part of the organisational strategy.
2.2 CONCEPT OF NEW PRODUCT DEVELOPMENT

NPD describes the process of the new product that starts with an innovative idea, and is then developed through a number of developing steps and is finally launched into the market.

2.2.1 Management of innovation

Innovation is complex and involves different activities to be managed effectively. Some companies are more innovative than others and results of their success of long term sustainability show that innovation is synonymous with NPD and is important towards generating revenue (Trott, 2012:28). Innovation acts as a source for NPD and literature on innovation helps to better understand the complexity of NPD (Trott, 2012:30). Innovation - viewed as a management process - is illustrated in figure 2.1, with an iterative nature of network processes and representing an endless innovation circle with interconnected cycles.

The circular concepts by Trott (2012:30) help explain how firms gather information, use societal and technical knowledge and develop innovative propositions. With an entrepreneur positioned at the centre, partnerships are achieved with those having capabilities that are to the benefit of each party. In the cyclic innovation model engineering, behavioural science, natural science and markets are brought together to activate changes, leading to potential business opportunities (figure 2.1). Entrepreneurship plays a central role in innovation and new products and management of innovation need to let innovations build on innovations – a non-linear thinking process.
Figure 2.1: Innovation circle with interconnected cycles

(Source: Berkhout et al., 2010)

New products are developed through innovation and, although being complex, it is enhanced by the right people who can create ideas, concepts and challenges in the workplace.

2.2.2 Innovation management and NPD

The importance of innovation and effective management of the innovation process can lead to corporate success. With new products that are created through innovation, the concern is that the right organisational conditions have to be in place to ensure NPD (Trott, 2012:418).

It is through NPD that opportunities are transformed into physical products and are influenced by management disciplines involved in NPD. Different functional departments have their own perspectives of NPD. Production management ensures an effective and less expensive high quality product and process
The marketing perspective is different and would be concerned with the needs of the customer. The multiple perspectives to the development of new products hinder a common approach, while the variety of views on NPD should strengthen it. Figure 2.2 illustrates the functional perspectives.

Figure 2.2: Variety of functional perspectives

(Source: Trott, 2012:419)

Long-term organisational success is dependent on the organisation’s ability to compete; the organisation needs products that are superior to those of the competition (NPD Solutions, 2016:1). Cooper (1999) suggested that on average an increasingly larger slice of the company revenue is earned by new products less than five years old. Product life cycles are increasingly becoming shorter for different reasons which include rapid technological change and competition.

2.3 THE CONCEPT OF NEW PRODUCTS

Products new to the organisation do not mean that they are new to other organisations, while products new to the market are introduced to the market for the first time. This illustrates that “newness” is a relative term which, together with “what is a product?” will be discussed in the following sections.
2.3.1 “Newness” of products

Attributes of products can meet the needs of the customer by only changing its configuration (such as the size of the packaging), or a product in a smaller compact format (such as a smaller compact disc player compared to an existing one). From a marketing perspective, any product that did not exist before can be seen as a new product and is marketable (Trott, 2012:428).

According to Stanski (2016), “newness” of products can be defined as either new to the company or new to the market and these two types can again be classified into six classes of products. Percentages given are a generalised international indication by Trott (2012:430):

- **New to the world:** It is a new market that is created with first of its kind products. These are innovations that usually contain technological development and sometimes lead to revolutionary new designs. New to the world products represent about 10% of all new products.
- **New product lines:** It is a product new to the business and creates a new market segment for the business. This represents about 20% of new products.
- **Additions to existing product lines:** This is a product new to the business, but part of an existing product line and market segment. This represents approximately 23% of new products.
- **Improvement and revisions to existing products:** Improvement means replacing existing products through incremental innovations. This makes up 34% of new products.
- **Repositioning:** New applications for existing products to target new market segments make up 4% of new products.
- **Cost reductions:** A product with similar benefits and performance as the old product, but at a lower cost to the business. This new product represents approximately 9% of innovated new products.

In practice, new products of an organisation are part of a product portfolio due to the classification of new products. On calculation of the above percentages,
most of the projects of an organisation’s portfolio (70%) are improvements to existing products.

2.3.2 Concept of a product

As described by Kotler and Armstrong (2014:275), consumer products are products and services bought for personal consumption by consumers. Industrial products, on the other hand, are those products bought for further processing or use in conducting a business. A product is identified at three levels and consists of the core value, the actual product and the augmented product. Each level adds more customer value and is presented in figure 2.3.

Figure 2.3: Three levels of product.

(Source: Kotler & Armstrong, 2014:250)

The three levels of a product, i.e. the core value, the actual product and the augmented product, are described by Claessens (2015) as follows:
2.3.2.1 Core customer value
The core customer value or core benefit (also refers to the first product level) describes the main purpose of the product or core value that the customer seeks. If it is an automobile, the core value will be transportation. The core customer value answers the question: What is the buyer really buying? Some customers might seek status or glamour and not only transportation. The core customer value is more than the product itself and the customer determines the value of the product.

2.3.2.2 Actual product
After the core customer value for a product has been established by marketers, the real product can be developed accordingly. The actual product attributes relate to the first level product or core customer value. Developing a product involves product design, product features, a quality level, a brand name and packaging of the product. This second level product or actual product builds on the core customer value to add value to the product for the customer. Elaboration on these attributes follow:

- **Brand name:** A brand is described by a brand name that can be vocalised, or a trade mark that can be recognised (e.g. Pepsi, or the Adidas logo). The trade mark can be a name, a word, a symbol or mark. The brand or trade mark has been registered, has legal protection and presents advantages such as product identification and acceptance and trust by the customer (Friedman, 2011).

  The brand name selection should be something about the product’s benefits and qualities. The name must be easy to pronounce and to recognise, and must be remembered by clients (Australian Seafood CRC, 2013). The name clearly identifies the specific product and when the name is changed, an alternative product is expected from clients.

- **Quality specification:** To ensure the specification of the final product, the buyer has to be sure that suppliers of products are following quality requirements and expectations as set out for the specific product. A quality product or quality service is the degree in which customer requirements are
met when both supplier and customer agree on the requirements (Hermans & Liu, 2013). Quality has different orientations, described as follows by Hermans and Liu (2013):

- **Product-oriented quality**: This quality is the sum of the properties of the product and can be defined by metrics. A better quality requires higher costs, because new property increases costs.

- **Function-oriented quality**: This quality is defined as a uniformity or equivalence to product specification and is effective and faultless of the function. Function-oriented quality is strongly linked to preventive problem solving and cost reduction.

- **Customer-oriented quality**: Products with high quality fulfil customers’ needs and expectations and highlight suitability for usage. Success of supplier companies depends mostly on their ability to identify customer needs and create products that meet these needs and are produced at low cost. Product quality specification has become an important competitive issue and, by changing the product specification, a new product is defined.

Kotler and Armstrong (2014:254) stated that organisations view quality as an investment and can be described as performance quality (product ability to perform its functions) and conformance quality (freedom of defects and consistent delivering of the same level of performance). Quality does not only apply to the product or service, but involves the associated people, processes and the organisation that handles and markets it.

- **Packaging**: Packaging of products is unavoidable. Merely all products require packaging in all kinds of industries. Products and packaging have become integrated items in the process of NPD. With national and global transactions between countries, packaging has become part of the product (Hult & Nilsson, 2005:15).

Three basic principles of packaging include protection (and tamper proofing) of the product, containment and identification of the product (Trott, 2012:461). Protection as a primary role is to preserve the integrity of the product by protecting it against transit and climate hazards. Special
packaging designs, methods and materials are used to prevent tampering. Containment of products distinguishes between dry and wet products and between packaging as an additional item and packaging as part of the product, such as a cool drink. Some packaging has dispensing and resealing features. It is practical to identify products by labelling the package. Many attributes of printing can be used to identify and market products. The product can be displayed in many different colours, shapes and materials by design.

Packaging considerations start with the product in mind and the reasons to contain, protect and identify the product; the consumer is also kept in mind with packaging opening up a world of possibilities for marketing (Boundless, 2016:2). Environmental considerations are also of high importance and involve environmental responsibility, recycling alternatives and considerations for sustainability of the environment.

Depending to what extent the packaging of a product is changed; the expectation of the client is raised for a product with new attributes or a totally new product.

- **Design:** Product design contributes to customer value. Through style and design, the appearance and usefulness of a product are described. Technical specifications identify the product and through its attributes, it contributes value to the customer. Along with functionality, design of a product includes materials, colour and its packaging. Considerations for design success include functionality, aestheticism, innovation, simplicity, durability and being environmentally friendly (Palffy *et al*., 2015:306).

- **Features:** The core product defines the core purpose and benefits for the customer. Features can be added to the product that increase its value, creating a higher quality product. By adding features to a product, it is used as a competitive tool for differentiating the product from those of competitors and can also be used to extend its lifetime. Features of a product describe and communicate the capability of the product to the customer (Kotler & Armstrong, 2014:254). Although customers are
interested in product benefits in the first place, product features are compared; a unique feature may provide a competitive advantage.

2.3.2.3 Augmented product
The augmented product or third level product again adds value to the other two product levels and contributes to customer value. The augmented product offers additional consumer benefits and services and completes the product that is presented to the customer in the form of after-sale service, instructions or a warranty. The three levels of product are marketed as one product in order to create customer value and satisfaction.

2.4 THE PRODUCT LIFE CYCLE

After a new product has been launched into the market, it has a life cycle during which it is accepted by the consumer and reaches a phase of maturity, meaning that sales peak. After the maturity phase, sales decline and it is time for the product to be withdrawn, improved or repositioned. NPD involves development and improvement of products at the appropriate time of its life cycle to benefit the organisation best.

A product’s life cycle can be divided into several phases and a curve can be drawn, showing product revenue over time. The curves in the figure below illustrate the sales and profits of a product over time and may change for different products (Kotler & Armstrong, 2014:296). Noteworthy, is that a product’s lifetime may be very short, such as a few months for a fad product or years for an automobile or industrial equipment.
The phases of the product life cycle are described below with reference to Kotler (2014:295) and Hazer and Render (2014:194):

- **Product development phase**: During the product development phase, costs accumulate without any sales. This phase represents the NPD process (see section 2.7.1.4) and can be very costly if the product fails. Product development can take years to complete that make managing of every stage of the NPD process very important.

- **Introduction phase**: The purpose of introduction is to make customers aware of the product and its benefits. Sales can be expected to be low during this phase, while costs are typically high for advertising in order to increase customer awareness. The marketing strategy for the specific product is executed and needs to direct the marketing purpose for the rest of the product’s life cycle.

- **Growth phase**: The growth phase is a period of rapid revenue growth. The goal is to increase sales and gain consumer preference. Competitors may enter the market that can result in price competition and an increase in promotional costs.
- **Maturity phase**: The sales peak and the cost per customer are at its lowest. Competition increase could result in decreased market share and/or prices. At this point, competing products may be very similar, making product differentiation very difficult. The primary goal of the maturity phase is to maintain market share and extend the product life cycle.

- **Decline phase**: Sales begin to decline for different reasons, such as when the market becomes saturated, customer tastes change or the product becomes technologically obsolete and the product needs to be improved, repositioned or replaced.

Fading products can harm the reputation of an organisation and delay the search for replacements, creating lopsided product mix and hurting current profits. Although products do not have very well-defined life cycles such as living organisms, an organisation identifies products and their position in the life cycle to review strategic options. The NPD team should stay committed towards developing and improving a product till it is withdrawn.

### 2.5 DEFINE NEW PRODUCT DEVELOPMENT

NPD is the process of developing a new product or service for the market. The process entails a number of steps that must be completed before the product can be introduced to the market. Steps include the conceptualization, development and marketing of products or services. Organisations must carry out a systematic customer-driven NPD process for finding and developing new products (Kotler & Armstrong, 2014:285).

NPD may be done to improve an existing product or to develop a new product that will compete with other products in the market. The objective of product development is to cultivate, maintain and increase a company’s market share by satisfying consumer demand (Rouse, 2016).
2.6 STAGES OF NPD PROCESS

Early stages of the new product development process are defined as idea generation and screening, and concept development and testing. These stages of NPD represent an idea before it takes on any physical form as a product that is marketable. From this point onwards, costs will rise significantly as the product is manufactured and taken through the different steps to commercialisation (Bhuiyan, 2011:748).

The functional organisational activities undertaken to develop a product from idea to commercialisation present the actual process for NPD and are captured as a linear stage process for NPD as described by Trott (2012:433). The linear models for the NPD process presented by Cooper (2008) as well as Kotler and Armstrong (2014:285), describe the same steps for the NPD process as Trott (2012:433), but not in the exact sequence. This difference, however, does not refer to a problem area, but rather prove that the process has room to be applied differently according to the organisation’s preference. Regardless of the above minor difference in the stages for the NPD process, the eight-stage process is frequently presented and explained in the linear stage process for NPD.

2.6.1 Linear stage process for NPD

The linear stages for the NPD process are shown below as presented by Trott (2012:433). The eight stages are as follows in sequence:

- **Stage 1. Idea generation:** This is to search for product ideas and opportunities that meet the company objectives.
- **Stage 2. Idea screening:** This comprises an analysis to determine which ideas are pertinent and merit a more detailed study. Ideas for unfeasible products are stopped.
- **Stage 3. Concept testing:** To find out if the concepts have strong consumer appeal, new product concepts were tested with a group of target consumers.
• **Stage 4. Business analysis**: A review of the sales, profit projections and costs for a new product to evaluate whether these factors satisfy the company’s objectives.

• **Stage 5. Product development**: Develop the product concept into a physical product to ensure that the product idea can be produced and marketed.

• **Stage 6. Test marketing**: The product and the proposed marketing programme of the new product are tested in realistic market settings.

• **Stage 7. Commercialisation**: Products are introduced to the target market.

• **Stage 8. Monitoring and evaluation**: The success of the product in the market is monitored and evaluated.

The linear stages in the NPD process are widely recognized and appear to encompass all the stages found in literature. Companies that successfully introduce new products to the market are more likely to have a formal NPD process in place, passing through the stages.

Research suggests that the simple linear model is not a true representation of reality and that the process should be viewed as a simultaneous and concurrent process with an interaction that is cross-functional (Barczak et al., 2009). Cross-functional teams (see section 2.7.1.3) build creativity that accelerates the time to market of new products and improves long term product success. This positive influence can be explained by the wide cross-functional involvement that contributes greater information diversity (Bunduchi, 2009). NPD decision making requires a greater variety of information to be taken into consideration which leads to problem-solving creativity. A cross-functional team assigned to each project will increase the NPD performance of the organisation.

### 2.7 MODELS OF NEW PRODUCT DEVELOPMENT

Different models for NPD were developed to represent the activities undertaken by the organisation to constitute the actual NPD process (Ulrich & Eppinger, 2011).
2.7.1 Different NPD models

A number of NPD models had been developed over the years and can be classified into distinct categories according to Trott (2012:439). These models are:

- departmental-stage models;
- activity-stage models;
- cross-functional models (teams);
- decision-stage models;
- network models; and
- traditional methods.

The above mentioned models for NPD are now discussed.

2.7.1.1 Departmental-stage models

Departmental-stage models are based on the linear model of innovation for the NPD process where a different department is responsible for a certain task to complete the NPD project. The engineering department will only start developing prototypes after research and development had finished their technical ideas and the manufacturing department will start after prototypes had been developed.

2.7.1.2 Activity-stage models

An activity-based model emphasises activities conducted for the NPD process and is a better representation of reality of the process than the department-stage model. The activity-based model facilitates iteration of the activities through the use of feedback loops. The latter activity-stage models have highlighted the simultaneous nature of activities within the NPD process (Trott, 2012:439). This emphasises the need for a cross-functional approach of execution of the NPD process-like activities that occur simultaneously, but with different intensity. In practice, the development process is delayed by the passing of tasks from one to the other department within activity-stage models.
2.7.1.3 Cross-functional models (teams)

Common problems with the product development process revolve around communication between different functional departments. With projects being passed unnecessarily between departments, increased changes and subsequent lengthening of the process occurs. With cross-functional teams limitations will be removed by having a dedicated project team. This model puts emphasis on the use of project management and interdisciplinary teams (Kim, 2008:3).

2.7.1.4 Decision-stage models

Decision-stage models for NPD present a series of decisions that need to be taken in order for the project to progress. The stage-gate process model was developed and, according to Cooper (2008:3), the stage-gate process model is widely employed and divides the process into distinct time-sequenced stages separated by management decision gates. A prescribed set of related cross-functional tasks must first be completed by multifunctional teams to obtain management approval. Approval at every stage must be given before the team can proceed to the next stage.

The stage-gate process model also has some limitations that include the process which is focused on the end gates rather than on the customer and, if the gatekeeper’s knowledge is limited, it can lead to poor judgements being made about the project (Trott, 2012:441). Figure 2.5 presents a typical five-stage, five-gate NPD process model.
2.7.1.5 Network models

Network models are presented as accumulating knowledge from a variety of different inputs, such as research and development, manufacturing and marketing. As the project progresses through the development stages, NPD knowledge is gradually enhanced over time. This process of knowledge accumulation from a variety of sources forms the basis of the network model (Trott, 2012). Network models contribute to NPD and emphasise external linkages that are coupled to internal activities. This suggests that external linkages can facilitate knowledge flow into the organisation and enhance the product development process.

2.7.1.6 Traditional methods

A traditional method of product development and manufacture, especially in small enterprises, is to operate a craftsman-style approach. After idea screening of the new product, the manager will give the idea or the idea and basic drawings to the craftsman who has to make the prototype. This is a practical way of execution and can be expected to continue in future.
2.8 NPD BEST PRACTICE FRAMEWORK

A framework entails an outline of interlinked items which supports a particular approach to a specific objective and can be modified as required. The NPD framework serves as a guide by which the product development process can be guided.

2.8.1 Introduction

The literature study conveyed new product development and the aspects of direct influence to new products as a variety of perspectives and product development process models. Organisations need a portfolio of NPD projects that is custom to them with a corresponding mixture of processes that promote success for new products and services (Kahn et al., 2012:182).

2.8.2 NPD best practice definition

Best practices have proven to reliably lead to a desired result and are formulated through experience and research and can be applied across industries to explain a best or most efficient way of doing the work. New standards for a problem are set by defining a problem, measuring, testing and implementing best practices as an improvement and solution to the problem. To share and compare best practices between organisations, it can be used as a benchmark for business performance (Investopedia, 2016).

2.8.3 NPD best practice framework development

NPD has various facets that are delineated across different dimensions (see section 2.8.4) and can be classified into numerous characteristics (see section 2.8.5). Scholars who identified best practices for NPD (Adams-Bigelow, 2005; Barczak et al., 2009), expect organisations to use and sustain the best practices. The NPD framework of this study builds on previous studies (Barczak et al., 2009; Nicholas et al., 2011) and delineates NPD best practice across seven dimensions, namely strategy, research, commercialization, NPD
process, project climate, company culture and metrics, and performance measurement.

According to Nicholas et al. (2011), different researchers were involved over time in developing the seven dimensions framework for NPD. The progressive result is described as follows:

- NPD practice was portrayed across dimensions of cross-functional co-operation, demand-pull and customer orientation, champion and top-management support (Lock, 2000:246).
- The dimensions of strategy, leadership, planning and selection, communication and collaboration, culture and climate, and structure and performance were used by Cormican and O’Sullivan (2004).
- Dooley et al. (2002) used generic dimensions of NPD strategic implementation (goals, project selection, and product strategy customer involvement), while execution of NPD (process control, documentation, and metrics) is controlled, enhancing NPD human resources and improving the NPD uncertain front end.
- Best practice was characterised across nine dimensions, including new product strategy development, resource allocation, NPD process, strategic synergy, senior management accountability, management commitment, NPD team composition, organisation, and project climate (Cooper & Kleinschmidt, 1995:374).
- Kahn et al. (2006) described the six best practice areas of portfolio management, market research, strategy, process, people, and metrics and performance evaluation.
- The seven dimension framework was explored involving 20 NPD experts and seven separate dimensions characterising NPD were proposed. The Barczak and Kahn (2007) framework can be seen as one of the most relevant frameworks for NPD in an environment that is dynamic and a changing body of knowledge (Nicholas et al., 2011:230).
2.8.4 NPD best practice dimensions

The NPD framework of Barczak and Kahn (2007) was identified and is used as the framework for this survey, because the framework can be seen as one of the most relevant frameworks for NPD. To gain insight and understanding of the practices that influence NPD success, the seven dimensions of the framework are as follows:

2.8.4.1 Strategy
Strategy for NPD is to define and plan a focus and clear objectives to provide guidance for the new product effort that complies with the corporate strategy as a whole. Clearly defined areas are needed, such as research and development, technology, management and markets in order to give direction to the organisation’s new product programme (Bhuiyan, 2011:747). Financial goals for NPD are defined in terms of organisational growth, i.e. a percentage of anticipated growth that is attributable to new products or services. A dedicated budget for NPD needs to be drawn up. A well-considered strategy will help to efficiently execute the NPD process and utilise resources. Wasting of time and money will be avoided.

2.8.4.2 Research
Research to strengthen development of new products involves application of methodologies and techniques to learn and understand environmental forces, competitors, suppliers and customers in the marketplace (Barczak & Kahn, 2007). More successful products are the result of a strong market and orientation with the customer’s needs and wants in mind. Market research techniques include concept, product and market testing in order to determine customer response and product definition (Cooper et al., 2002).

2.8.4.3 Commercialization
Commercialization of new products can be the most costly step of the NPD process (Cooper et al., 2004a). The organisation’s first opportunity will be its best opportunity to launch a new product and maximise profits. Commercialization represents the activities that stimulate customer adoption
and market diffusion and include marketing, launch and post-launch management of new products.

2.8.4.4 NPD process
According to Barczak and Kahn (2007), the NPD process is the implementation of stages and gates (see section 2.7.1.4) for product development that moves products from concept to launch. A differentiating factor for the failure or success of new product development is the use of a formal NPD process (Million, 2016).

2.8.4.5 Project climate
Project climate represents team-related initiatives and human resources to manage projects. Project climate includes leading, managing and motivating individual and team human resources (Barczak & Kahn, 2007). Leading organisations use cross-functional teams to enhance the NPD process, while employees from different areas of expertise also contribute to the development of new products (Cooper et al., 2002, 2004a).

2.8.4.6 Company culture
Company culture is described by the organisational management value system driving product development collaboration (between organisational teams) and development-thinking with external partners such as suppliers and customers (Barczak & Kahn, 2007). NPD success is influenced by an entrepreneurial climate and the level of senior management support. Best practice enterprises claim many of the mentioned attributes as being characteristic of successful NPD cultures which are trust, passion, risk-taking, flexibility, team orientation, openness to new ideas, tolerance for mistakes, willingness to experiment and diversity of thinking (Million, 2016).

2.8.4.7 Metrics and performance measurement
Metrics and performance measurement refer to the tracking, reporting and measurement of product development (Barczak & Kahn, 2007). Improved product success is supported by measurement of NPD performance. Specific NPD goals are measured, such as market share, time to market and financial objectives for NPD.
2.8.4.8 International comparison

Results for NPD dimensions of an international survey comparing results of samples between the USA, UK and Ireland are presented in figure 2.6 (Kahn et al., 2012:187). For purpose of the graphs “metrics and performance measurement” will be written as “metrics and pm”.

Figure 2.6: Relative importance of NPD dimensions across USA, UK and Ireland.

![Relative importance of NPD dimensions for USA, UK and Ireland](image)

Significant differences between the USA and UK pertain to the dimensions of project climate and company culture. The UK views project climate as being more important than company culture and, given the background information, the UK is likely to have smaller, dedicated cross-functional teams that emphasize project climate due to limited employee resources opposed to the USA sample with larger enterprises. The relative importance of the seven NPD dimensions portrayed in the figure gives an indication as to what the current survey can present.

2.8.5 NPD best practice characteristics

Best practice characteristics describe the seven dimensions that were defined in the previous section. The characteristics define the maturity levels for each dimension and indicate the organisational operating level for a particular
practice (Barczak & Kahn, 2012:295; Nicholas et al., 2011). Based on the findings of general benchmarking studies by Barczak and Kahn (2012), best practice characteristics were developed and portray poor to best practices. Four maturity levels were chosen to reflect these activities and they are poor, good, better and best.

A brief discussion follows of the characteristics selected for each dimension of the NPD framework:

- **Strategy:** Involves defining and planning the NPD vision and resource support of projects. Characteristics will reflect these activities across maturity levels. Characteristics of a poor maturity level will indicate that an organisation has unclear goals and no prioritisation of NPD projects. Best practice characteristics will indicate maturity in having well developed and clear NPD goals, with projects being reviewed on a regular basis and the projects in a portfolio being aligned to the NPD strategy.

- **Research:** Involves methodologies and techniques to understand competitors, customers and external business forces. No customer involvement in the NPD process and incomplete market research are considered to be poor practices. Characteristics for best practices describe an organisation where customers are involved in the NPD process and research has a high priority.

- **Company culture:** This dimension within the framework is defined as the organisational value system that promotes product development thinking and collaboration with external partners. Best maturity characteristics reflect multiple sources for ideas and senior management that supports NPD efforts. Poor maturity characteristics reflect management as not being supportive to NPD projects and an organisational environment that does not encourage creativity.

- **Commercialization:** Describes the activities that promote marketing, launch and post-launch management of new products. Best practice characteristics are seen as practices when cross-functional teams are used and when marketing is part of the project from the beginning. Poor practice characteristics are when teams and marketing are not an integrated part of the NPD process.
• **Project climate**: This dimension can be seen as the means and ways that support product development within the organisation integrates at team and individual levels, motivating human resources. Best and poor practice characteristics are described by a project climate where NPD work is completed by either empowered cross-functional teams or individuals on an ad-hoc basis, respectively.

• **NPD process**: The process for NPD is described as the implementation of product development stages; moving products from concept to launch. This process includes knowledge management and activities and systems necessary. A best practice characteristic indicates a process that cuts across organisational groups, and is flexible in meeting the needs, size and risk of individual projects. A poor practice is characterised by the absence of criteria and documentation regarding the NPD process.

• **Metrics and performance measure**: The metrics process for NPD is described as measuring, tracking and reporting product development performance. A best practice characteristic indicates a process where formal objectives are set against which performance can be evaluated, and flexible enough metrics are used to meet the needs of individual products. Poor practice in an organisation is characterised when no evaluation criteria exist for their NPD capability.

The description on how each characteristic should perform at each maturity level helps the practitioner evaluate every characteristic of the dimensions in practical terms.

### 2.8.6 NPD best practice gaps

Implementation of NPD best practice needs to be developed and benchmarked from time to time. Organisations’ NPD strategy needs to be flexible to respond to new markets and products. By assessing how the organisation accomplished its goals in terms of NPD and at what stage it should be, priorities can be set for making improvements to cover the “gap” between the current practices and best practices (Barczak & Kahn, 2012:298; NPD Solutions, 2016). The assessment of best practice and an improvement process are presented below.
Best practices were organised into a framework with seven major dimensions; in this survey they are strategy, research, company culture, project climate, NPD process, commercialization, and metrics and performance measurement. By analysing the questionnaire for the seven dimensions, an assessment can be made for the best practice gap between the current situation and industry performance (benchmarking), with an industry data base in place, and also against a best practice framework that is established through research by different institutions. The said performance evaluation is illustrated in figure 2.8 below.
The best practice gaps between what researchers present as best practices and what practitioners consider to be best practices, present a challenge to all involved (Nicholas et al., 2011).

2.9 MANAGING NEW PRODUCT DEVELOPMENT

Concepts of strategy and marketing and the functions of NPD have to be coordinated and managed effectively. To manage the NPD process successfully, a variety of personnel from across the organisation need to be involved in the NPD project. Starting with the initial idea to launch, work will flow and iterate between departments such as manufacturing, technical and marketing. The role of a project team managing the NPD process is crucial towards completing projects successfully (Salomo et al., 2010).

2.9.1 Fuzzy front-end of NPD

The front-end activities that precede the formal NPD-structured process are called the “fuzzy front-end” of NPD (Koen, 2002:5). Reasons for NPD projects often failing at the end of the process often seem to be established at the fuzzy front-end. The period that starts when an opportunity for a new product is first considered and ends when the product idea is ready to enter the formal NPD process, is considered a period of which the understanding is still limited, yet critical towards ensuring a successful outcome for the NPD process (Frishammer, 2013:1).

2.9.2 Managing the NPD dimensions

An organisation has to manage the key activities of the NPD model that is adopted or developed for the organisation. The NPD process is a series of linked activities and could be the 8-stage linear model, or the 5 stages of the Stage-Gate model (see section 2.6). The essence is that the process for NPD has to be managed and that activities such as idea generation and screening, business opportunities, product concept generation, product prototypes, market
and technical testing and commercialization have to be executed effectively for successful NPD.

Product development from a practitioner’s view will be useful when it is described as a series of linked activities; business managers need to know which activities should be undertaken. For good reason, different NPD models were developed (see section 2.7) that contribute towards having better insight into processing new products, because activities are context-dependant and, in particular, industry-dependant (Kahn et al., 2012:182).

To manage the NPD dimensions, the organisation is in need of an NPD framework that is designed and tested for the organisation and its specific circumstances. A systematic approach is needed to guide the processes that are required to get a new product to market in the most efficient way (Rouse, 2016:1). Human and financial resources, the presence of cross-functional teams to execute the process of NPD, and management of the resources are crucial to ensure a sustainable NPD function as part of the organisation in the long term.

2.9.3 Attrition rate of new products

To find the cause of failure of a new product is not always easy for reasons such as complexity of the process, unwillingness by companies to disclose information or even poor marketing communications.

Many of the often cited reasons for failure of NPD were identified by Crawford and Di Benedetto (2008) and are listed as follows:

- The product offers nothing new or no improved performance
- Inadequate budget to develop ideas or market the product.
- Poor market research, positioning or misunderstanding the consumer needs.
- Lack of top management support.
- The customer was not involved.
• Exceptional factors such as government decision (e.g. new law on firearm control may seriously affect the manufacturer of a new firearm).
• Market too small, either forecasting error with sales or insufficient demand.
• Poor match with organisation’s capabilities, or the organisation has insufficient experience of the technology or market.
• Competitive response was strong and competitors were able to move quickly to face the challenge of the new product.
• Internal organisational problems often associated with poor communication.
• Poor return on investment forcing organisation to abandon project.
• Unexpected changes in consumer tastes/fashion.

Organisations need to know the reasons for product failure and manage the NPD process to minimise losses. The earlier problems can be solved in the developing process, the less it will cost the organisation.

2.10 ORGANISATION STRATEGY AND NPD

To develop an NPD strategy, the organisation must determine its primary strategic orientation and distinguish between the primary strategy and an NPD strategy. The importance of the synchronisation between the NPD strategy and the primary strategy of the organisation cannot be underestimated. Before products are developed, the marketing strategy is formulated and includes the target market selection and product positioning. New products are vital for sustainable and growing organisations and play a crucial part in the strategic planning of the organisation (Rossi et al., 2014:455). NPD capabilities are the basis for successful competition and have to be developed, maintained and secured by the organisation.

Products are useful for a limited period (see section 2.4), due to changes in consumer needs, technological developments and competition or if the organisation wants to capitalise on an opportunity. In such cases, the product needs improvement, repositioning or has to be re-invented (Stanski, 2016).

The NPD strategy needs to accommodate a diverse portfolio of projects, because many organisations need to execute different NPD projects.
simultaneously. Different NPD strategies are available for organisations and include the following for a variety of circumstances, as described by Nielsen (2016):

- **Product diversification strategy**: This strategy is employed when revenues are stagnant and the existing market seems saturated. A newly developed product could lead to a new market where new opportunities for business growth exist.

- **Product modification strategy**: This strategy is aimed at existing markets with the product having new attributes, applications or cost reduction to the enterprise.

- **Revolutionary product strategy**: These are products that have not been known before and once the idea of the product has been accepted, it changes an industry, the way people behave and drastically changes the competitive landscape.

Competition within existing markets is strong and organisations have to compete with low margins and most probably a shrinking profit pool, while industry structures are complex. Many organisations compete in what is called the “red ocean” (Kim & Mauborgne, 2015). Instead of markets competing under the same rules and complex external factors, new markets can be created through creative thinking and development of new products that create opportunities and require a new strategy. New markets for own benefit can be created where the organisation can prosper by low costs and good profit propositions. Untested markets could be found where the organisation can differentiate itself and establish sustainability. This is a call for a “blue ocean” strategy for organisations of the future.

**2.11 SUMMARY**

A new product is the item offered for sale and can be a service or a product. Each product has a useful life due to changes in consumer needs or preferences, technological developments, increased competition or the organisation wanting to capitalise on an opportunity.
New products were discussed in terms of the three levels, namely concept of a product, what a new product is and the integration of packaging. New product development and innovation are connected and synonymous. Development of new products and services will follow the same procedure in relation to NPD.

Different NPD process stages and models have been discussed to have an overview on NPD and what is involved in practice to develop new products efficiently. In managing the NPD process, a few important points were raised to understand the complexity of NPD.

The best practice NPD framework with seven dimensions was discussed. The characteristics of each of the dimensions and the process towards evaluating the best-poor practices were explained.

NPD strategy for organisational growth was discussed, in view of the importance of new product development and its enormous impact on sustainability and organisational growth.

Appropriate terms that are being used in the study have been defined. This chapter concluded the literature overview towards an understanding of the NPD environment and how it relates to previous investigations.

In the next chapter, an empirical investigation will be done into the data collected for this study. The chapter will commence with an explanation of questionnaire development, the sampling procedure and data collection. The chapter will proceed with an evaluation of the data. The empirical study that will be conducted makes use of a questionnaire to capture demographic information in section A and information about the seven NPD dimensions in section B.
CHAPTER 3

EMPIRICAL INVESTIGATION

3.1 INTRODUCTION

An empirical research design encompasses a range of systematic approaches to gather evidence, resulting from either or both theoretical and practical investigation (Smit, 2008:1). Researchers identify and conceptualise the problem they want to investigate.

A research question was composed and a research plan was constructed for the study population to participate. Data was collected and analysed statistically. The findings were then interpreted.

The previous chapters presented the theoretical and organisational environment for the study; the analysis of the data collected during the empirical research is presented in this chapter.

3.2 RESEARCH METHODOLOGY AND STATISTICAL ANALYSIS

3.2.1 Questionnaire development

Barczak and Kahn (2012:295) presented a framework (see Appendix A) to identify best practices of new product development (NPD) and it was also used for the purpose of this study after some minor adaptations had been effected.

The questionnaire was developed to measure NPD best practices of the seven dimensions that were identified (see section 2.8.4) and that should be evident in an organisation. For each of the seven dimensions, seven to ten characteristics (items) were identified to evaluate that specific dimension (construct). The questionnaire uses a five-point Likert-scale as measurement tool and the degree of disagreement or agreement with the specific statement has to be indicated by the participants (the scale ranges from 1 to 5 where 1=strongly disagree, 5= strongly agree).
The first section of the questionnaire gathered demographical information from the participants and includes age, academic qualification and job level. Business information gathered includes employee numbers, turnover of the business, business sector, business legal status and type of designated address. The second section of the questionnaire gathered information on the seven dimensions and include strategy (9 statements), research (10 statements), commercialization (7 statements), NPD process (7 statements), project climate (8 statements), company culture (9 statements) and metrics and performance measurement (7 statements). An open-ended question of “Any suggestion(s) to improve NPD at your business?” was asked to conclude the questionnaire.

3.2.2 Sampling procedure

The randomly selected target population was comprised of organisations that came from a convenience sample, assistance by the local chamber of business and full-time managers of various organisations. The sample was randomly taken from businesses located mainly in the Vaal Triangle. Participants were management-level employees of the businesses involved.

3.2.3 Data collection

The study sample was identified and questionnaires were collected during a period of seven weeks. Questionnaires were delivered and received by hand as well as through electronic communication. In a few instances, the participants were revisited to complete missing data on the questionnaires.

Of the 170 questionnaires that were disseminated, 113 (66%) were useful to perform an analysis, of which 76 (67%) questionnaires were filled out by SMEs and 37 (33%) by large enterprises (see Table 2.1 for classification of enterprises).

The collected data was analysed statistically by the statistical consultancy of the NWU Vaal Triangle Campus and is presented. The analysis was done to present the demographic information, identify best practices for NPD and
evaluate relationships between demographical variables and the best practice NPD dimensions. Analysis was also done to evaluate the correlations between the NPD dimensions.

3.3 STATISTICAL ANALYSIS AND DISCUSSION OF RESULTS

Section A of the questionnaire captures demographic information and section B captures information about the seven NPD dimensions, namely strategy, research, commercialization, NPD process, project climate, company culture and metrics performance. Statistical analysis of the data was done on the following data sets that will be discussed in the chapter:

- Demographical information (descriptive frequencies and histograms).
- Assess the relative importance of the seven dimensions for NPD best practices (to establish the relative importance of each dimension) in respect of NPD success (the dimension with the highest statistical average is the most important dimension).
- Reliability of the questionnaire measuring the dimensions (Cronbach’s alpha).
- Comparisons between specific demographic information (designated address, employment, turnover, self-employment, type of products produced and economic sector of organisations) and the seven dimensions for NPD best practice. Tests for significance and effect sizes were performed.
- Categorise the NPD dimension characteristics in respect of best and poor practices (ranking of the characteristics demonstrate best and poor practices).
- Open-ended questions response analysis.
- Structural equation modelling of the dimensions for organisations (correlation between factors).
- Evaluate the difference of NPD best practices between SMEs and large enterprises.
3.3.1 Demographic information

Respondents had to indicate their demographical information which is presented below.

3.3.1.1 Gender

From the 110 respondents, 28 (25%) are female and 84 (76%) are male. A majority of three times more males than females are presented in the sample.

Figure 3.1: Gender distribution of respondents

3.3.1.2 Age of respondents

Of 111 respondents, the majority of 45 (41%) are in the age group between 21 and 35. The next largest group of 38 (34%) respondents are between 36 and 45 years of age. The third largest group of 26 (23%) are in the age group of 46 to 60. Only two persons are older than 60 years and none was younger than 21 years of age. The average age of the sample between 36 and 45 years is relatively young.
3.3.1.3 Qualification

All respondents indicated their highest academic qualification. The distribution presents quite a high academic qualification curve.

Of the 113 respondents, 19 (17%) have grade 12 or lower, 8 (7%) are artisans, 22 (20%) are in possession of a diploma, 31 (27%) have a degree and 33 (29%) have a postgraduate qualification. The sample represents a strongly graduated group of respondents and a relatively low percentage of artisans.
3.3.1.4 Designated NPD address

Of the 113 respondents, 48 (43%) indicated that they have a dedicated address. In response to the question pertaining to what type of NPD address, 17 (15%) of the total of 113 indicated that it is a “person”, 23 (20%) indicated a “department” as an address and 8 (7%) indicated “head office” as an NPD address. Figure 3.4 shows the above mentioned information. Most respondents indicated that they do not have an NPD-designated address.

Figure 3.4: Designated NPD address

3.3.1.5 Employment information

In response to the question on years working for the company (tenure), the largest group of 44 (42%) has been working for the company for a period of 1 to 4 years. The second largest group of 43 (41%) has been working between 5 to 10 years for their company and the groups of 14 (13%) and 4 (4%) respectively have been working 11 to 20 years and longer than 20 years. The average years of employment within the group is 5 to 10 years of service, representing good practical working experience.
3.3.1.6 Managerial job levels

Job levels are indicated as follow for the 113 respondents: supervisor 5 (4%), middle management 29 (26%), senior management 11 (10%), director/owner 53 (47%), other types of jobs not included in the above 14 (12%). The high number of directors/owners could be ascribed to the number of SMEs that participated in the sample.

Figure 3.6: Managerial job levels
3.3.1.7 Persons reporting (span of management control)

The distribution of groups that represents the number of persons that report directly to their superior is presented in Figure 3.7. A number of 64 (57%) respondents reported that fewer than 5 persons report to them. A number of 28 (25%) respondents mentioned that 6 to 10 persons report directly to them and 11 (10%) and 8 (8%) respondents respectively said between 11 to 15 persons and more than 15 persons report to them. Very small and small enterprises do not normally have strong management structures in place that will cause their “persons reporting” numbers to rise. The high number reported for a span of 5 persons can be ascribed to the large number of micro enterprises.

Figure 3.7: Persons reporting (span of management control)

3.3.1.8 Permanent employees

The average of employees that work permanently at the business as indicated by the respondents is presented in Figure 3.8. Micro enterprises represent 42 (38%) of the businesses with fewer than 5 employees according to the criteria of the National Small Business Amendment Act (26 of 2003) of South Africa as set out in section 2.1. Very small and small enterprises total 19(17%) and 11(10%) respectively.
Medium size enterprises with between 51 and 200 employees represent 10 (9%) of the enterprises. The total number of SMEs is 40 (36%) and large enterprises with more than 200 employees constitute 28 (26%) of the sample.

3.3.1.9 Annual turnover

The average annual turnover of the different organisations is presented in Figure 3.9 and according to the criteria of the National Small Business Amendment Act (26 of 2003) of South Africa as set out in section 2.1, organisational sizes can be distinguished. The annual turnover statistics show that 63 (59%) of the 106 organisations are small enterprises with a turnover less than R13M. The medium enterprises total 6 (6%) of the organisations and have a turnover between R13M and R51M. Large enterprises are 37 (35%) of organisations with a turnover of more than R51M.

The annual turnover statistics suggest a shift to a higher annual turnover of SMEs in relation to the number of employees (compare statistics of sections 3.4.9 and 3.4.10).
3.3.1.10 Self-employment
To the question whether or not they are self-employed, 54 (48%) of the 112 respondents indicated self-employment. The respondents of the survey are relatively evenly distributed between self-employment and not being self-employed.

3.3.1.11 Enterprise legal status of business
The legal status of organisations are illustrated in Figure 3.11 and the organisations are divided into sole proprietor 4(3.6%), partnership 3(2.7%), closed corporation 24(21.4%), company Pty (Ltd) 80(71.4%), and franchises
1(0.9%). A company is the preferred legal business status, even for small enterprises.

Figure 3.11: Enterprise legal status of business

3.3.1.12 Enterprise sectors

Enterprises are divided into sectors indicated as private sector 89 (80%), government sector 8 (7%) and parastatal sector 14 (13%). Private organisations are dominantly presented.

Figure 3.12: Enterprise sectors
3.3.1.13 Product type

The product type produced by the 113 involved enterprises is divided into 29 (26%) physical products, 53 (47%) services and both 31 (27%). Services form the major product type.

Figure 3.13: Product type

3.3.1.14 Economic sector

Enterprises operate in the different economic sectors. The larger manufacturing sector represents 28 (25%) of the sample. Other strong sectors indicated are construction 11 (9%), business services 11 (9%), agriculture, hunting and forestry 9 (8%) and “other” (meaning an economic entity that is not described as a sector) 16 (14%). The following sectors have a similar index of 8 (7%) and include mining, retail, motor trade, and catering and accommodation. The least represented sectors are community and social services 5 (4%), electricity, water and gas 4 (4%), transport and communications 3 (3%) and wholesale trade 2 (2%). Numbers of some economic sections are low, influencing the reliability of statistical analysis negatively.
3.3.2 Assessment of NPD dimensions for organisations

3.3.2.1 Calculation of the mean and standard deviation

In section B of the questionnaire, respondents were requested to evaluate the seven dimensions of best practices for NPD in respect of NPD success on a 5-point Likert-scale. The 1 on the scale represents “poor practice” and 5 “best practice”.

The process followed for the analysis and best practices was to calculate the mean according to Levine, Stephan & Szabat (2014:136) for each best practice characteristic, where for sample n:

\[
\text{Mean, or } M = \frac{\sum_{i=1}^{n} X_i}{n} = \frac{X_1 + X_2 + X_3 + \ldots + X_n}{n}
\]

- \(n\) - Size of the sample (or total number of respondents).
- \(X_n\) - Observed values of the sample.
- \(M\) - The arithmetic mean (or most common measure) of central tendency of the values of a sample (or average score on the original 5-point scale of the questionnaire).
The next step is to calculate the standard deviation for each NPD best practice characteristic, where for the sample $n$:

$$\text{Std dev. or } S = \sqrt{\frac{\sum_{i=1}^{n}(X_i - M)^2}{n-1}}$$

Std dev. or $S$ - Standard deviation from the mean of the sample.

The sample mean is the most common measure of central tendency in which all values play an equal role. The mean therefore can suggest a typical or central value for the data (Levine et al., 2014:136).

The standard deviation measures the average scatter of data values around the mean of the sample. The formula involves the sum of the squared differences between individual values and the mean, which will always be a positive value. The smaller this value, the smaller the variance between the individual results; it means a higher degree of agreement (Levine et al., 2014:142).

3.3.2.2 Relative importance of NPD dimensions for organisations.

Findings of the assessment regarding the seven NPD dimensions are listed in Table 3.1. Relatively low numbers of the mean value represent disagreement with the characteristics of best practices, whilst relatively high numbers represent agreement with the characteristics.

Table 3.1: Mean values and relative importance of NPD dimensions in organisations.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>N</th>
<th>Mean M</th>
<th>Std Dev. S</th>
<th>Relative importance %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>113</td>
<td>3.53</td>
<td>0.964</td>
<td>15.6</td>
</tr>
<tr>
<td>Company culture</td>
<td>112</td>
<td>3.52</td>
<td>0.88</td>
<td>15.5</td>
</tr>
<tr>
<td>Research</td>
<td>111</td>
<td>3.32</td>
<td>1.027</td>
<td>14.6</td>
</tr>
<tr>
<td>Project climate</td>
<td>112</td>
<td>3.22</td>
<td>0.975</td>
<td>14.2</td>
</tr>
<tr>
<td>Commercialization</td>
<td>113</td>
<td>3.16</td>
<td>1.082</td>
<td>13.9</td>
</tr>
<tr>
<td>NPD process</td>
<td>110</td>
<td>3.06</td>
<td>1.06</td>
<td>13.5</td>
</tr>
<tr>
<td>Metrics and performance measurement</td>
<td>113</td>
<td>2.88</td>
<td>1.062</td>
<td>12.7</td>
</tr>
</tbody>
</table>
The findings show that strategy ranks the highest at 3.53, but is not dominant to company culture with the second highest value at 3.52. The mean values of the following three dimensions are close to one another; they are research 3.32, project climate 3.22 and commercialization 3.16 respectively. The NPD process follows with 3.06 and the lowest mean value of 2.88 is represented by metrics and performance measurement.

The standard deviation (S) is relatively high for all the constructs. The lowest of 0.88 is presented by company culture. Standard deviations for strategy and project climate, 0.964 and 0.975 respectively, are just beneath 1.0 and the rest are all above 1.0. This indicates that the data are scattered relatively wide around the mean of each construct.

The findings as presented in Table 3.1 are used to calculate the percentage of each dimension in relation of 100%, totalling all seven dimensions. The findings are ranked from high to low in Figure 3.15 to indicate the importance of the dimensions.

Figure 3.15: Relative importance of NPD dimensions in organisations.
3.3.2.3 Correlation coefficients of NPD dimensions for organisations.  
The synonym for correlation is relationship. This relation, statistically, is referred to as a linear trend. A positive correlation is indicated when the value of the dependent variable improves as the independent variable increases. A negative correlation is indicated when the value of the dependent variable decreases as the independent variable increases.

Table 3.2 presents the correlation between the seven dimensions. The lowest correlation coefficient (0.448) lies between strategy and commercialisation. The highest correlation coefficient (0.764) lies between metrics and performance measure and NPD process. Correlations between all the dimensions are significant at the 0.01 (99%) level (2-tailed). This means that the dimensions are meaningful and applicable.
Table 3.2: Correlation coefficients between NPD dimensions in organisations

<table>
<thead>
<tr>
<th>Spearman's Rho</th>
<th>STRAT (Binned)</th>
<th>RESEARCH (Binned)</th>
<th>COMMERC (Binned)</th>
<th>NPDPROC (Binned)</th>
<th>PROJCLIM (Binned)</th>
<th>CULTURE (Binned)</th>
<th>MEASURE (Binned)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRAT (Binned)</td>
<td>Correlation Coefficient</td>
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<td>.605**</td>
<td>.448**</td>
<td>.613**</td>
<td>.538**</td>
<td>.655**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
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<td>110</td>
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<tr>
<td>RESEARCH (Binned)</td>
<td>Correlation Coefficient</td>
<td>.605**</td>
<td>1.000</td>
<td>.552**</td>
<td>.692**</td>
<td>.592**</td>
<td>.619**</td>
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<td>1.000</td>
<td>.693**</td>
<td>.702**</td>
<td>.552**</td>
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<td>Sig. (2-tailed)</td>
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<td>113</td>
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<td>NPD PROCESS (Binned)</td>
<td>Correlation Coefficient</td>
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<td>.692**</td>
<td>.693**</td>
<td>1.000</td>
<td>.750**</td>
<td>.646**</td>
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<tr>
<td>PROJECT CLIMATE (Binned)</td>
<td>Correlation Coefficient</td>
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<td>.592**</td>
<td>.702**</td>
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<td>.726**</td>
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<td>.726**</td>
<td>1.000</td>
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<td>112</td>
<td>112</td>
<td>112</td>
</tr>
<tr>
<td>METRICS AND PERFORMANCE MEASUREMENT (Binned)</td>
<td>Correlation Coefficient</td>
<td>.526**</td>
<td>.599**</td>
<td>.614**</td>
<td>.764**</td>
<td>.711**</td>
<td>.599**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>113</td>
<td>111</td>
<td>113</td>
<td>110</td>
<td>112</td>
<td>112</td>
<td>113</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).
3.3.2.4 Reliability of the questionnaire for NPD dimensions in organisations.
To determine the reliability of the measuring instrument, internal consistency is used. In order to determine the internal consistency between the constructs of the questionnaire, Cronbach alpha coefficients were calculated (Welman, Kruger & Mitchell, 2005:147).

The coefficient of Cronbach alpha is based on the average correlation of the variables within a test. The smaller the Cronbach alpha coefficient is, the less reliable the scale. The measuring instrument can be interpreted as reliable and is internally consistent when the Cronbach alpha coefficient is greater than 0.7 (Tavakol & Dennick, 2011; Webb et al., 2006).

The results of reliability testing using the Cronbach alpha criteria range are listed in the table that follows.

<table>
<thead>
<tr>
<th>no</th>
<th>Construct</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Strategy</td>
<td>0.92</td>
</tr>
<tr>
<td>2</td>
<td>Research</td>
<td>0.92</td>
</tr>
<tr>
<td>3</td>
<td>Commercialization</td>
<td>0.93</td>
</tr>
<tr>
<td>4</td>
<td>NPD process</td>
<td>0.93</td>
</tr>
<tr>
<td>5</td>
<td>Project climate</td>
<td>0.93</td>
</tr>
<tr>
<td>6</td>
<td>Company culture</td>
<td>0.91</td>
</tr>
<tr>
<td>7</td>
<td>Metrics and performance measurement</td>
<td>0.94</td>
</tr>
</tbody>
</table>

All seven dimensions have acceptable reliabilities, because Cronbach alpha values for each of the dimensions are greater than 0.7.

3.3.3 Comparisons between demographic variables and NPD best practice dimensions.

3.3.3.1 Portrayal of reliability between demographic variables and NPD best practice dimensions.
To examine relationships between the dimensions and the demographic variables, a t-test was used to determine the values for significance and effect sizes. T-tests are hypothesis tests in statistics when means of data have to be compared.

The size of the difference between the means of the dimensions, the sample size and the standard deviation of the dimensions determine statistical significance (Ellis & Steyn, 2003:51). The $p$-value of the statistical significance test describes the probability that the $H_0$ hypothesis is either true or not ($H_0=0$ or $H_0\neq0$). A $p$-value smaller than or equal to 0.05 is considered as sufficient evidence that the result is statistically significant, meaning that the $H_0$ hypothesis is not true; a meaningful difference between means exists and a relationship between the dimensions is considered. The $p$-value > 0.05 means that the $H_0$ hypothesis is true and with statistically no difference between the mean values of the constructs, no relationship is considered (Frost, 2016:4).

The t-test effect size complements its statistical significance. Whether or not the means of the constructs are significantly different, the effect size describes the magnitude of the difference between the means. Cohen’s $d$ ($d$-value) is an expression for a type of effect size - the standardised mean effect (standardised difference between two populations). The meaning of effect size varies by context, but standard interpretation offered, is (Ellis & Steyn, 2003:51):

- small effect $d = 0.2$ (1/5 of standard deviation);
- medium effect $d = 0.5$ (½ of standard deviation); and
- large effect $d = 0.8$ (8/10 of standard deviation).

For the purpose of this study, the practical effect sizes taken into account, will be small $d < 0.3$, medium $0.3 < d < 0.5$, large $d > 0.5$ (Frost, 2016:4).

To examine relationship between dimensions and the demographic variables, $p$-values and effect sizes were calculated between the mean values of the variables. Relatively low numbers for the mean values indicate disagreement with the characteristics and relatively high numbers indicate agreement with the
characteristics of the NPD dimensions. The symbols used in the tables represent the mean rank (MR), standard deviation (S), statistical significance (p) and effect size (d) of the compared characteristics. Comparisons are made by calculations using non-parametric independent t-tests with Mann-Whitney test for two conditions with data from different sources; and Kruskal-Wallis test for three or more conditions with data from different sources. MR is a value used to compare the strength between two or more constructs and is not the same as the arithmetic mean of central tendency of the values of a sample.

3.3.3.2 Comparison between organisational employment and NPD dimensions.
• **Mean rank values of comparison between organisational employment and NPD dimensions.**

The MR values of each dimension for SMEs and large enterprises are portrayed in Table 3.4 that follows, illustrating the relationship between employment of SMEs and large enterprises versus the NPD dimensions.

| Table 3.4: Statistical mean rank and significance test values for organisational employment. |
|---------------------------------|---------------------------------|-----------------|-----------------|-----------------|-----------------|
| **Dimension**                   | **SME employment (6-200)**      | **Large enterprise employment (200+)** | **Values**     |
|                                | **N** | **Mean rank MR** | **N** | **Mean rank MR** | **p** | **d** |
| Strategy                       | 40    | 32.35            | 28    | 37.57            | 0.264 | 0.137 |
| Research                       | 40    | 29.53            | 28    | 41.61            | 0.008 | 0.316 |
| Commercialization              | 40    | 29.33            | 28    | 41.89            | 0.007 | 0.325 |
| NPD process                    | 40    | 29.85            | 28    | 41.14            | 0.015 | 0.294 |
| Project climate                | 40    | 29.41            | 28    | 41.77            | 0.006 | 0.327 |
| Company culture                | 40    | 30.68            | 28    | 39.96            | 0.040 | 0.245 |
| Metrics and performance measurement | 40    | 28.39            | 28    | 43.23            | 0.001 | 0.387 |

A distinction is made between SMEs with 6 to 200 employees and large enterprises with more than 200 employees (see Table 2.1 for classification of enterprises).
The MR values of all the NPD dimensions for organisational employment in large enterprises are in general stronger than those for SMEs. The difference suggests that there is a stronger application of NPD processes in large enterprises with more employees than in SMEs with fewer employees.

The strongest NPD dimension for large enterprises is metrics and performance measurement (MR=43.23) and the weakest NPD dimension is given as strategy (MR=37.57). The strongest NPD dimension for SMEs is portrayed by strategy (MR=32.35) and the weakest NPD dimension is metrics and performance measurement (MR=28.39). The higher metrics and performance measurement suggests that large enterprises tend to value and pay the specific dimension more attention than SMEs, because the former have more resources, means and capacity. The opposite action is performed by large enterprises in paying less attention to strategy than SMEs. Strategy is the most important NPD dimension for SMEs relative to the other dimensions according to the statistical MR value.

The NPD dimension values for organisational employment are shown in the accompanying figure.

Figure 3.16: Column chart of enterprise employment and NPD dimensions.
Reliability of the comparison between organisational employment and NPD dimensions.

The relationship between organisational employment and NPD dimensions are described by evaluating the \( p \)-values and \( d \)-values (see section 3.3.3.1). As indicated (see Table 3.4), the \( p \)-values for employment at organisations indicate that strategy is not significant. All the other NPD dimensions show a statistically significant difference between the two means of “turnover” for SMEs and large enterprises, i.e. research \( (p = .008) \), commercialization \( (p = .007) \), NPD process \( (p = .015) \), project climate \( (p = .006) \), company culture \( (p = .040) \) and metrics and performance measurement \( (p = .001) \).

Cohen’s \( d \)-value for effect size indicates that the NPD process \( (d = .294) \) and company culture \( (d = .245) \) are both small. The other four dimensions have a medium effect size, namely research \( (d = .316) \), commercialization \( (d = .325) \), project climate \( (d = .327) \) and metrics and performance measurement \( (d = .387) \).

Assessment of organisational employment suggests that a moderate relationship exists between implementing best practices for the NPD dimensions of research, commercialization, project climate and metrics and performance measurement. Available human resources improve implementation of these NPD dimensions.

3.3.3.3 Comparison between organisational annual turnover and NPD dimensions.

The mean rank (MR) values of the comparison between organisational turnover and NPD dimensions.

The relationship between annual turnover of SMEs and large enterprises versus the NPD dimensions is illustrated in the following table.
Table 3.5: Statistical mean rank and significance test values for organisational annual turnover.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>SME turnover (R0.2M – R51M)</th>
<th>N</th>
<th>Mean rank MR</th>
<th>Large enterprise turnover (R51M+)</th>
<th>N</th>
<th>Mean rank MR</th>
<th>p</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>32</td>
<td></td>
<td>31.13</td>
<td>37</td>
<td>37</td>
<td>38.35</td>
<td>0.112</td>
<td>0.191</td>
</tr>
<tr>
<td>Research</td>
<td>32</td>
<td></td>
<td>28.09</td>
<td>37</td>
<td>37</td>
<td>40.97</td>
<td>0.004</td>
<td>0.341</td>
</tr>
<tr>
<td>Commercialization</td>
<td>32</td>
<td></td>
<td>27.8</td>
<td>37</td>
<td>37</td>
<td>41.23</td>
<td>0.003</td>
<td>0.348</td>
</tr>
<tr>
<td>NPD process</td>
<td>32</td>
<td></td>
<td>28.81</td>
<td>37</td>
<td>37</td>
<td>40.35</td>
<td>0.012</td>
<td>0.301</td>
</tr>
<tr>
<td>Project climate</td>
<td>32</td>
<td></td>
<td>30.17</td>
<td>37</td>
<td>37</td>
<td>39.18</td>
<td>0.049</td>
<td>0.238</td>
</tr>
<tr>
<td>Company culture</td>
<td>32</td>
<td></td>
<td>30.44</td>
<td>37</td>
<td>37</td>
<td>38.95</td>
<td>0.056</td>
<td>0.231</td>
</tr>
<tr>
<td>Metrics and performance</td>
<td>32</td>
<td></td>
<td>28.42</td>
<td>37</td>
<td>37</td>
<td>40.69</td>
<td>0.007</td>
<td>0.320</td>
</tr>
<tr>
<td>measurement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SMEs with a turnover between R0.2 million and R51 million by definition are distinguished from large enterprises with an annual turnover of more than R51 million (see Table 2.1 for classification of enterprises).

Mean rank values of all the NPD dimensions for annual turnover of large enterprises are higher than those for SMEs. This difference suggests a generally stronger NPD function present in large enterprises with a higher turnover than in SMEs with a lower turnover (as expected).

The strongest NPD dimension for large enterprises is commercialization (MR=41.23) and for SMEs it is strategy (MR=31.13). The weakest dimension for large firms is strategy (MR=38.35) and for SMEs it is commercialization (MR=27.80). Figure 3.17 that follows illustrates the above mentioned relationship between organisational turnover and NPD dimensions.
Figure 3.17: Column chart of enterprise turnover and NPD dimensions.

- **Reliability of the comparison between organisational turnover and NPD dimensions.**

The relationship between organisational annual turnover and NPD dimensions is described by evaluating the significance of \( p \)-values and \( d \)-values (see Table 3.5). The \( p \)-values for turnover show that strategy and company culture are not significant. The other NPD dimensions are statistically significant and indicate a difference between the two mean values of turnover for SMEs and large enterprises.

By evaluating Cohen’s \( d \)-values, it shows that project climate (\( d = .238 \)) suggested only a small practical significance. The NPD dimensions research (\( d = .341 \)), commercialization (\( d = .348 \)), NPD process (\( d = .301 \)) and metrics and performance measurement (\( d = .32 \)) indicate a medium relative strength in the relationship between the means of the dimensions for SMEs and large enterprises on the basis of annual turnover.

An assessment suggests that organisational turnover has a moderate relationship with implementing best practices for the NPD dimensions research, commercialization, NPD process, and metrics and performance measurement. Better financial resources improve implementation of these NPD dimensions.
3.3.3.4 Comparison between an organisation’s designated address and NPD dimensions.

- The mean rank values of the comparison between organisation’s designated address and NPD dimensions.

The relationship between a designated address and no-designated address versus the NPD dimensions is illustrated in Table 3.6.

Table 3.6: The statistical mean rank and significance test values for organisation’s designated address.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Designated address</th>
<th>No designated address</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean rank MR</td>
<td>N</td>
</tr>
<tr>
<td>Strategy</td>
<td>48</td>
<td>58.09</td>
<td>65</td>
</tr>
<tr>
<td>Research</td>
<td>47</td>
<td>61.83</td>
<td>64</td>
</tr>
<tr>
<td>Commercialization</td>
<td>48</td>
<td>61.55</td>
<td>65</td>
</tr>
<tr>
<td>NPD process</td>
<td>47</td>
<td>63.32</td>
<td>63</td>
</tr>
<tr>
<td>Project climate</td>
<td>47</td>
<td>62.87</td>
<td>65</td>
</tr>
<tr>
<td>Company culture</td>
<td>47</td>
<td>65.51</td>
<td>65</td>
</tr>
<tr>
<td>Metrics and performance measurement</td>
<td>48</td>
<td>60.42</td>
<td>65</td>
</tr>
</tbody>
</table>

The agreement for all the dimensions is stronger for the characteristics of designated address than for no-designated address with quite a large difference between the values. A difference is created for the benefit of NPD best practice by having a designated address functioning in the enterprise.

The strongest and weakest NPD dimensions for designated address are company culture (MR=65.51) and strategy (MR=58.09) respectively. The higher mean rank values of company culture (MR=65.51), NPD process (MR=63.32) and project climate (MR=62.87) suggest that senior management supports an NPD-designated address, encouraging NPD. The NPD process is
formal and clear and the organisation’s climate is conductive to NPD project work.

The weakest NPD dimensions for no-designated address are respectively NPD process (MR=49.67) and company culture (MR=49.98). A graphical illustration of the relationship of the above mentioned characteristics for NPD dimensions and designated address follows.

Figure 3.18: Column chart of designated address and NPD dimensions

- Reliability of the comparison between the organisation’s designated address and NPD dimensions.

The relationship between the NPD-designated address and NPD dimensions can be described by evaluating the significance $p$-values and Cohen’s $d$-values.

The $p$-values for NPD-designated address in Table 3.6 indicate that the only NPD dimensions that are statistically significant are NPD process ($p = .021$) and company culture ($p = .007$). This states that there is a difference in best practices between an NPD-designated address or no-designated address of NPD process and company culture. To distinguish the size of the difference (practical significance), Cohen’s effect size values for NPD process ($d = .220$, small) and for company culture ($d = .253$, small) indicate that both NPD
dimensions only have a small relative relationship strength with designated address.

This assessment suggests that the designated address of organisations has a relatively small relationship with implementing best practices for the NPD dimensions company culture and NPD process. Implementation of these NPD dimensions will improve as a result of a designated address.

3.3.3.5 Comparison between organisational self-employment and NPD dimensions.

- The mean rank values of the comparison between organisational self-employment and NPD dimensions.

The mean rank values of each dimension for SMEs and large enterprises are portrayed in the table that follows to illustrate the relationship between self-employment of SMEs and large enterprises versus the NPD dimensions.

Table 3.7: Statistical mean rank and significance test values for self-employment.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Self-employment</th>
<th>Not self-employed</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean rank MR</td>
<td>N</td>
</tr>
<tr>
<td>Strategy</td>
<td>54</td>
<td>52.57</td>
<td>58</td>
</tr>
<tr>
<td>Research</td>
<td>52</td>
<td>46.33</td>
<td>58</td>
</tr>
<tr>
<td>Commercialization</td>
<td>54</td>
<td>48.85</td>
<td>58</td>
</tr>
<tr>
<td>NPD process</td>
<td>51</td>
<td>48.34</td>
<td>58</td>
</tr>
<tr>
<td>Project climate</td>
<td>53</td>
<td>51.92</td>
<td>58</td>
</tr>
<tr>
<td>Company culture</td>
<td>53</td>
<td>51.83</td>
<td>58</td>
</tr>
<tr>
<td>Metrics and performance</td>
<td>54</td>
<td>50.86</td>
<td>58</td>
</tr>
</tbody>
</table>

In general, the MR values of NPD dimensions for self-employment are lower than the MR values for not being self-employed. These differences of NPD MR
values suggest that self-employment does not support or excel the implementation of an NPD process, probably because business owners are in smaller organisations and those not being self-employed are working in large organisations and tend to pay more attention to NPD and related processes.

The strongest NPD dimension for self-employment is strategy (MR=52.57), while the weakest dimension is research (MR=46.33). The not self-employed NPD dimensions show that research (MR=63.72) is the strongest and project climate (MR=59.73) is the weakest dimension. The NPD dimension values for organisational self-employment and its relationship with NPD dimensions are shown in the accompanying Figure 3.19.

Figure 3.19: Column chart of self-employment and NPD dimensions.

- **Reliability of the comparison between organisational self-employment and NPD dimensions.**

By evaluating the \( p \)-values and \( d \)-values (see Table 3.7) of the relationship between self-employment and NPD dimensions, relationships are assessed. The \( p \)-values for self-employment show that the NPD dimensions strategy \((p = .193)\), project climate \((p = .179)\), company culture \((p = .164)\) and metrics and performance measurement \((p = .064)\) are not statistically significant.
The NPD dimensions of research \( (p = .002) \), commercialization \( (p = .012) \) and NPD process \( (p = .032) \) show a statistically significant difference between the means of NPD dimensions for self-employed and not being self-employed. After further evaluation of all three dimensions, the significance is indicated as a small relative strength indicated by the \( d \)-values for research \( (d = .286) \), commercialization \( (d = .236) \) and NPD process \( (d = .205) \).

Assessment of self-employment in organisations indicates that self-employment has a small relationship with implementation of best practices of the NPD dimensions research, commercialization and NPD process. Because of the influence of self-employment, implementation of NPD dimensions could be limited.

3.3.3.6 Comparison between organisational type of products and NPD dimensions.

- *Mean rank values and reliability of comparison between organisational products and NPD dimensions.*

Comparison between the seven NPD dimensions and the type of product produced by the organisation is statistically analysed. The type of product produced by the organisation is distinguished as “products”, “services” and “both”.

The MR values of all the NPD dimensions for the organisation that produce “both” products, are generally stronger than those for “products” and “services”. MR values for “products” are stronger than for “services”. The difference suggests that there is stronger application of NPD processes in organisations with “both” products than for the other two; and stronger NPD processes for organisations with “products” than for “services”. A relatively stronger realisation of NPD best practices exists in organisations that produce “products” than in organisations that produce “services”.

70
Table 3.8: Statistical mean rank and significance test values for type of products.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Products</th>
<th>Services</th>
<th>Both</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean rank MR</td>
<td>N</td>
<td>Mean rank MR</td>
</tr>
<tr>
<td>Strategy</td>
<td>29</td>
<td>59.52</td>
<td>53</td>
<td>51.25</td>
</tr>
<tr>
<td>Research</td>
<td>29</td>
<td>57.78</td>
<td>52</td>
<td>49.61</td>
</tr>
<tr>
<td>Commercialization</td>
<td>29</td>
<td>56.4</td>
<td>53</td>
<td>51.96</td>
</tr>
<tr>
<td>NPD process</td>
<td>29</td>
<td>56.5</td>
<td>52</td>
<td>49.3</td>
</tr>
<tr>
<td>Project climate</td>
<td>29</td>
<td>57.38</td>
<td>53</td>
<td>52.15</td>
</tr>
<tr>
<td>Company culture</td>
<td>29</td>
<td>59.31</td>
<td>53</td>
<td>49.94</td>
</tr>
<tr>
<td>Metrics and performance measurement</td>
<td>29</td>
<td>59.02</td>
<td>53</td>
<td>52.61</td>
</tr>
</tbody>
</table>

No significant relationship could be found between any of the seven NPD dimensions and type of product, namely “both”, “products” and “services”. This assessment on type of product concludes that the type of product does not influence best practices for NPD in organisations.

3.3.3.7 Comparison between organisation economic sector and NPD dimensions.

- **Mean rank values and reliability of comparison between organisation economic sectors and NPD dimensions**

A statistical analysis is done to evaluate comparisons between the seven NPD dimensions and the economic sectors. Of all the NPD dimensions, only strategy indicates a significant relationship with some of the economic sectors that are portrayed in the table that follows (see section 3.3.1.14 for economic sectors). These relationships are significant when the “mean difference” measure is greater than the “critical difference” as set out in Table 3.9.
Table 3.9: Statistical mean rank and significance test values for economic sectors.

<table>
<thead>
<tr>
<th>Economic sector</th>
<th>N</th>
<th>Mean Rank M</th>
<th>Mean differ</th>
<th>Critical differ</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CLUSTER 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture, hunting, forestry and fishing</td>
<td>9</td>
<td>71.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity, gas and water</td>
<td>4</td>
<td>21.75</td>
<td>49.25</td>
<td>47.24</td>
<td>Yes</td>
</tr>
<tr>
<td>Construction</td>
<td>11</td>
<td>29.36</td>
<td>41.64</td>
<td>35.34</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>CLUSTER 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>11</td>
<td>29.36</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mining and quarrying</td>
<td>8</td>
<td>68.69</td>
<td>39.33</td>
<td>36.54</td>
<td>Yes</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>28</td>
<td>58.66</td>
<td>29.30</td>
<td>28.02</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>CLUSTER 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial and business services</td>
<td>11</td>
<td>70.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity, gas and water</td>
<td>4</td>
<td>21.75</td>
<td>48.25</td>
<td>45.92</td>
<td>yes</td>
</tr>
<tr>
<td>Construction</td>
<td>11</td>
<td>29.36</td>
<td>40.64</td>
<td>33.54</td>
<td>yes</td>
</tr>
</tbody>
</table>

In Cluster 1, the relationships are between the sectors of agriculture and electricity as well as between agriculture and construction. Both relationships are indicated as significant.

In Cluster 2, the relationships are between the sectors of construction and mining as well as between construction and manufacturing. Both relationships are indicated as significant, because of the “mean difference” that is greater than the “critical difference” as set out in Table 3.9.

In Cluster 3, the relationships are between the sectors of financial and electricity as well as between financial and construction. Both relationships are indicated as significant.

An assessment suggests that strategy best practices for NPD have a relationship with the economic sectors for organisations. The sectors that have a relationship with NPD are agriculture with electricity and construction; construction with mining and manufacturing; and financial with electricity and construction.
3.3.4 Assessment of NPD best-poor practices

The best and poor practices are evaluated in respect of the ranking of each characteristic. Dimension characteristic mean values were listed and ranked to evaluate their strength as a best or a poor practice. The higher the mean value, the stronger is the characteristic. Ranking of the characteristics of NPD practices demonstrates the level of knowledge by organisations.

A criterion is used to categorise the stronger and weaker characteristics of the dimensions. The characteristics are categorised as a best or poor practice according to the mean value of the characteristic that falls within the range of either the fourth quartile or the first quartile of the mean of the specific dimension. The highest mean value will indicate the strongest best practice. Similarly, the mean value of a poor practice indicates a characteristic mean value within the first quartile of the mean of the specific dimension and the lowest mean value will indicate the strongest poor practice. Characteristics in-between the best and poor practices are not specifically categorised. The objective is to identify and understand the strongest and weakest characteristics of each dimension.

3.3.4.1 Best-poor practices for the strategy dimension
Mean values of the characteristics of the strategy dimension are listed and ranked in Table 3.10, portraying the following:
Table 3.10: Mean values of the characteristics of the strategy dimension

<table>
<thead>
<tr>
<th>Strategy</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>B4  Does your company consider NPD as a long-term strategy?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.69</td>
<td>1.16</td>
</tr>
<tr>
<td>B5  Do mission and the strategic plan help define strategic arenas for new opportunities?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.61</td>
<td>1.11</td>
</tr>
<tr>
<td>B1  Do most NPD projects fit with the company mission?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.58</td>
<td>1.22</td>
</tr>
<tr>
<td>B2  Does your company have NPD goals?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.53</td>
<td>1.28</td>
</tr>
<tr>
<td>B8  Is NPD opportunity identification ongoing?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.46</td>
<td>1.18</td>
</tr>
<tr>
<td>B7  Does the company carefully consider the resource requirements necessary to support NPD projects?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.37</td>
<td>1.12</td>
</tr>
<tr>
<td>B9  Is there a ranking or prioritization of NPD projects?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.31</td>
<td>1.09</td>
</tr>
<tr>
<td>B3  Are NPD goals clearly defined and visible within the company?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.26</td>
<td>1.15</td>
</tr>
<tr>
<td>B6  Are NPD projects and programmes reviewed on a regular basis?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.04</td>
<td>1.14</td>
</tr>
</tbody>
</table>

In general, mean values of the strategy characteristics are rated relatively the strongest compared to the characteristics of the other dimensions. The characteristics with mean values equal to or less than 3.26 are described as poor practices. The means of the described best practices are between 3.53 and 3.69 and within the fourth quartile of the characteristics of the strategy dimension. The assessed best and poor practices for strategy follow:

Best practice:
- NPD is considered as a long-term strategy.
- Mission and the strategic plan help define new opportunities.
- NPD projects fit well with the company mission.
- NPD company goals are important.

Poor practice:
- NPD projects and programmes are not reviewed on a regular basis.
• NPD goals are not clearly defined and visible within the company.

3.3.4.2 Best-poor practices for the research dimension
Mean values of the characteristics of the research dimension are listed and ranked in Table 3.11.

Table 3.11: Mean values of the characteristics of the research dimension

<table>
<thead>
<tr>
<th>Research</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2 Is market research an integral part of all NPD projects?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.53</td>
<td>1.18</td>
</tr>
<tr>
<td>C3 Is concept testing an integral part of the NPD process?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.49</td>
<td>1.15</td>
</tr>
<tr>
<td>C1 Are studies of customers focused on both current and future customer</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.47</td>
<td>1.09</td>
</tr>
<tr>
<td>needs and problems?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C4 Is market testing an integral part of the NPD process?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.38</td>
<td>1.20</td>
</tr>
<tr>
<td>C6 Are customers an integral part of the NPD process?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.27</td>
<td>1.22</td>
</tr>
<tr>
<td>C5 Are NPD testing results formally evaluated?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.25</td>
<td>1.15</td>
</tr>
<tr>
<td>C10 Are NPD testing and market research results used to improve new</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.21</td>
<td>1.18</td>
</tr>
<tr>
<td>products being developed?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C9 Are market studies on customers, competitors, and macro-environment</td>
<td>112</td>
<td>1</td>
<td>5</td>
<td>3.13</td>
<td>1.26</td>
</tr>
<tr>
<td>trends undertaken to understand the marketplace for every NPD project?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C7 Does your organisation have a formal market research function?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.10</td>
<td>1.22</td>
</tr>
<tr>
<td>C8 Does the organisation have a formal budget for market research?</td>
<td>111</td>
<td>1</td>
<td>5</td>
<td>3.00</td>
<td>1.33</td>
</tr>
</tbody>
</table>

The mean values of the research characteristics are rated relatively strong against the characteristics of the other dimensions. The weakest characteristics with means ranging from 3.0 to 3.13 are described as poor practices. The characteristic means within the fourth quartile describe best practices and are between 3.47 and 3.53 in the table above. The assessed best and poor practices for research follow:
Best practice:
- Market research is an integral part of NPD projects.
- Concept testing is an integral part of the NPD process.
- Both current and future customer needs and problems are important.

Poor practice:
- No formal budget for market research.
- No formal market research function.
- Market studies are not undertaken to understand the market place for NPD projects.

3.3.4.3 Best-poor practices for the commercialization dimension
Mean values of the characteristics of the commercialization dimension are listed and ranked in Table 3.12:

Table 3.12: Mean values of the characteristics of the commercialization dimension

<table>
<thead>
<tr>
<th>Commercialization</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D5 Is a project post-mortem meeting held after the new product has been launched?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.24</td>
<td>1.18</td>
</tr>
<tr>
<td>D2 Is a cross-functional team involved in manufacturing decisions for a new product?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.23</td>
<td>1.17</td>
</tr>
<tr>
<td>D1 Does the company have a standard launch process/protocol for new products?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.19</td>
<td>1.21</td>
</tr>
<tr>
<td>D6 Are customer service and customer support personnel part of the launch team?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.19</td>
<td>1.29</td>
</tr>
<tr>
<td>D7 Is commercialization a formal part of the NPD process?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.14</td>
<td>1.24</td>
</tr>
<tr>
<td>D4 Is a cross-functional team involved in marketing decisions for a new product?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.08</td>
<td>1.16</td>
</tr>
<tr>
<td>D3 Is a cross-functional team involved in logistics and supply chain decisions for a new product?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.06</td>
<td>1.23</td>
</tr>
</tbody>
</table>
The mean values of the commercialization characteristics are rated less strongly than the two previous dimensions, but are higher than the midpoint of 3 on the Likert-scale. The weakest characteristics with means of 3.06 and 3.08 are described as poor practices and the means of the described best practices are between 3.23 and 3.24 within the fourth quartile. The assessed best and poor practices for commercialization follow:

Best practice:
- Post-mortem meetings are held after new products have been launched.
- Cross-functional team is involved in manufacturing decisions.

Poor practice:
- Cross-functional team is not involved in supply chain decisions.
- Cross-functional team is not involved in marketing decisions.

3.3.4.4 Best-poor practices for the NPD process dimension
Mean values of the characteristics of the NPD process dimension are listed and ranked in Table 3.13:

<table>
<thead>
<tr>
<th>NPD process</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>E5 Is the NPD process flexible and adaptable to meet the needs, size, and</td>
<td>111</td>
<td>1</td>
<td>5</td>
<td>3.16</td>
<td>1.12</td>
</tr>
<tr>
<td>risk of individual projects?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E1 Are criteria for evaluating NPD projects well defined?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.12</td>
<td>1.25</td>
</tr>
<tr>
<td>E7 Does the NPD process have a process owner or process champion?</td>
<td>111</td>
<td>1</td>
<td>5</td>
<td>3.12</td>
<td>1.23</td>
</tr>
<tr>
<td>E3 Is there documentation on the NPD process?</td>
<td>112</td>
<td>1</td>
<td>5</td>
<td>3.06</td>
<td>1.23</td>
</tr>
<tr>
<td>E6 Does a formal and clear NPD process exist?</td>
<td>111</td>
<td>1</td>
<td>5</td>
<td>3.03</td>
<td>1.22</td>
</tr>
<tr>
<td>E2 Does a common NPD process cut across all company groups?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.02</td>
<td>1.13</td>
</tr>
<tr>
<td>E4 Are NPD Go/No-go criteria clear?</td>
<td>111</td>
<td>1</td>
<td>5</td>
<td>2.90</td>
<td>1.18</td>
</tr>
</tbody>
</table>
The mean values of NPD process characteristics are rated less strongly compared to the previous characteristics of the commercialization dimension. The weakest characteristic with a mean of 2.9 is described as a poor practice. The means of the other NPD process characteristics lie within the fourth quartile between 3.12 and 3.16 and are described as best practices. The assessed best and poor practices for the NPD process follow:

Best practice:
- NPD process is flexible and adaptable.
- Criteria for NPD evaluation are well defined.
- The NPD process has a process champion.

Poor practice:
- No NPD go/no-go criteria.

3.3.4.5 Best-poor practices for the project climate dimension
Mean values of the characteristics of the project climate dimension are listed and ranked in Table 3.14.

Table 3.14: Mean values of the characteristics of the project climate dimension

<table>
<thead>
<tr>
<th>Project climate</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1 Is the company climate conducive to NPD project work?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.39</td>
<td>1.14</td>
</tr>
<tr>
<td>F4 Does each project have a clearly identifiable project leader?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.33</td>
<td>1.11</td>
</tr>
<tr>
<td>F5 Is there careful consideration of how team members are assigned to teams?</td>
<td>112</td>
<td>1</td>
<td>5</td>
<td>3.24</td>
<td>1.11</td>
</tr>
<tr>
<td>F6 Is NPD cross-functional in nature?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.15</td>
<td>1.21</td>
</tr>
<tr>
<td>F2 Is there an identifiable NPD group in the company?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.13</td>
<td>1.22</td>
</tr>
<tr>
<td>F8 Is there enough formal communication to properly coordinate NPD activities?</td>
<td>112</td>
<td>1</td>
<td>5</td>
<td>3.11</td>
<td>1.08</td>
</tr>
<tr>
<td>F3 Does each project have a core cross-functional team?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>2.98</td>
<td>1.20</td>
</tr>
<tr>
<td>F7 Is the NPD group dedicated to just NPD work?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>2.89</td>
<td>1.23</td>
</tr>
</tbody>
</table>
Mean values of project climate characteristics are rated less strongly than the first two dimensions of strategy and research, but are higher than the midpoint of 3 on the Likert-scale. The weakest characteristic with means of 2.89 and 2.98 are described as poor practices. The means of characteristics between 3.33 and 3.39 are within the fourth quartile and are the described best practices of this project climate dimension. The assessed best and poor practices for project climate follow:

Best practice:
- Company climate is conducive to NPD project work.
- Every project has a clear identifiable project leader.

Poor practice:
- NPD group is not only dedicated to NPD work.
- Each project does not have a core cross-functional team.

3.3.4.6 Best-poor practices for the company culture dimension
Mean values of the characteristics of the company culture dimension are listed and ranked in Table 3.15:
Table 3.15: Mean values of the characteristics of the company culture dimension

<table>
<thead>
<tr>
<th>Company culture</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>G7 Does the company culture embrace and support the concept of open innovation</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.61</td>
<td>1.06</td>
</tr>
<tr>
<td>G6 Does senior management encourage knowledge sharing across different strategic</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.57</td>
<td>1.07</td>
</tr>
<tr>
<td>G2 Is NPD a senior management priority?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.52</td>
<td>1.16</td>
</tr>
<tr>
<td>G1 Does the company culture facilitate the NPD effort?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.41</td>
<td>1.14</td>
</tr>
<tr>
<td>G3 Does top management provide the necessary resources to support NPD activities</td>
<td>112</td>
<td>1</td>
<td>5</td>
<td>3.41</td>
<td>1.10</td>
</tr>
<tr>
<td>G4 Can NPD ideas come from outside the company?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.39</td>
<td>1.18</td>
</tr>
<tr>
<td>G5 Does the company actively work with customers to develop new products?</td>
<td>112</td>
<td>1</td>
<td>5</td>
<td>3.37</td>
<td>1.12</td>
</tr>
<tr>
<td>G8 Does senior management encourage risk-taking?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.30</td>
<td>1.17</td>
</tr>
<tr>
<td>G9 Are there financial resources to pursue “white space” innovations?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>3.15</td>
<td>1.18</td>
</tr>
</tbody>
</table>

The mean values of the company culture characteristics are rated relatively strong compared to the characteristics of the strategy dimension. The weakest characteristic with a mean of 3.15 is described as a poor practice. The means of the described best practices are within the fourth quartile and between 3.52 and 3.61. The assessed best and poor practices for company culture follow.

Best practice:
- Company culture embraces and supports the concept of open innovation.
- Senior management encourages knowledge sharing across business units.
- NPD is a senior management priority.

Poor practice:
- No financial resources to pursue “white space” innovations.
3.3.4.7 Best-poor practices for the metrics and performance measurement dimension

Mean values of the characteristics of the metrics and performance measurement dimension are listed and ranked in Table 3.16.

<table>
<thead>
<tr>
<th>Metrics and performance measurement</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>H5 Are NPD metrics clearly understood by company personnel?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>2.91</td>
<td>1.15</td>
</tr>
<tr>
<td>H6 Are NPD projects ever halted before they are launched?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>2.91</td>
<td>1.16</td>
</tr>
<tr>
<td>H7 Is there a formal NPD performance measurement effort in place that tracks and stores performance data?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>2.91</td>
<td>1.19</td>
</tr>
<tr>
<td>H4 Are NPD project evaluations made by multiple persons?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>2.88</td>
<td>1.23</td>
</tr>
<tr>
<td>H2 Are there standard criteria for evaluating the overall NPD effort?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>2.83</td>
<td>1.19</td>
</tr>
<tr>
<td>H1 Does the company have specific NPD metrics (costing)?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>2.81</td>
<td>1.18</td>
</tr>
<tr>
<td>H3 Are there standard criteria for evaluating individual NPD projects?</td>
<td>113</td>
<td>1</td>
<td>5</td>
<td>2.79</td>
<td>1.14</td>
</tr>
</tbody>
</table>

The mean values of metrics and performance measurement characteristics are rated relatively weak compared to mean values of the characteristics of the other dimensions. All the mean values for the characteristics of metrics and performance measurement are less than the midpoint of 3 on the Likert-scale. The characteristic means within the fourth quartile describe best practices and are all of the same value of 2.91. The means for poor practices are between 2.79 and 2.81. The assessed best and poor practices for metrics and performance measurement follow.

Best practice:
- NPD metrics are clearly understood by company personnel.
- NPD projects are halted before they are launched.
A formal NPD performance measurement effort is in place.

Poor practice:
- No standard criteria exist for evaluating NPD projects.
- No standard criteria exist for evaluating the overall NPD effort.

### 3.3.5 Assessment of structural relationships of NPD dimensions for organisations

To analyse the structural relationship of the dimensions for an organisation, a multivariate statistical analysis technique is used that is known as structural equation modelling (SEM). This technique is used to analyse the structural relationship between measured variables (data points) and latent constructs (NPD dimensions) by using a combination of factor analysis and multiple regression analysis. This method estimates the multiple and interrelated dependence in a single analysis and is therefore preferred as an instrument to analyse structural relationships (Lani, 2016; Wang & Wang, 2012:3).

With model identification, the measured variables (data points) need to be 10 to 15 times more than the estimated latent constructs (NPD dimensions) to adequately evaluate the results (Wuensch, 2014). With the relatively small study sample of 113, the decision is made to analyse four of the seven NPD dimensions to find the structural relationship between them. The NPD dimensions to be used are strategy, research, company culture, and metrics and performance measurement. The four NPD dimensions were chosen because of the idea that strategy and metrics and performance measurement represent the origin and outcome of formal NPD projects. Literature confirms the relative importance of these important relationships. Strategy defines and provides guidance for the new product effort, while metrics and performance measurement measures the success of the NPD effort. Company culture and research are two dimensions that influence the way of thinking for NPD by involving organisational values, also understanding customer needs and external forces. With the structural relationship of the four dimensions, the
inter-related relationships and the direction of these relationships were evaluated and drawn in Figure 3.20.

3.3.5.1 Measurement model
To analyse structural relationships, factors of the four NPD dimensions with a value smaller than 0.35 were withdrawn to formalise the standardised model. Reasons for removing problematic factors are because factor loadings are too low when smaller than 0.35; too many correlations with other items and/or factors outside its own construct; certain item error variances are allowed to correlate if they are from the same construct and show high modification indices. Items excluded from strategy were B8; from research C3, C4 and C9; and from company culture G9 (also see Appendix A, the excluded numbers correspond with questionnaire numbers). Descriptive statistics and reliability coefficients are displayed in Table 3.17.

Table 3.17: Descriptive statistics and reliability coefficients

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategy</td>
<td>3.5</td>
<td>0.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Research</td>
<td>3.3</td>
<td>1.0</td>
<td>0.41†*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company culture</td>
<td>3.5</td>
<td>0.8</td>
<td>0.48†*</td>
<td>0.43†*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>8</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metrics</td>
<td>2.8</td>
<td>1.0</td>
<td>0.39†*</td>
<td>0.47†*</td>
<td>0.55‡*</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>6</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

* p < 0.05  † r > 0.30  ‡ r > 0.50
** p < 0.01

A standardised measurement model of the four NPD dimensions was drafted. After the factor loading selection, all current factors (characteristics) of the four dimensions correlate satisfactorily with the constructs (NPD dimensions).
To evaluate the measurement model fit, the Chi-square test of model fit was used. The Chi-square test value (667.63) with its associated degrees of freedom (df =397) indicates a good fit. The incremental fit index as indicated by both the Comparative fit index (CFI) with value (.88) and Tucker-Lewis index (TLI) with value (.87) indicates a reasonable good fit of the model. The incremental fit index describes a relatively good fit of the model when the values of CFI and TLI are > 0.90 (Wang & Wang, 2012:18). The measurement model fit explains a good relationship between the four NPD dimensions. All four NPD dimensions were indicated as significant and have a positive relationship with one another. When the value of one dimension is raised, the values of the other dimensions will also rise. The fit statistics of the measurement model are presented in Table 3.18.

Table 3.18: Fit statistics of the measurement model

<table>
<thead>
<tr>
<th>Fit statistics of measurement model</th>
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<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Model</td>
</tr>
</tbody>
</table>

$\chi^2$ = chi-square; df = degrees of freedom; AIC = Akaike Information Criteria; BIC = Bayesian Information Criteria; TLI = Tucker-Lewis index; CFI = Comparative Fit index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Square Residual; SE= Standard error.

Remarks on the fit statistics of the measurement model:
A sample size of at least 200 is needed to construct a reliable model for the dimensions. A model that produces the lowest AIC and BIC values is the most superior model. A CFI value closer to 1.0 indicates better fit. A Non-Normed Fit Index (NNFI) equal or > 0.95 is a threshold for the TLI value. The minimum cut-off value for RMSEA is 0.06. Values less than 0.08 for SRMR are deemed acceptable.
3.3.5.2 Structural model

After the measurement model had been tested, the structural model was formulated to test whether strategy, research and culture possibly preceded metrics. Values are indicated in Table 3.19.

Table 3.19: Initial framework fit indices and standardised path coefficients

| Initial framework fit indices and standardised path coefficients |
|---------------------|------------------|
| Measures            | Direct and indirect pathways |
| Fit indices         | $\chi^2$ 668.43  |
|                     | $df$ 397         |
|                     | AIC 8332.69      |
|                     | BIC 8599.98      |
|                     | CFI 0.88         |
|                     | TLI 0.87         |
|                     | RMSEA 0.08       |
|                     | SRMR 0.07        |
| Direct effects on metrics | Strategy 0.14 |
|                     | Research 0.57** |
|                     | Company culture 0.44** |
| Direct effects on research | Strategy 0.78** |
| Direct effects on company culture | Strategy 0.74** |

* $p < 0.05$  ** $p < 0.01$

Remarks on the fit indices of the framework:

There is a debate about the accurate usefulness of the fit indices, but agreement that adhering strictly to recommended cut-off values can lead to instances of type 1 error (wrongly rejecting an acceptable model).

The significant structural pathways produced by the analysis are presented by Figure 3.20. Beta ($\beta$) is the parameter of directional relation between two endogenous latent variables. The pathway’s direction flows from strategy to
both research ($\beta = .78$) and company culture ($\beta = .74$). The relationship between both research ($\beta = .57$) and company culture ($\beta = .44$) flows to metrics and performance measurement. Noteworthy, is the correlation between strategy and metrics and performance measurement as indicated by the value of $\beta = .14$ and the $p$-value that is larger than 0.05, indicating insignificance.

R-squared is a statistical measure of how close the data is to the fitted regression line and it gives the greatest indication of the strength of the relationship. R-squared is also known as the coefficient of determination and is used as a guideline to measure the accuracy of the model. R-squared is always between 0 and 100% and the higher the R-squared, the better the model fit.

In the structural model (Figure 3.20) of the study, the R-squared values of the dimensions of research ($R^2 = .61$) and metrics and performance measurement ($R^2 = .62$) both indicate a moderate relationship. A percentage of 61% of the variation in research can be explained in a linear relationship with strategy (the predictor). Variation in company culture is explained by a 54% linear relationship with strategy and in the case of metrics 62% of the variation can be explained in linear relationships with research, company culture and strategy. Figure 3.20 presents the structural model for the four NPD dimensions.

Figure 3.20: Structural model of NPD dimensions in organisations.
The structural model contributes to a theoretical understanding of the factors that promote the diffusion of NPD in organisations. The model provides direct insight into the interrelationships between the variables. Strategy is used as an independent variable and research, company culture and metrics and performance measurement as dependent variables.

Assessing the structural model means that strategy for NPD is more important than the other dimensions. The dimension of strategy directs the NPD process, followed by the dimensions of research and culture. Metrics and performance measurement is the NPD dimension measuring the overall NPD effort and it is practical that metrics and performance measurement will follow the preceded NPD dimensions.

3.3.6 Difference of NPD best practices between SMEs and large enterprises

A distinction is made between SMEs and large enterprises according to Table 2.1 that indicates the classification of enterprises.

The relative importance of NPD best practices for SMEs is ranked from the strongest to the weakest in Table 3.20 and is also shown for large enterprises respectively. Ranking of NPD dimensions (best practices) for SMEs and large enterprises is not in the same order of importance. The relative importance is also shown in Figure 3.21.
Table 3.20: Relative importance of NPD dimensions for SMEs versus large enterprises.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>SME</th>
<th>LARGE ENTERPRISE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean Rank</td>
</tr>
<tr>
<td>Strategy</td>
<td>40</td>
<td>51.49</td>
</tr>
<tr>
<td>Commercialization</td>
<td>40</td>
<td>49.16</td>
</tr>
<tr>
<td>NPD process</td>
<td>40</td>
<td>49.01</td>
</tr>
<tr>
<td>Company culture</td>
<td>40</td>
<td>48.75</td>
</tr>
<tr>
<td>Research</td>
<td>40</td>
<td>48.50</td>
</tr>
<tr>
<td>Project climate</td>
<td>40</td>
<td>47.28</td>
</tr>
<tr>
<td>Metrics and performance measurement</td>
<td>40</td>
<td>46.88</td>
</tr>
</tbody>
</table>

The relative importance of strategy (15.1%) is indicated as most important to SMEs and suggests that NPD goals are important; identification of new opportunities is part of the SME strategy which is a strong driving force towards the survival of SMEs. The best practice of metrics and performance measurement (13.7) is shown as the least important to SMEs and proposes that SMEs do not give much attention to managing metrics as part of the NPD process.

The strongest NPD best practice for large enterprises in contrast to SMEs is metrics and performance measurement. Metrics (15%) for large enterprises implies that management focuses on managing performance measurement to gain a higher success rate for the NPD process. With cross-functional teams and different NPD projects, it becomes important to keep record of all activities, evaluating NPD performance.
The strategy dimension of NPD best practices (12.9%) is indicated as the weakest for large enterprises in relation to the other practices. Management of large enterprises is well structured and together with established procedures and processes allows management to focus less on NPD strategy and more on the other NPD practices.

Company culture supports the concept of open innovation or a creative environment and relates to motivation of personnel and teams. The low ranking (second least) of company culture of large enterprises is unexpected for large enterprises, while large enterprises do have the means to promote NPD company culture. Figure 3.21 presents the relative importance of NPD dimensions for SMEs versus large enterprises.

### 3.4 OPEN-ENDED QUESTIONS

An open-ended question as part of the survey instrument disseminated to all the participants was filled out by 9.7% of the respondents. The different answers to the open question were:

- To have and appoint designated staff.
• To communicate throughout the business and unite the NPD development process.
• More involvement of customers and service managers in NPD.
• Educate more business people to become more equipped with new skills regarding NPD.
• Need to be properly trained to realize the goals of NPD.

These answers are summarised and rewritten in terms of suggestions to improve NPD and are as follows:

• Dedicated NPD practitioners are needed.
• Communication throughout the company is important.
• Involve customers in NPD.

These suggestions are in line and are part of the NPD dimension best practices that were assessed. Dedicated NPD practitioners are part of the NPD process (see section 2.8.4.4) and are also discussed in section 3.3.3.4 of a designated address. Communication throughout the company is part of the project climate NPD dimension (see section 2.8.4.5), while customer involvement is part of the company culture NPD dimension (see section 2.8.4.6).

3.5 SUMMARY

Chapter three presents the data collection process, statistical analyses and findings. An elaboration on research methodology and methods was done and the findings were illustrated with figures and tables.

The demographic profile of the respondents was illustrated by the descriptive frequencies and histograms. The relative importance of the seven NPD dimensions was explained and correlations of the dimensions were shown as well as reliability of the questionnaire measuring the seven NPD dimensions. An assessment of structural relationships of NPD dimensions for organisations was done.
Comparisons were made between the seven dimensions and various demographic variables, namely designated address, size of organisation by employment and annual turnover, self-employment, types of products produced and economic sectors.

The NPD poor-best practices were rated and were described as a poor or best practice for each dimension. An assessment of relationships was done by means of t-tests for significance and effect sizes. Open questions by respondents were assessed and different NPD best practices for SMEs had been identified.
CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

4.1 INTRODUCTION

The literature study has given a better understanding of new product development (NPD) and the structured manner by which to manage the process efficiently and successfully. The NPD framework of seven dimensions was discussed and a better understanding was obtained about the dimension characteristics in order to evaluate best and poor practices. The data collection process, statistical analysis and findings of the survey were presented in Chapter three. In Chapter four conclusions will be drawn from the findings of the previous chapters.

Conclusions follow regarding the relative importance of NPD dimensions, comparisons between NPD dimensions and demographic variables, best-poor practice levels of NPD best practices, the structural modelling of NPD dimensions, the difference of NPD practices between SMEs and large enterprises, and finally remarks pertaining to the open question. The primary and secondary objectives as set out in Chapter one will be evaluated to confirm whether they have been met. Recommendations and suggestions for further research will be made.

4.2 MAIN FINDINGS

4.2.1 Demographic information

The sample distribution of “gender” is 76% male and 24% female. There is no reason to believe that gender will influence the results of NPD. The “management job level” that was analysed from the sample represents a relatively high skilled level of the workforce involved in the survey, comprising middle-management, senior management and directors/owners of the organisation who show a good understanding of the survey on NPD. The
sample for the survey represents 38% micro enterprises, 36% SMEs and 26% large enterprises according to the South African classification of enterprises as set out in Table 2.1.

4.2.2 Relative importance of NPD dimensions

Literature confirms the results on the relative importance of NPD dimensions in organisations that were found through the survey. A comparison of SMEs and large enterprises shows that they do not have similar opinions regarding the relative importance of the seven dimensions for NPD.

4.2.2.1 Relative importance in organisations.

As shown in section 3.3.2.2, the mean values of the seven dimensions for organisations are between 3.53 for strategy as the highest and 2.88 for performance metrics measurement as the lowest value. The rankings of the seven dimensions in organisations are set out in Table 3.1 (and Figure 3.15), showing strategy with the highest mean value as the most important best practice for organisations. This suggests that organisations understand and prioritise strategy as of importance for NPD. Strategy defines a plan and provides guidance in different areas of the NPD programme. This finding reinforces other research on NPD that strategy is the most important dimension for organisations (Nicholas et al., 2011:241).

The NPD dimensions of research, project climate and commercialization and NPD process all reflect the same importance. The importance of this group of dimensions follows strategy. The meaning of these four dimensions is that application of the dimensions to practitioners is important in general and NPD dimensions are familiar to them. These four dimensions mean to involve customers, motivate human resources and acknowledge intra-company integration at team and individual levels.

Company culture shows a relatively strong ranking and could be explained by the influence of an entrepreneurial climate expected for SMEs. This survey
sample consists of more SMEs than large enterprises that could favour company culture.

Metrics and performance measurement appears to be the least important of the seven dimensions in organisations and suggests a general lack of practicing NPD measures and evaluations relative to the other dimensions.

4.2.2.2 Comparison with international research
The ranking of the dimensions shown in Figure 3.15 compares with international research for the USA, UK and Ireland done by Kahn et al. (2012:180) as shown in section 2.8.4.8 and Figure 2.6. Strategy is the highest ranking dimension and compares well with the USA and UK. The ranking of both company culture and metrics and performance measurement shows a relatively stronger presence than the survey in the USA and UK. This suggests that local organisations understand and promote a need and urgency to embrace and support innovation, also to measure and evaluate NPD performance.

4.2.3 Reliability-
To determine the reliability of the measuring instrument, internal consistency between the constructs of the questionnaire was measured by Cronbach’s alpha coefficient and was calculated as a value larger than 0.7 for all seven NPD dimensions (see Table 3.3). This measurement means that the measuring instrument can be interpreted as reliable and the results could be analysed statistically.

4.2.4 Comparison between NPD dimensions and demographic information
A comparison was made between NPD dimensions for the organisation and different demographic variables to evaluate relationships and the subsequent influence on the NPD function in organisations.
• *Employment:* The relationship between employment at SMEs and large enterprises versus NPD dimensions was analysed (see Figure 3.16). Findings indicated that strategy is the strongest and metrics and performance measurement the weakest dimension for SMEs; and for large enterprises, it is the other way around. Upon further investigation, it was found that the four dimensions of research, commercialization, company climate and metrics and performance measurement have a medium relationship with SMEs and large enterprises. Assessment suggests that the medium relationships of these four dimensions will cause an organisation to benefit and improve its NPD function by having access to skilled human resources.

• *Annual turnover:* The relationship between annual turnover of SMEs and large enterprises versus NPD dimensions was analysed (Figure 3.17). It was found that all the dimensions of large enterprises had a stronger NPD function than those of SMEs. The strongest NPD dimension of large enterprises was commercialization. By evaluating the relationships between NPD dimensions for SMEs and large enterprises, the NPD dimensions of research, commercialization, NPD process and metrics and performance measurement had a medium relationship. The assessment suggests that because there is a medium relationship between these four NPD dimensions, financial resources will improve the NPD function in organisations.

• *Designated address:* Assessment of the relationship between a designated NPD address and NPD dimensions of an organisation reveals that all the NPD dimensions are stronger when a designated address exists (see Figure 3.18). Further investigation shows that two of the NPD dimensions, namely company culture and NPD process have a small relationship with designated address. Implementation of these two dimensions will improve NPD, as a result of a designated address.
• **Self-employment:** The relationship between self-employment and NPD dimensions was analysed in SMEs and large enterprises (see Figure 3.19). The difference in strength between NPD dimensions for self-employment in SMEs and large enterprises reveals that self-employment does not improve the NPD functions. Further investigation indicates a small relationship between self-employment and the dimensions of research, commercialization, and NPD process. Because self-employment has a small relationship with these three NPD dimensions, the influence of self-employment can have a negative effect on improvement of NPD functions in organisations.

• **Type of product:** A comparison was investigated between the type of product produced by the organisation and the relationship with NPD dimensions (Table 3.8). The type of products produced by an organisation is distinguished as “products”, “services” and “both”. The strength of the NPD dimensions for the products differ with “both” as the strongest, “products” lower and “services” as the weakest. No significant relationship could be found between any of these products and NPD dimensions. This assessment concludes that the type of product does not influence best practices for NPD in organisations.

• **Economic sectors:** A statistical analysis is done to evaluate the comparison between economic sectors and the NPD dimensions (see Table 3.9). It is revealed that the NPD dimension of strategy has a significant relationship with some economic sectors. The economic sectors that have a significant relationship are between agriculture with electricity and construction; construction with mining and manufacturing; and lastly, financial with electricity and construction.
4.2.5 Best-poor level of NPD best practices

The Capability Maturity Model (CMM) describes a framework of five levels of NPD process maturity (NPD-solutions, 2016b). These CMM framework levels are indicated as follow:

- **Level 1. Initial level:** A stable environment for developing new products is not provided by the organisation.
- **Level 2. Under developed level:** Policies for managing a development project and procedures to implement those policies are established.
- **Level 3. Defined level:** A standard process of developing new products is documented.
- **Level 4. Managed level:** The organisation establishes metrics for products and processes and measures results.
- **Level 5. Optimized level:** The organisation is focused on continuous process improvement.

It was not the aim of the study to investigate the levels of maturity of NPD, but rather to categorize the NPD practices as either best or poor, related to each dimension characteristic. Best and poor NPD practices in organisations were identified and assessed and findings were set out in section 3.3.4 in Chapter 3. Findings were compared to the framework for best and poor NPD practices in the literature of section 2.8.5 in Chapter 2.

The findings indicated that organisations reflected quite evenly over all the NPD best and poor practices, but slightly less over the NPD best practice on the dimensions of commercialization and project climate (sections 3.3.4.3 and 3.3.4.5) as compared to the other five dimensions. A general consensus among practitioners exists to what constitutes a best and a poor NPD practice on the seven dimensions.

4.2.5.1 Strategy

Study results of best practices (section 3.3.4.1) reveal that NPD is considered a long-term strategy. The NPD projects fit well with the company mission and the
mission and strategic plan help define opportunities. Poor NPD practices include projects and programmes that are not regularly reviewed and NPD goals that are not clearly defined or visible in the company. The results suggest that the best practice of strategy is well understood by organisations.

4.2.5.2. Research
NPD best and poor practices of research (section 3.3.4.2) agree well with practices in literature (section 2.8.5). The finding suggests that the NPD research best practices of market research and concept testing are an integral part of NPD, and that current and future customer needs and problems are important to consider when it comes to NPD. Poor NPD practices of research are when there is no formal market research function or budget and market research studies are neglected. “No formal budget for market research” is known in the finding as a poor practice of research which is not in particular mentioned as a poor practice in literature.

4.2.5.3 Commercialization
Best and poor practices of commercialization (section 3.3.4.3) agree with practices in literature and indicate that cross-functional teams should be involved in manufacturing decisions. After new products have been launched, post-mortem meetings should also be held. Poor practices of commercialization include cross-functional teams not involved in both marketing decisions and supply chain decisions. The results suggest that NPD practitioners are not familiar with best and poor practices of commercialization. The practices identified are few and evenly spread as either a best or poor practice.

4.2.5.4 NPD process
Best and poor practices of the NPD process (section 3.3.4.4) are well identifiable and agree with the practices in literature. NPD process best practices include a flexible and adaptable process with well-defined criteria and a process owner or champion to oversee the NPD process. The lack of go/no-go criteria for the NPD process is mentioned as a poor practice in accordance with literature. A designated address or champion is a best practice for the
NPD process and the findings suggest that SMEs need to formalize their NPD process more, yet retaining flexibility. This can be expected to be the opposite in the case of large enterprises that make use of a project champion to try and gain more flexibility in their rigid formalised NPD process.

4.2.5.5 Project climate
Best and poor practices of project climate (section 3.3.4.5) agree with practices in literature. The results imply that NPD projects have a clear identifiable project leader and the company climate is conducive to NPD project work. A poor practice of project climate according to the survey is an NPD group that is not dedicated to NPD. Indicated by the few practices identified as best or poor practices for project climate, it suggests that organisations have a lack of understanding of these practices.

4.2.5.6 Company culture
Best and poor practices of company culture agree mostly with the finding of the survey (section 3.3.4.6). Findings of the best practices indicate that senior management encourages knowledge sharing across business units. The best practice of open innovation that is embraced by company culture is placed at the top of the ranking for best practices and indicates that organisations have a good understanding of best practices of company culture. The lack of financial resources for “white space” innovations is indicated as a poor practice and could be seen as indicative of an organisational environment that does not encourage creativity.

4.2.5.7 Metrics and performance measurement
Findings of best practices for metrics and performance measurement (section 3.3.4.7) do not fully agree with practices as set out in literature. The finding describes best practices for metrics as being clearly understood by company personnel. That means that NPD projects are halted before they are even launched and before a formal NPD performance measurement effort is in place. These best practices indicate that organisations do have an understanding of best practices for metrics in contradiction with a general comment of previous
research that there used to be a lack of understanding in this area. Findings of poor practices for metrics confirm poor practices as presented by literature.

4.2.6 Structural equation modelling of NPD dimensions

The SEM approach was used to draft a model that allows for the specification of relationships between the NPD process variables (dimensions). The structural relationship of four of the NPD dimensions was tested by using the structural equation modelling (SEM) technique (see section 3.3.5). These four dimensions of NPD are strategy, research, company culture, and performance metrics. After the measurement model had been tested and the structural model formulated, the NPD dimensions were tested to find the sequential order for the structural model (see Figure 3.20).

The structural model provides insight into the inter-relationships of the NPD dimensions. Strategy is used as the independent variable that defines NPD opportunities, providing direction to NPD projects and aligning NPD projects with the organisational strategic plan. Company culture follows strategy and involves organisational values and knowledge sharing across business units. Research also follows strategy and contributes to the NPD process function to help understand customer needs, evaluate results of concepts, product and market testing and external forces. Performance measures follow both research and culture, also measuring the success of the NPD effort.

4.2.7 Difference of NPD best practices between SMEs and large enterprises

The NPD dimensions for SMEs and large enterprises were ranked from the strongest to the weakest for SMEs in Table 3.20. SMEs and large enterprises do not have similar opinions regarding the relative importance of the seven dimensions for NPD (see section 3.3.6). Ranking of the dimensions for SMEs and large enterprises was shown in Figure 3.21 and indicates quite opposite priorities, especially for the dimensions strategy, and metrics and performance measurement. Given the structural, behavioural and cultural differences
between SMEs and large enterprises, a difference in relative importance would be expected (Nicolas et al., 2011:239). The finding relates to literature.

Strategy is the strongest NPD dimension for SMEs and suggests that NPD goals and opportunities are important to SMEs. The weakest dimension for SMEs is metrics, suggesting that SMEs do not have good NPD measures in place to evaluate the success of the NPD function or halt a project in time. The NPD dimensions of metrics and strategy are the strongest and weakest dimensions for large enterprises respectively.

The low ranking of company culture for large enterprises is unexpected. Company culture relates to motivation of personnel and teams and large enterprises are expected to follow such procedures as part of human resource programmes. This phenomenon of a low company culture for large enterprises compares to the finding of Nicholas et al. (2011:239).

The order of importance of NPD dimensions are not the same for SMEs and large enterprises. The order of importance of NPD dimensions for SMEs are strategy, commercialization, NPD process, company culture, research, project climate and metrics. The order of importance of NPD dimensions for large enterprises are metrics, commercialization, research, project climate, process, company culture and strategy.

4.3 OPEN-ENDED QUESTIONS

The open question was answered by some participants (9.7%) and summarised into statements for NPD (see section 3.4). It becomes clear that those statements are part of the NPD best practices that had been assessed during the course of the survey.
4.4 EVALUATION OF THE STUDY

4.4.1 Evaluation of the research

The success of this study is based upon achieving the primary and secondary objectives as set out in section 1.3 of this survey. The primary objective was to assess best practices for new product development in organisations. Achievement of the primary objective was supported by realising the secondary objectives.

Realising secondary objectives are explained as follows:

*The first secondary objective was to obtain insight into NPD best practices by means of a literature review.* This objective was achieved in Chapter 2 by means of a literature review towards understanding the NPD environment, theoretical aspects and previous investigations. The chapter defined the appropriate terms being used in the study.

*The second secondary objective was to identify a best practice framework for NPD in organisations.* This objective was achieved in Chapter 2 by means of the literature review in sections 2.8.3 and 2.8.4.

*The third secondary objective was to assess the relative importance of NPD dimensions in organisations.* This objective was achieved in Chapter 3 by means of the statistical analysis in section 3.3.2.

*The fourth secondary objective was to assess comparisons between demographic variables and NPD dimensions in organisations.* This objective was achieved in Chapter 3 in section 3.3.3.

*The fifth secondary objective was to categorise NPD best practice characteristics in respect of best-poor levels of the NPD dimensions.* This objective was achieved in Chapter 3 in section 3.3.4.
Based on achievement of all the secondary objectives, the primary objective for
the study has been met.

Additional work complementing the survey was done and includes assessing
structural relationships of NPD dimensions in organisations (section 3.3.5), and
also to identify the difference of NPD best practices between SMEs and large
enterprises (section 3.3.6).

4.4.2 Recommendations

Innovation is crucial in developing new products and companies need to invest
in opportunities and an environment that promote innovation. This includes
skilled innovative human resources and financial resources to support the NPD
effort in the long term. Entrepreneurs play a central role in innovation and new
products, but tend to get stuck in a series of management procedures. Effective
management of the innovation process can lead to success. Flexibility and responsiveness are key factors for NPD in large organisations – a flexible and simplified development process is needed.

Small cross-functional teams can create and manage the NPD effort effectively
and successfully from the initial idea to the launch. The focus is on “small”
cross-functional teams that have the ability to quickly respond to problems and
decision making. The necessary NPD processes must be managed, but more
emphasis on managing the goals is needed. Empowerment of the small cross-
functional teams is important to secure efficient development of new products.
The team needs decision-making power over product functionality and design.
This will make development decisions efficient and empower the team towards
better work satisfaction.

More attention should be given to the fuzzy front-end. Market research towards
identifying the opportunity and new product cannot be under estimated.
Identification of the product and subsequent design criteria set the course for
the NPD process and are critical towards ensuring a successful outcome of the
NPD process.
When the NPD best practice framework is implemented in the organisation and the necessary human and financial resources are supplied, it bottles down to management responsibility that ensures a successful NPD. Sound management of NPD will include metrics and performance measurement information to secure high quality products and an efficient idea-to-launch process. It is not only the system or procedures that ensure the success of NPD, but it also has to be actively managed.

The co-ordination of managers at different levels that involves the bigger picture of departments and achieving the mission and vision of the organisation has a final influence. Senior management has to support, provide and encourage NPD in the organisation.

Best practices for NPD are presented by the seven dimensions, namely strategy, research, company culture, commercialization, NPD process and metrics. This framework is developed as one of the most relevant frameworks and the organisation has to fit and test the framework to establish the best use of NPD.

Strategy is important towards guiding NPD activities, regardless of the size of the organisation. The survey shows it as the strongest dimension of NPD. Strategy clearly defines the need for areas such as research, technology, markets and management to give direction to NPD. The NPD strategy needs to be drawn up alongside and to comply with the strategy of the organisation. A well-considered strategy will help to efficiently execute the NPD effort.

SMEs do not seem to be a scaled down version of a large company, having different characteristics that distinguish it from large companies. SMEs are independent in their operations and management, with multi-tasking personnel needs in many cases, minimal structures and policies that promote personal responsibility and more informal personal relationships. When it comes to NPD, SMEs must use their advantages which include a shorter decision-making process and a more innovative friendly atmosphere to compete in the
market place. To implement the NPD best practices framework, SMEs will have to fit the framework whilst retaining the advantages of the SME structure.

4.4.3 Suggestions

Organisations without a proper NPD-designated address (champion) will tend to work without process continuity, information and technology can easily get lost and a good success rate of NPD is doubtful. It is important for bigger organisations to have a designated NPD address in place to ensure successful product development.

Both private and public sector organisations should prioritize NPD to grow and build the economy of South Africa. When ideas come from outside the organisation through relationships with customers and other organisations, NPD in the organisation will be stimulated to the benefit of all. It is imperative that larger organisations assist the smaller enterprises in NPD.

A specific NPD budget that will be managed by the NPD team and be measured as a performance indicator needs to be in place. Long-term NPD sustainability and an efficient NPD effort need to be managed and supported by sufficient financial resources.

Cross-functional teams contribute to innovation and NPD performance in an organisation. The question is whether too many organisational contexts will make multifunctional teams less effective, regardless of the level of collaboration at team level. What is needed is a multilevel study that will investigate team level relationships.

Research should be expanded on national level. A survey with a large sample from a broader geographic area can be done in order to determine the generalisability of the findings with regard to correlations and factor structures and to facilitate comparative studies.
4.5 CONCLUSION

The importance of new products to be introduced to the market for continuing business success was emphasized in the previous chapters. The new product development framework and best practices were discussed to gain a better understanding of the NPD dimensions. Chapter four presents the conclusions and recommendations of the study that had been presented in the first three chapters.

Comparisons between demographic variables and NPD dimensions help understand relationships between these and the influence on the NPD function in organisations. The relative importance of NPD dimensions helps managers manage the NPD process and focuses on the area where most needed. The relative importance of NPD dimensions is an indicator of effectiveness of the NPD function in the organisation and can help formulate the strategy in the longer term.

Best-poor levels of NPD practices were assessed and findings indicate that practitioners have a relative good understanding of poor and best NPD practices. Strategy is the most important NPD dimension of the seven dimensions and gives direction and clear goals to the NPD process.

A structural relationship between four of the NPD dimensions was tested by using SEM; hence formulating a structural model. This model provides insight into the inter-relationships of the NPD dimensions. NPD dimensions between SMEs and large enterprises were ranked and compared in order to understand the difference in context pertaining to the size of the organisation.

The chapter concludes by acknowledging the achievement of all the objectives, offering some recommendations and suggestions for future research.


published jointly with the product development institute, Inc. Ancaster, ON, Canada.

http://academic.brooklyn.cuny.edu/economic/friedman/mmproductpolicy.htm


http://www.slideshare.net/NigelEngelbrecht1/gemsouthafrica2014report1431707163


Date accessed: 12 Sept. 2016.


# APPENDIX A: QUESTIONNAIRE

## NEW PRODUCT DEVELOPMENT (NPD) SURVEY

This questionnaire will take only a few minutes to complete. Mark the applicable block with a cross (X). Complete all questions.

## SECTION A: DEMOGRAPHICAL INFORMATION

### A1. Gender
- a) Male
- b) Female

### A2. Age
- a) Younger than 20
- b) 21-35
- c) 36-45
- d) 46-60
- e) Older than 60

### A3. What is your highest qualification in NPD?
- a) Grade 12 or lower
- b) Qualified Artisan
- c) Diploma
- d) Graduate
- e) Post-graduate

### A4.1. Do you have a dedicated or designated address for NPD?
- a) Yes
- b) No

### A4.2. If “yes” is it a
- a) Person
- b) Department/ Business Unit/ Branch
- c) Head Office/Parent

### A5. Years working for this company?
- a) 1 - 4
- b) 5-10
- c) 11-20
- d) 21-30
- e) >30

### A6. What is your current job level?
- a) Supervisor
- b) Middle management
- c) Senior management
- d) Director / Owner
- e) Other

### A7. Number of persons that report directly to you?
- a) 1 - 5
- b) 6-10
- c) 11-15
- d) More than 15

### A8. How many permanent employees working (on average) for the business?
- a) 1 – 5
- b) 6 - 20
- c) 21 - 50
- d) 51 - 200
- e) > 200

### A9. What is the estimated total annual turnover of the business? (millions)
- a) < R0.2M
- b) R0.2 – R5M
- c) R5 – R13M
- d) R13 – R51M
- e) > R51M

### A10. Are you self-employed?
- a) Yes
- b) No

### A11. What is the legal status of the business?
- a) Sole Proprietor
- b) Partnership
- c) Close Corporation
- d) Company PTY (Ltd)
- e) Franchise
A12. In which sector do you work?

- a) Private
- b) Government
- c) Parastatal

A13. What do you produce?

- a) Product(s)
- b) Service(s)
- c) Both

A14. In which economic sector does the business operate? (pick one)

- a) Agriculture, hunting, forestry and fishing.
- b) Mining and quarrying.
- c) Manufacturing.
- d) Electricity, gas and water.
- e) Construction.
- f) Retail and Motor trade and Repair Services.
- g) Wholesale Trade, Commercial Agents and Allied Services.
- h) Catering, Accommodation and other Trade.
- i) Transport, Storage and Communications.
- j) Financial and Business Services.
- k) Community, Social and Personal services.
- l) Other (explain):

SECTION B: NEW PRODUCT DEVELOPMENT (NPD) DIMENSIONS

Indicate the degree to which you agree with each new product development (NPD) statement by using the following 5-point scale:

<table>
<thead>
<tr>
<th>STRATEGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1 Do most NPD projects fit with the company mission?</td>
</tr>
<tr>
<td>B2 Does your company have NPD goals?</td>
</tr>
<tr>
<td>B3 Are NPD goals clearly defined and visible within the company?</td>
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<tr>
<td>B4 Does your company consider NPD as a long-term strategy?</td>
</tr>
<tr>
<td>B5 Do mission and the strategic plan help define strategic arenas for new opportunities?</td>
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<tr>
<td>B6 Are NPD projects and programs reviewed on a regular basis?</td>
</tr>
<tr>
<td>B7 Does the company carefully consider the resource requirements necessary to support NPD projects?</td>
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<td>B8 Is NPD opportunity identification ongoing?</td>
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<td>B9 Is there a ranking or prioritization of NPD projects?</td>
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<table>
<thead>
<tr>
<th>RESEARCH</th>
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<tbody>
<tr>
<td>C1 Are studies of customers focused on both current and future customer needs and problems?</td>
</tr>
<tr>
<td>C2 Is market research an integral part of all NPD projects?</td>
</tr>
<tr>
<td>C3 Is concept testing an integral part of the NPD process?</td>
</tr>
<tr>
<td>C4 Is market testing an integral part of the NPD process?</td>
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<tr>
<td>C5 Are NPD testing results formally evaluated?</td>
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<td>C6 Are customers an integral part of the NPD process?</td>
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<td>C7 Does your organization have a formal market research function?</td>
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<td>C8 Does the organization have a formal budget for market research?</td>
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<tr>
<td>Question</td>
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<td>------------------------------------------------------------------------</td>
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<tr>
<td>C9 Are market studies on customers, competitors, and macro-environment trends undertaken to understand the marketplace for every NPD project?</td>
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<tr>
<td>C10 Are NPD testing and market research results used to improve new products being developed?</td>
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<tr>
<td><strong>COMMERCIALIZATION</strong></td>
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<tr>
<td>D1 Does the company have a standard launch process/protocol for new products?</td>
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<td>D2 Is a cross-functional team involved in manufacturing decisions for a new product?</td>
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<tr>
<td>D3 Is a cross-functional team involved in logistics and supply chain decisions for a new product?</td>
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<tr>
<td>D4 Is a cross-functional team involved in marketing decisions for a new product?</td>
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<tr>
<td>D5 Is a project post-mortem meeting held after the new product is launched?</td>
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<tr>
<td>D6 Are customer service and customer support personnel part of the launch team?</td>
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<tr>
<td>D7 Is commercialization a formal part of the NPD process?</td>
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<tr>
<td><strong>NPD PROCESS</strong></td>
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<tr>
<td>E1 Are criteria for evaluating NPD projects well defined?</td>
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<tr>
<td>E2 Does a common NPD process cut across all company groups?</td>
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<td>E3 Is there documentation on the NPD process?</td>
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<td>E4 Are NPD Go/No-Go criteria clear?</td>
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<td>E5 Is the NPD process flexible and adaptable to meet the needs, size, and risk of individual projects?</td>
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<tr>
<td>E6 Does a formal and clear NPD process exist?</td>
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<td>E7 Does the NPD process have a process owner or process champion?</td>
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<td><strong>PROJECT CLIMATE</strong></td>
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<td>F1 Is the company climate conducive to NPD project work?</td>
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<td>F2 Is there an identifiable NPD group in the company?</td>
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<td>F3 Does each project have a core cross-functional team?</td>
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<td>F4 Does each project have a clearly identifiable project leader?</td>
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<td>F5 Is there careful consideration of how team members are assigned to teams?</td>
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<td>F6 Is NPD cross-functional in nature?</td>
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<td>F7 Is the NPD group dedicated to just NPD work?</td>
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<td>F8 Is there enough formal communication to properly coordinate NPD activities?</td>
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<td><strong>COMPANY CULTURE</strong></td>
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<tr>
<td>G1 Does the company culture facilitate the NPD effort?</td>
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<td>G2 Is NPD a senior management priority?</td>
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<td>G3 Does top management provide the necessary resources to support NPD activities?</td>
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<td>G4 Can NPD ideas come from outside the company?</td>
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<td>G5 Does the company actively work with customers to develop new products?</td>
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<td>G6 Does senior management encourage knowledge sharing across</td>
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Any suggestion(s) to improve NPD at your business?: ________________________
___________________________________________________________________

Thank you! The Researcher (2016)
APPENDIX B: CONFIRMATION OF LANGUAGE EDITING

DECLARATION OF EDITING

I hereby declare that I was responsible for the language editing of the manuscript Assessing best practices for new product development in organisations submitted by WJS Claasens (12530603) and that I suggested changes here and there.

DR ELSABÉ DIEDERICKS

18 December 2016