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Product innovation strategies that support an organisation's reset business strategy

Marang Norah Maithufi

WITS Business School

Thesis presented in partial fulfilment for the degree of Master of Business Administration to the Faculty of Commerce, Law, and Management, University of the Witwatersrand

25 March 2021


WITS
UNIVERSITY

DECLARATION

I, Marang Norah Maithufi declare that this research report entitled 'Product innovation strategies that support an organisation's reset business strategy' is my own unaided work. I have acknowledged, attributed, and referenced all ideas sourced elsewhere. I am hereby submitting it in partial fulfilment of the requirements of the degree of Master of Business Administration at the University of the Witwatersrand, Johannesburg. I have not submitted this report before for any other degree or examination to any other institution.

MN Maithufi

Marang Norah Maithufi

Signed at Johannesburg on 25 March 2021

Name of candidate	**Marang Norah Maithufi**
Student number	**2272810**
Email address	**2272810@students.wits.ac.za**
First year of registration	**2019**
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Name of supervisor	**Shungu Mupfawa**

ABSTRACT

Literature reveals that many organisations do not have well-communicated innovation strategies, or rarely articulate their innovation efforts to align with business strategies. In addition, research further emphasises that without innovation strategies, different parts of an organisation can find themselves pursuing conflicting priorities even in the existence of a clear business strategy.

Organisation A, the case under study, has recently accounced its new refresh business strategy; in order to align itself with the changing business and consumer landscapes. The new business strategy focusses on value delivery through customer-centricity and market-focused businesses.

The aim of this study is to ascertain product innovation strategies that can support *Organisation A*'s new business ambitions.

Organisation A produces and markets a wide range of products, including chemicals; both commodity as well specialty chemicals.

The products identifed for the study are polymers products, selected due to the unique challenges the products currently face; which include being commodity products at the mature stage of their product lifecycle. Parallel to this, these products have recently endured substantial environmental scrutiny relating to the increasing (polymers) plastics waste footprint in the environment and other externalities, with consumers thus demanding more environmentally sustainable product solutions.

For a richer discovery, as well as uncovering perceptions which may influence how innovation is conducted at *Organisation A*, a qualitative single case study research strategy was pursued, via semi-structured interview schedules with *Organisation A*'s employees involved in and associated with the development, production, marketing, sales and support of polymers products under study.

The study revealed that although innovation is widely acknowledged as important, the perceptions held within the business were that polymers product innovation was not a

forefront imperative. This, according to the study participants, manifested as an environment that was unsupportive of product innovation endevours, a business that was overly risk-averse, internally focussed, and considered other categories of innovation such as manufacturing process innovations as more value creating than polymers product innovation efforts. Consequently, only incremental and sustaining product innovation activities that were perceived to not disrupt the business were embraced.

Three strategies or opportunity areas are proposed, that *Organisation A* can explore for its polymers product innovation efforts to support the new business strategy.

Open Innovation strategies are the first of the proposed opportunity areas. Open Innovation presents *Organisation A* an opportunity, as one of the key participants in the plastics value chain, to apply the principles of collaborative innovation with other value chain participants in responding to the changing consumer landscape. While collaborating across the value chain, these proposed collaborative strategies could also enable *Organisation A* to satisfy its strategic ambition of customer centricity.

The study also revealed that polymers product innovation efforts were perceived to be low in value creation, therefore came against intense scrutiny and reluctance to be progressed. Underpinning these perceptions were the constructs surrounding operating within the context of a commodity business where products are under constant margin pressures and low cost-to-serve targets.

In addressing the value creation concerns surrounding polymers product innovation, the second opportunity area recommends a joint and collaborative development of project selection criteria and metrics with the relevant inter-functional or inter-company stakeholders involved in polymers products. This would allow clear alignment of value creating metrics across the different and associated functions.

The third and last recommendation proposes that *Organisation A* establishes and articulates product innovation management systems that are aligned with the ambitions of the new business strategy. Fitting innovation metrics would also then need to be ascertained and embedded, to ensure that the right innovation efforts are pursued.

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DEFINITION OF KEY TERMS AND CONCEPTS

Polymers: Materials consisting of large molecules or macromolecules, made up of many repeating subunits. Polymers exhibit diverse properties such as chemical, mechanical and thermal; making them suitable for a wide range of applications (Young & Lovell, 2011).

Plastics: Plastics are a family of polymers that can be melted when heated and hardened when cooled. These characteristics are reversible, thus plastics can be repeatedly reheated, cooled and reshaped into new shapes and products. Plastics are also known Thermoplastics (AISBL Plastics Europe, 2019).

Plastics/Polymers value chain: A set of functional activities (including products and services) that plastics/polymers stakeholders undertake to create value for customers (James, 2019; Ryberg, Laurent, & Hauschild, 2018).

Circular Economy: An economy that is restorative and regenerative by design, based on three principle *viz.* "design out waste and pollution, keep products and materials in use and regenerate natural systems" (MacArthur, Waughray, & Stuchtey, 2016).

Commodity products: Products with a high level of standardisation, comparability and/or substitutability. Competition and purchasing decisions are usually primarily price-based (Zysman, 2014).

Innovation strategy: A reflection of an organisation's innovative orientation, by outlining guiding principles for innovation plans and ambitions (Pisano, 2015).

Customer centricity: The perspective and mindset that puts customers at the core of business decisions, processes and actions (Shah, Rust, Parasuraman, Staelin, & Day, 2006).

Open Innovation: The use of purposive internal and external sources of knowledge to fast-track internal innovation, as well as grow the markets for external use of innovation (H. W. Chesbrough, 2006).

1 INTRODUCTION TO THE RESEARCH

1.1 Background and context

Organisation A, the organisation under study, has recently announced its new business strategy to position the company for the changing business and consumer landscape (Organisation A, 2020). The new business strategy emphasises focus on value delivery through customer-centricity and market-focused businesses.

Organisation A produces and markets a range of chemicals, including commodity as well specialty chemicals. The organisation has been in existence for over 70 years, and its global footprint spans over 30 countries.

Over the past several years, the crude oil industry has seen price volatility trends largely with regards to supply and demand. Companies that associate their business models with or have exposure to oil prices have therefore been vulnerable to these macroeconomic variables. As such, *Organisation A* has not been spared.

Organisation A was also dealt blows by the Covid-19 pandemic impacts; which saw the demand of many products such as chemical products reducing and thus eroding profit margins.

The company also had growth ambitions beyond the borders of its local operations. The growth project however ended up accruing excessive cost and time overruns; and required significant additional spend to complete (Organisation A, 2019, 2020).

These dynamics have left the company highly geared. High debt levels weaken the ability to withstand market disruptions such as Covid-19 pandemic, as such investments in new growth opportunities are not readily available.

In the face of megatrends, drivers such as the changing consumer landscape and shrinking product lifecycles; innovation has become a crucial aspect for companies to compete, survive and differentiate themselves in the highly competitive global markets. Organisations therefore are focusing on aligning their product and service offerings towards customers perceptions of value-creation.

Within these dynamics, *Organisation A* revealed its new refresh or reset business strategy to respond to the changing business landscape.

1.1.1 An introduction to formative evaluation

Organisation A has an extensive array of products across its various businesses. The products serve different customer markets with varying needs. The products of interest for this study are Polymers products; which fall under the Chemicals family.

The chemicals industry is entering a new phase; referred to as Chemistry 4.0. This new phase signifies an alignment with the Fourth Industrial Revolution (4IR). Chemistry 4.0 is defined as the interphase of Digitalization and the Circular Economy (Bock, Nickel, & Meincke, 2017; Tetko, Engkvist, Koch, Reymond, & Chen, 2016; von Knop, 2016).

Within the realm of Circular Economy, polymers have gained substantial attention due to the negative publicity that these products have recently garnered due to issues surrounding sustainability, waste and the overall use of some chemicals in polymers products (De Smet, 2016; MacArthur et al., 2016; Mrowiec, 2018).

According to MacArthur *et al.* (2016), Circular Economy is based on three principles; which are "design out waste and pollution, keep products and materials in use and regenerate natural systems". As such, Circular Econony is therefore an economy that is restorative and regenerative by design.

Polymers considered for this study fall under a family of materials called thermoplastics, which are generally known as plastics (AISBL Plastics Europe, 2019).

For the purpose of simplicity, the words polymers and plastics may be used interchangeably in this report.

Figure 1-1 is a depiction of some common application areas for polymers; which fall under the plastics family of products. The plastics' family of products composes of a wide variety of materials designed to meet different performance requirements of many end-use applications and products, as Figure 1-1 shows.

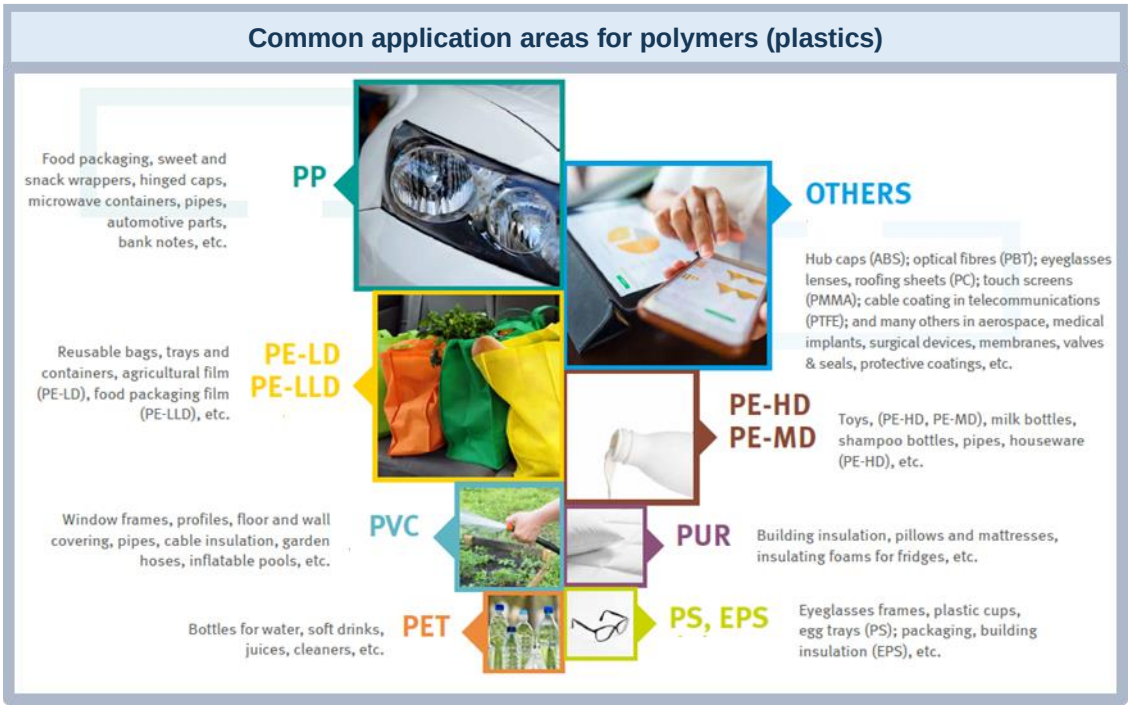


Figure 1-1: Common application areas of plastics.
Source: Adapted from (AISBL Plastics Europe, 2019).
PP= Polypropylene; PE- LD = Polyethylene Linear Density; PE-LLD = Polyethylene- Linear Low Density; PE-HD = Polyethylene High Density; PE-MD = Polyethylene Medium Density; PVC = Polyvinyl chloride; PET = Polyethyleneteraphthalate; PS = Polystyrene, EPS = Expanded Polystyrene., PUR = Polyurethane.

Another aspect of consideration with the products under this study is that the polymers products of interest are considered commodity products. Commodity products have high levels of standardisation and substitutability by comparable products. Product innovation and differentiation therefore highly consider trade cost dynamics since the purchasing decisions and competition are primarily price-based (Roland Berger Consulting, 2014; Zysman, 2014).

Within the bounds of the mentioned dynamics, this research therefore aims to determine product innovation strategies for polymers products, by unpacking the current innovation landscape within the organisation's polymers business, outline gaps and recommend actions for suitable product innovation strategies.

1.2 Research conceptualisation

The research problem statement

Innovation is one of the top strategic agenda of many organisations. Schumpeter, often referred as the founding father of innovation and entrepreneurship; defined innovation as a process that entails the creation of new or improved products, processes or systems that can be sold in markets (Schumpeter, 1976).

At the same time, it is widely reported that product lifecycles are shrinking at a faster pace, conversion of ideas to commercialisation through increased speed to market is one of the indicators of such and one of the levers companies are turning to as a competitive advantage (Bascle *et al.*, 2012; Ringel, Taylor, & Zablit, 2015). In the chemicals industry particularly, customers are more than ever demanding of chemicals companies to be a source of innovation to support new product development. As a result, product innovation has become a crucial aspect for companies to compete, survive and differentiate themselves amongst their competitors in the highly competitive global markets.

Innovation is als inherently crucial to *Organisation A*, as a company within the chemicals industry. The organisation has a patent portfolio of around 2500 patents granted worldwide according to company annual reports. The patent portfolio over the years, together with the Research and Development (R&D) investment are illustrated in Figure 1-2.

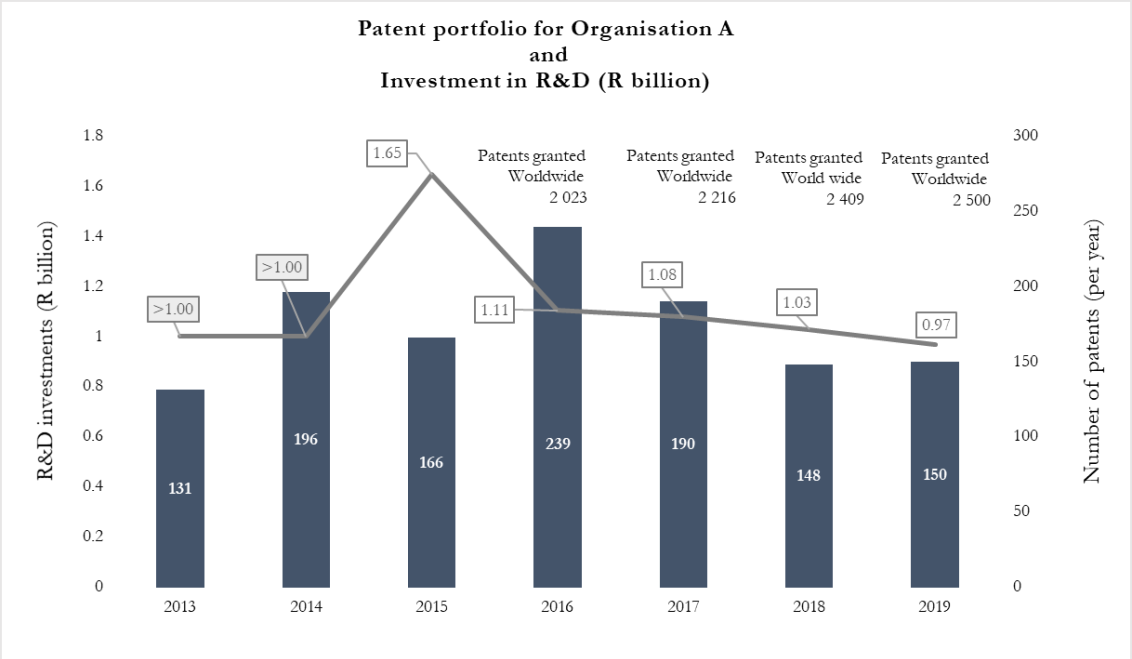


Figure 1-2: Organisation A's patent portfolio.
Source: Information retrieved from Organisation A's integrated annual reports between 2013 to 2019.

Patent publications as well as R&D sepending are but some of the metrics that serve as proxies for innovation, in and of themselves they do not provide a comprehensive insight into the measure of an organisation's innovation efforts and the associated or expected market value (National Academies of Sciences & Medicine, 2017). However, as it can be seen from Figure 1-2 the portfolio of patents has stagnated, leaning towards declining over the years. This observation thus presents an opportunity for a closer look into whether the organisation's innovation approaches or strategies serve their growth ambition, particularly against the changing business strategy.

Innovation strategies reflect the innovative orientation of organisations by defining actions and guiding principles for innovation plans and ambitions. According to Pisano (2015), companies rarely articulate their strategies to align their innovation efforts with business strategies. The author further asserts that without an innovation strategy, different parts of an organisation can end up pursuing conflicting priorities, even in the presence of a clear business strategy. Cooper and Edgett (2010) posit that "an innovation strategy is an essential tool for product development and continued growth, even in difficult times".

Other researchers further emphasize the significance of innovation management as a vital discipline for organisations to assess their innovation efforts and test their efforts accordingly. Jung and Waiboer (2007) state that successful innovation management begins with an alignment of business strategy with the innovation strategy while Aydinoglu (2007) also submits the interrelatedness of innovation strategy and innovation management. It is thus apparent that organisations require both innovation strategies and innovation management systems that are aligned to the business strategy.

The newly announced business strategy presents a significant opportunity to determine the innovation climate of the organisation; assess the fit and alignment to the changing business landscape and determine innovation strategies that will support the new business strategy.

The research purpose (aim and objectives) statement

The project aims to determine how innovation is undertaken for *Organisation A*'s polymers products, and out of these findings establish fitting product innovation strategies that are aligned with the new business strategy.

The objectives for the study are threefold:

1. Conduct a polymers product innovation landscape that will determine how innovation is undertaken for *Organisation A*'s polymers products, as well as the types of innovation pursued.
2. Out of the innovation landscape mapping, conduct a gap analysis against the ambitions of the new business strategy.
3. Then determine the most fitting innovation strategies that would support the new business strategy.

1.2.3 The research questions as well as where applicable accompanying research hypotheses or research propositions

The study's objectives will be achieved by answering the main research question

The main research question: "how is innovation pursued and undertaken for Organisation A's polymers products"?

To help answer this main research question, the following research questions will be explored:

RQ1: *What are the perceptions held within the business regarding innovation for polymers products*?

Proposition 1: Polymers are considered mature commodity products, therefore there is no intentional focus on product innovation.

RQ2: *What type of innovation is pursued for the products under investigation*?

Proposition 2: Only incremental and sustaining innovations are pursued, this then potentially suppresses innovation efforts from other innovation types.

RQ3: *How does the organisation assess if sufficient and relevant innovation activities are being pursued and advanced*?

1.3 Delimitations and assumptions of the research study

Organisation A has several business units and segments with a wide range of product portfolios. For the purpose of this study, the focus is on polymers products. This is chiefly because polymers products are experiencing unique challenges relating to environmental and regulatory sustainability pressures; as well as the commodity nature of the products. These aspects are elaborated further under Section 2.

As such, any other products within the organisation's product portfolios are excluded from this study.

It is also taken into consideration that as Figure 1-3 outlines; there are several forms of innovations.

Source: Stratley

Categories of innovation		Examples
Product and its application	Physical	Improved chemical properties of a material
	Service	Customized material selection support
Manufacturing process		New synthesis route for chemical product which saves 30% of energy
Business process		Improved human resource process to select better talents
Business and operating model		Separate commodity business (besides specialty business)

Figure 1-3: Categories of innovation in the chemicals industry.
Source: Innovation in the chemical industry (Gawad, Gruhlke, & Rieken, 2014).

This study will however be focussed towards product and application innovations. This is largely due to the challenges highlighted in Section 1.1.1; which would potentially require innovative product solutions.

However, should there be related areas of overlap and adjacencies with other innovation categories that this study may uncover, these will be noted and reported as such.

1.4 Significance of the research study

Chemicals and polymers (as a sub-set of chemicals) touch almost all products that consumers use and are a significant enabler of modern living. Topical to the current reality, the chemicals industry has been playing a critical role in providing products to combat Covid-19, such as pharmaceuticals for medicine, protective equipment (*e.g.* surgical masks) for front-line workers and civilians; and chemicals for hygiene products such as disinfectants and sanitisers.

Also as mentioned earlier the chemicals industry is entering a new phase; Chemistry 4.0; which is defined as the interphase of digitalization and the Circular Economy Bock *et al.* (2017); Tetko *et al.* (2016); von Knop (2016). Changes brought about by these trends are significant considerations that organisations need to take heed of and put strategies in place. These trends furthermore, emphasise the changing consumer landscape, where customers are becoming more demanding of their product expectations, being it speed to market according to Bascle *et al.* (2012) and Ringel *et al.* (2015), or more environmentally sustainable product solutions according to (De Smet, 2016; MacArthur *et al.*, 2016). Consequently, product innovation has become a crucial aspect for companies to compete, survive and differentiate themselves amongst competitors in the highly competitive global markets.

Considerations mentioned above about the changing consumer landscape, as reflected by the shrinking product lifecycles with an increasing product speed to market and greater consumer awareness regarding safety and care for the environment are some of the factors stressing upon the need for this particular study to define and articulate fitting product innovation strategy to match the changing consumer landscape and support *Organisation A*'s new business strategy.

1.5 Preface to the research report

To this end, the report has six chapters. Following this introductory chapter, Chapter 2 provides a literature review covering the problem, the past studies, the explanatory framework and the conceptual framework. Chapter 3 discusses the research strategy, design, procedures, reliability and validity measures as well as limitations. Chapter 4 and Chapter 5 present and discuss the findings, respectively, to interrogating the research questions while Chapter 6 summarises and concludes the research.

2 LITERATURE REVIEW

This chapter has three broad objectives; namely to understand the research problem, to identify the knowledge gap, and to develop a framework for interpreting the research findings. Specifically, in Section 2.1, we detail the research problem. In Section 2.2, we review literature on studies that have attempted a similar study or research. With information arising from Section 2.2, we identify and detail qualitative attributes or quantitative variables that are key to this research in Section 2.3 as well as a framework that we will use to interpret our research findings in Section 2.4.

2.1 Research problem analysis

Innovation has become one of the highly cited strategic agenda across many industries, equally so in the chemicals industry (Androsch & Redl, 2019; Bock *et al.*, 2017; Staack & Cole, 2017).

According to Cooper and Edgett (2010), innovation strategies are reckoned as essential tools required for product development and continued growth, even during challenging times. At the same time, it is highlighted that companies rarely articulate their innovation strategies to align with business strategies as Pisano (2015) posits. The author further cites that without an innovation strategy, "different parts of an organisation can easily wind up pursuing conflicting priorities – even if there's a clear business strategy".

It is therefore imperative that even with a clearly communicated new business strategy; a well-articulated and importantly, fitting product innovation strategy is ascertained.

Customer-centricity

Organisation A's newly announced business strategy outlines customer-centricity as one of the key areas of focus. Customer centricity is not a new concept, however it continues to elude many organisations and businesses. This concept can be traced as far back as over 60 years when Peter Drucker cited that the customers are the ones who determine the type of business and products a business should produce, and importantly, customers are indeed after all who determine if the business would prosper (Drucker, 1954).

Nowadays rapid advances in technology, as well as an increase in data and information are enabling consumers to be more informed and demanding of their purchasing power (Deloitte, 2017; Hollander, Hertz, & Wassink, 2013; Soares, 2014). The result is a constantly evolving consumer landscape; which asserts an imperative into innovation frameworks and models that consumers perceive as value-adding (Hollander et al., 2013; Mohan Chandran & Gupta, 2004; Selden & MacMillan, 2006; Shah et al., 2006).

The basis of customer-centricity is the perspective and mindset that puts customers at the core of business decisions, processes and actions (Shah et al., 2006). The intersection of customer journey, customer experience, customer value is where customer-centricity lies, as depicted in Figure 2-1.

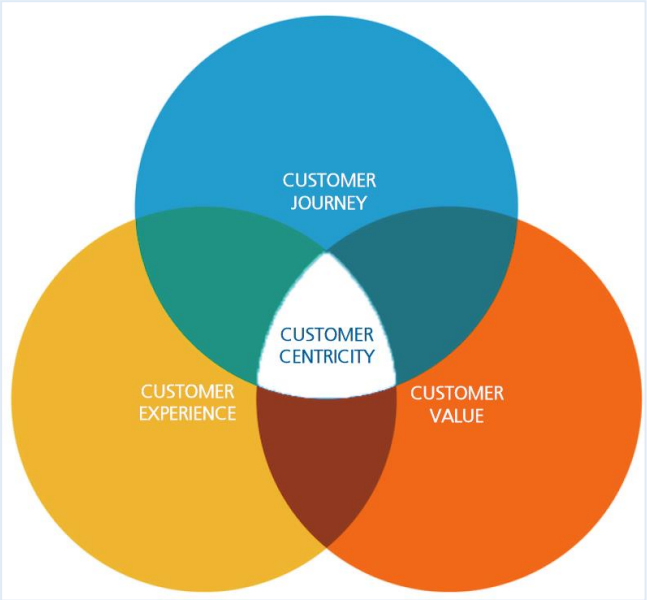


Figure 2-1: Customer centricity – the intersection of customer journey and customer experience. Source: http://www.customerradar.com/customer-centricity-best-practices/

An organisation considered to be customer-centric is one that has a strong knowledge and awareness of their customer needs, and one that is well versed in its customers' perception of value (Hollander *et al.*, 2013; Selden & MacMillan, 2006; Shah *et al.*, 2006). Therefore organisations should consistently and closely understand the changing needs, dynamics and demands of their customers. Organisations that are able to align their products and services with the customers' needs thus achieve customer-centricity. Without this alignment, organisations end up spending significant amount of research

funds in insular Research & Development (R&D) laboratories only to widen the growth gap; which as explained by Selden and MacMillan (2006) is the gap between business plans and market expectation growth.

As asserted by Selden and MacMillan (2006), understanding what the customers want, then directing innovation efforts in response to these drivers is deemed a key lever to closing the growth gap. The authors further asserts that customer centric innovation does not necessarily have to be an expensive undertaking. It may entail recalibration of the traditional product R&D funds towards customer R&D. Strategies such as product strategies such as market push/market pull *etc.* should therefore be assessed for their fit and suitability within the context of the consumers.

As outlined in the previous sections; customers in the chemicals industry demand of chemicals companies to be a source of innovation to support new product development. Therefore, assessing the position and involvement of customers in the value chain with regards to the product innovation in response to the new strategy is an important exploratory aspect for the study.

Commodity products and product lifecycles

Another dimension of this study is highlighted against the backdrop of the selected products for this study *viz.* polymers; being considered commodity products. Figure 2-2 contextualises these commodity polymers within what is known as the polymers pyramid.

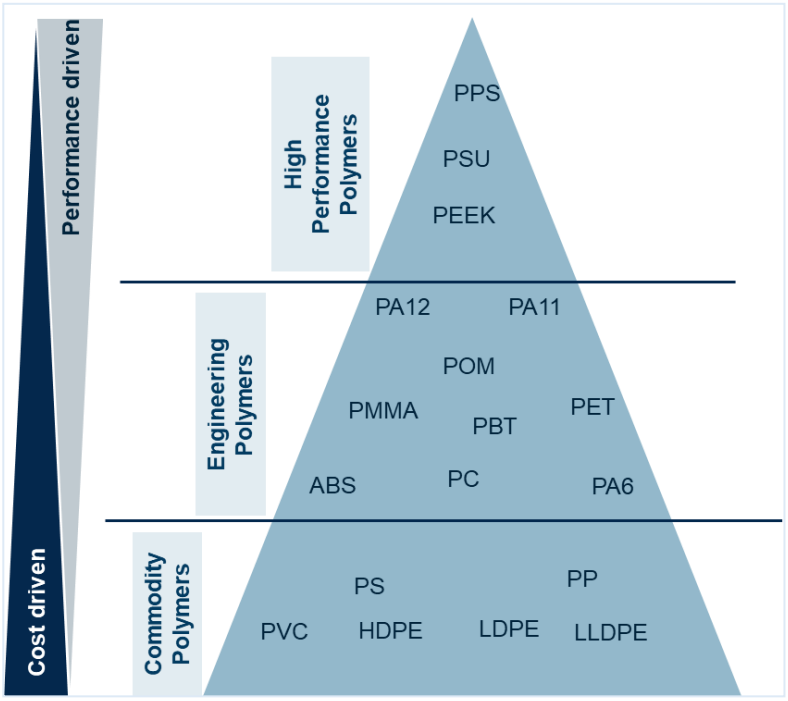


Figure 2-2: Polymers pyramid.
Adapted from sources: (Ligon, Liska, Stampfl, Gurr, & Mülhaupt, 2017).
PVC = Polyvinyl Chloride; HDPE = High Density Polyethylene; LDPE = Low Density Polyethylene; LLDPE = Low Density Polyethylene; PS = Polystyrene, PP = Polypropylene; ABS = Acrylonitrile Butadiene Styrene; PC = Polycarbonate; PA6 = Polyamide 6; PET = Polyethylene teraphthalate; PMMA = Polymethyl methacrylate; PBT = Polybutylene terephthalate; POM = Polyoxymethylene; PA12 = Polyamide 12; PA11 = Polyamide 11; PEEK= Polyether ether ketone; PSU = Polysulfone; PPS = Polyphenylene sulphide.

Briefly touched on under Section 1.1, commoditised products have a high level of standardisation in terms of features and qualities, the products are highly substitutable therefore experience a fierce competition (Lager & Blanco, 2010; Roland Berger Consulting, 2014).

Differentiation is limited with commodity products, as purchasing decisions and by extension competition are largely price-based (Roland Berger Consulting, 2014; Zysman, 2014). However as competition becomes purely price-based, it is common for suppliers of commodity products to find themselves facing a situation commonly known as commodity trap, where they experience an even further downward spiral of increasing price and margin pressures (Roland Berger Consulting, 2014; Zysman, 2014).

There are different phases in a product's lifecycle that give guidance to the type of innovation category that can be leverage, this is shown in Figure 2-3.

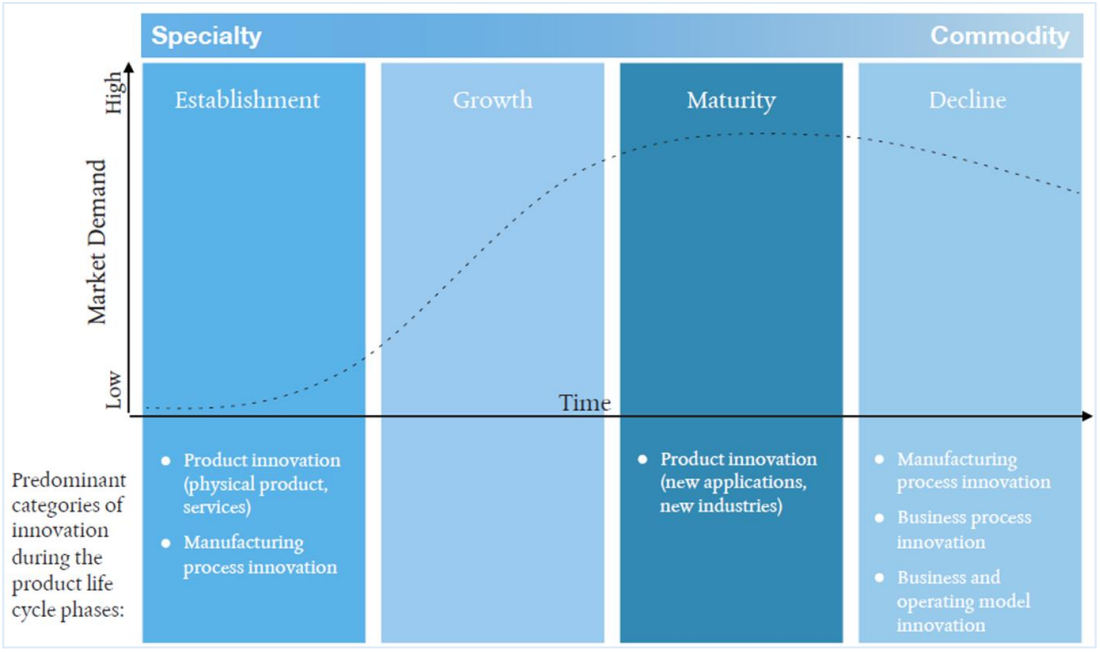


Figure 2-3: Product lifecycles.
Source: Innovation in the Chemical Industry (Gawad et al., 2014).

As can be seen in Figure 2-3, commodity products are largely in the maturity stage of their product lifecycle. At this stage and without interventions, products enter the decline stage where revenue continues to fall. Innovation models for commodity products are similarly cost driven, with an even greater focus on target costing (Roland Berger Consulting, 2014).

An imperative therefore exists to obtain fitting innovation strategies for the selected product stream within the confines of their commodity position as well as the organisations customer-centric ambitions.

Increasing stringent regulatory and environmental pressures

Polymers of interest for this study; also loosely and commonly known as plastics, have recently received negative attention and scrutiny for plastics waste footprint (MacArthur *et al.*, 2016).

The production of plastics has seen enormous growth, with about a twenty-fold growth over the past 50 years, shown in Figure 2-4.

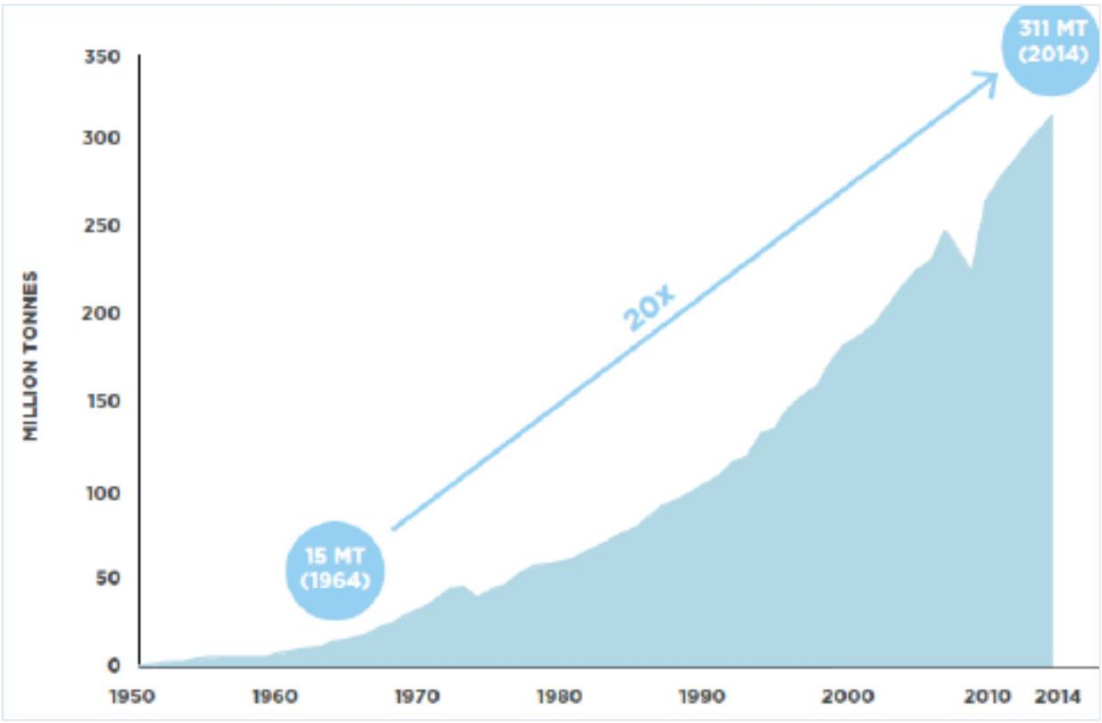


Figure 2-4: Growth in plastics production over the past 50 years.
Source: (MacArthur et al., 2016).

Plastics production and demands are expected to double over the next 20 years and quadruple by 2050 (MacArthur *et al.*, 2016). Market research reports estimate the global plastic market size to be about $722 billion by 2027, at a Compound Average Growth Rate (CAGR) of about 3.2% through the forecast period (Grandview Research, 2020). These growth prospects are in greater part due to plastics unrivalled high functionality and performance, as well as their versatile properties.

While growth prospects are significant, plastics as stated earlier have recently garnered bad consumer sentiments with regards to plastic waste in oceans and other externalities. Greater consumer awareness regarding health, wellness, safety and care for the environment are prompting the plastics value chain to come up with more environmentally sustainable plastics solutions in order to reduce plastics waste and footprint, in accordance with the Circular Economy principles that aims to limit the linear plastic usage (MacArthur *et al.*, 2016; Mrowiec, 2018).

Due to their environmental and sustainability related issues, a number of plastics segments have been identified for fundamental redesign, therefore new product

innovations would be neccesary (De Smet, 2016). The challenges surrounding plastics have triggered value chain wide collaborations and partnerships in addressing plastics sustainability (James, 2019; Mrowiec, 2018). As a polymers producer and a key value chain player, this scrutiny also demands the organisation's attentions.

The preceding analysis impresses on four key aspects pertinent to the study. These domains delineate the research problem, and are summarised in Figure 2-5.

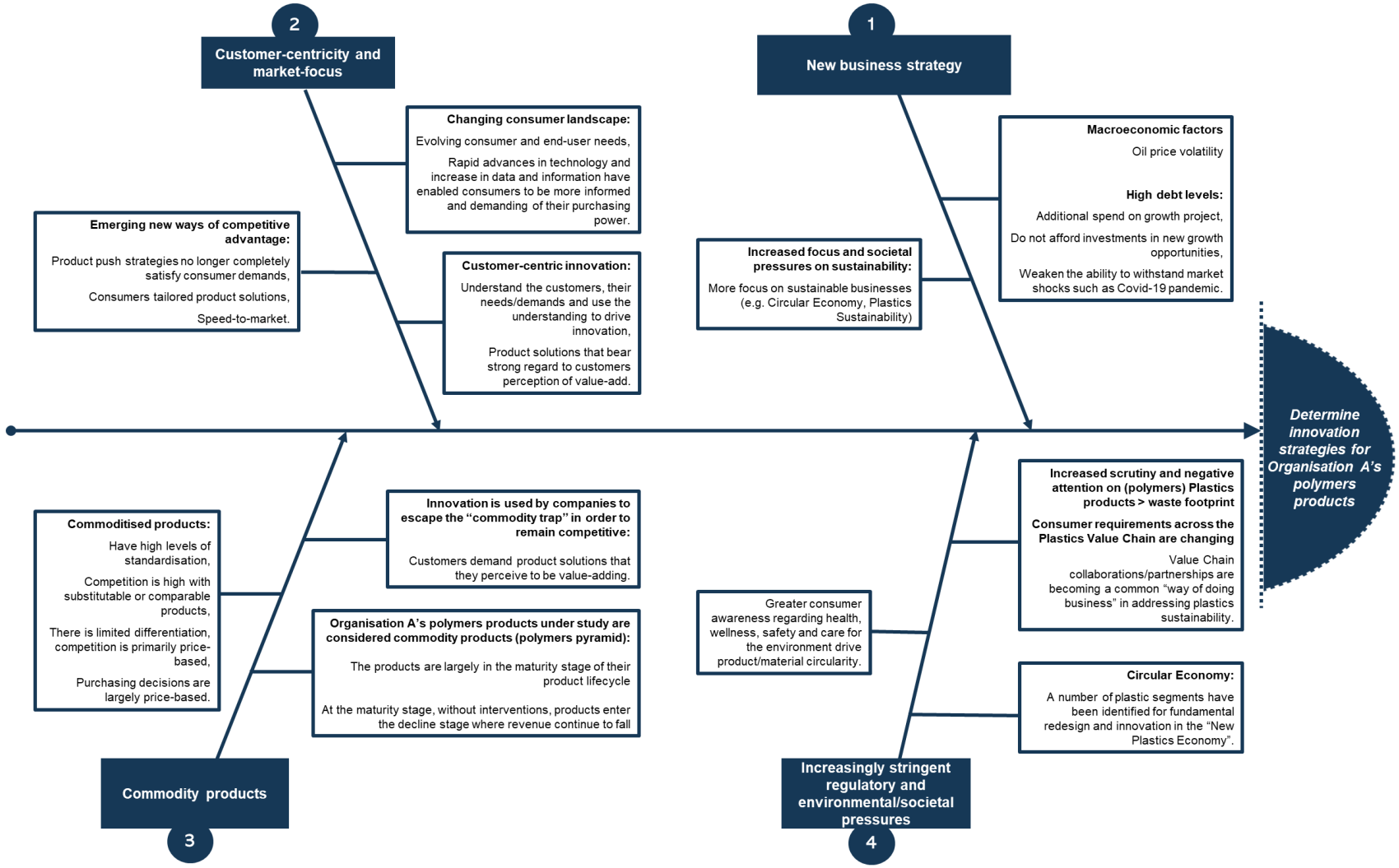


Figure 2-5: Research problem analysis.

2.2 Research knowledge gap analysis

The previous section painted an overview of aspects central to the research under study. The research gap analysis will be pursued against the identifed domains that emerged from the research problem analysis outlined in the preceding section, and also depicted in Figure 2-5.

It was shown from the previous section the exponential growth, both past and future prospects of plastics. Additionally, the future growth prospects were outline to be marred by regulatory and societal pressures due to environmental concerns surrounding the current linear usage of plastics; the "Take, Use and Dispose" model which is in opposition to the more sustainable Circular Economy model; which encourages the "Recycle Make Use" (MacArthur *et al.*, 2016).

At the same time, polymers considered for this study are commodity products where product differentiation is limited as competition is largely based on price advantages. Product innovation will therefore be an important lever agaisnt which the products under study are tested for their continued relevance and reliance for consumers in a sustainable manner.

The following section unpacks the review of available research on studies that have attempted to investigate the above highlighted dimensions of interest, as also outlined earlier in Figure 2-5.

2.2.1 Plastics sustainability in response to increasing stringent regulatory pressures

In responding to improving circular usage of plastics according to the Circular Economy and regulatory demands, several measures have been put in place such as bans on some plastic materials such as single-use plastics in some regions (Giacovelli, 2018; MacArthur *et al.*, 2016).

Other interventions include regulatory targets to increasing the content of recycled materials in products through the use of Post-Consumer Recyclate (PCR) in products, thereby reducing the amount of virgin polymer materials. Redesigning some of the plastics products considered problematic for recycling is another intervention. These

identified plastics products include single-use materials such as small formats (lids, caps, sachets), multi-material multi-layer packaging (*viz.* packaging that has inseparable multiple layers therefore challenging to be recycled), and nutrient-contaminated packaging (such as coffee capsules, takeaway food packaging) (De Smet, 2016; Mrowiec, 2018).

2.2.1.1 Plastics value chain

Figure 2-6 illustrates the plastics value chain with examples of some common value chain players.

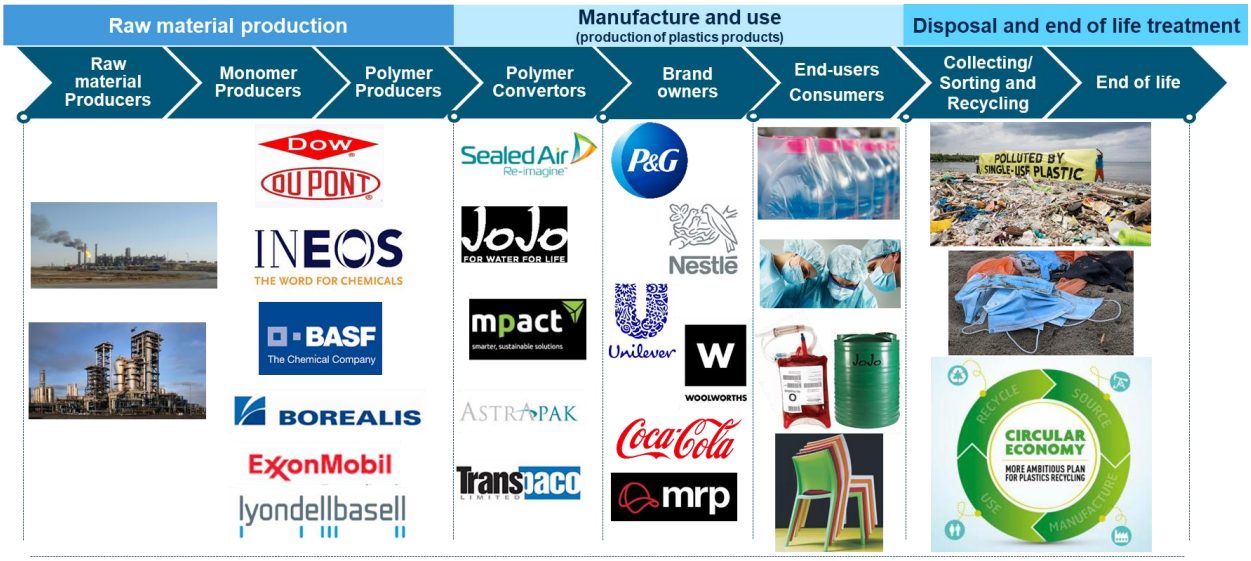


Figure 2-6: Plastics value chain with some examples of the various value chain players.
Source: Adaptation from (James, 2019; Ryberg et al., 2018) and compiled based on information from company websites and open source literature, https://www.greenpeace.org/usa/oceans/preventing-plastic-pollution, https://www.bbc.com/news/uk-politics-54057799.

The challenges faced by plastics products require a collaborative effort across the value chain. There is an evident increase in collaboration and partnership across the plastics value in addressing sustainable plastics solutions.

Figure 2-7 is a depiction of some of the drivers for change in the plastics landscape in an effort towards sustainable product solutions. These include regulatory drivers, various commitments made by some value chain stakeholders, and collaborations across the value chain.



Figure 2-7: Plastics sustainability drivers and responses across the plastics value chain.
Sources: Information compiled and adapted from company websites and open source literature.

As mentioned earlier, there is an increasing collaboration across the value chain in so far as addressing plastics sustainability challenges.

An example from Figure 2-7 highlights LyondellBasell, one of the top global polymers producers, who has formed a Joint Venture between a plastics recycling company Suez and a plastics recycling company Quality Circular Polymers (QCP) in order to boost production of high-quality recycled plastics. Each party brings strong expertise in their respective fields, SUEZ brings its leading-edge technology solutions to improve identification, sorting and preparation of recyclate to be used as feedstock at QCP, while QCP providing recycling technology expertise. LyondellBasell has a strong global presence and long-standing industry leadership in innovative plastics production technology, product development and strong knowledge of end-user markets (LyondellBasell, 2018; Paben, 2018).

Similarly, Borealis, another top global polymers producer has partnered with MTM Plastics, a recycling company with expertise in good quality recyclate feedstock (Borealis, 2016).

2.2.1.2 Product development innovations in addressing plastics products

Packaging materials usually contain multiple layers of different materials to provide different functionalities such as moisture barrier properties to enable fresher-for-longer properties. However, these multi-materials are usually incompatible. Due to this incompitability, these products fall under what is known as "hard-to-recycle" materials, thus adding to the challenges of plastics waste, recyclability and sustainability of such plastic materials.

Replacing the different layers of materials with one material, that can maintain the same desired functionalities could afford environmentally more sustainable packaging solutions that are more suitable for recycling than the current hard-to-recycle multi-material multi-layer products (World Economic Forum, 2017). In responding to this challenge, value chain collaborations are being leveraged as shown above earlier in Figure 2-7.

An examples in point, Dow Chemicals together with Printpack and Tyson Foods have co-developed a mono-material stand-up pouch for frozen food segments applications; which reportedly has improved recyclability suitable (Lingle, 2013).

In similar pursuits, Borealis has also partnered with Bockatech to produce Zero Waste Polypropylene beverage cups that are fully reusable and recyclable (Borealis, 2018).

It is apparent that redesigning alternative product solutions for the identified products requires innovative ways to maintain or improve the original workhorse functionality and versatility of plastics while at the same time maintaining the appealing low costs attribute of the products.

2.2.2 Systematic innovation through collaborative partnerships

There is a common thread running across the above reviews; which shines a light on collaborative partnerships for product solution innovation. The following studies outline Open Innovation and how collaborative partnerships have been pursued by others.

2.2.2.1 Open Innovation model

The concept of Open Innovation was introduced by (H. W. Chesbrough, 2003). The concept has developed variations of definitions over time however all pointing to the use of internal and external sources of knowledge for market growth. In its concise description, the author describes Open Innovation as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively" (H. W. Chesbrough, 2003, 2006). An illustration of the traditional closed innovation versus Open Innovation is illustrated in Figure 2-8.

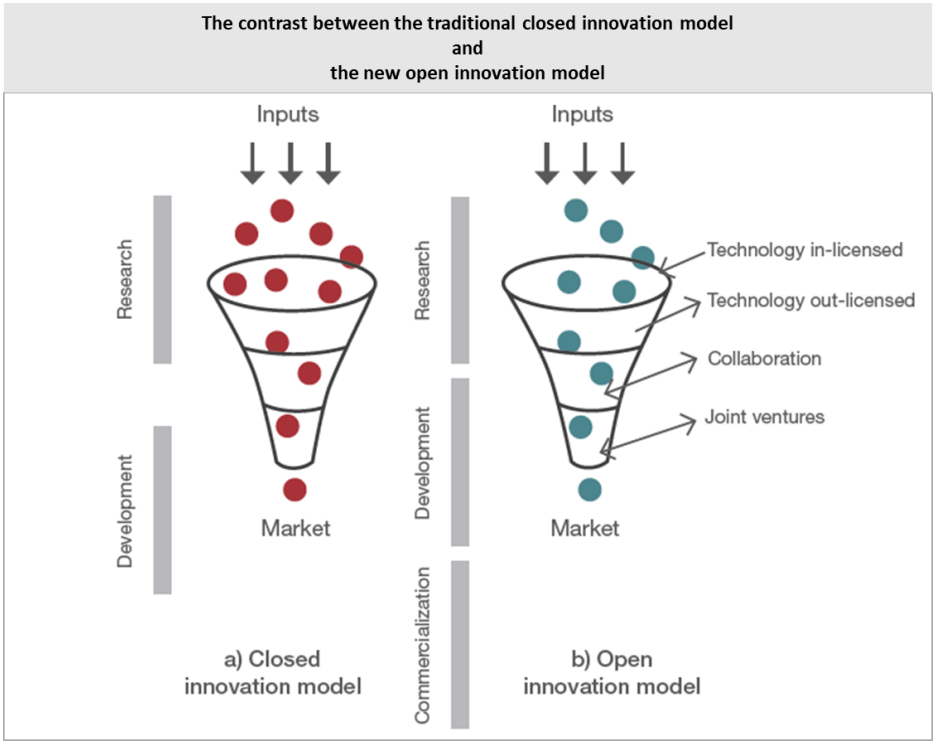


Figure 2-8: Traditional closed innovation and Open Innovation model.
Source: (H. W. Chesbrough, 2003).

According to the founder of the concept, Open Innovation is "the antithesis of the traditional vertical integration model where R&D activities lead to internally developed products that are then distributed by the firm" (H. Chesbrough, 2012; H. W. Chesbrough, 2003, 2006).

The author further argues that the significance of this innovation networking imperative is premised on the basis that "not all the smart people work for us. We need to work with smart people inside and outside our company" (H. W. Chesbrough, 2003).

2.2.2.2 Procter & Gamble collaborative innovation approach

Looking at how others have embraced the principles of Open Innovation, Procter & Gamble (P&G) is arguably the leader and trend setter in applying the concept of Open Innovation (Agafitei & Avasilcai, 2015a, 2015b; Huston & Sakkab, 2006; Ozkan, 2015). P&G is one of the most profitable consumer goods companies globally, with net sales over $70 billion dollars. The company has been in existence for over 180 years,

currently with roughly 99,000 employees, operations in over 70 countries, and products sold in over 180 countries (Procter & Gamble, 2020).

Since the adoption of Open Innovation over a decade ago, P&G has inspired and revolutionised product innovation by applying the principles of bringing external innovation internally (Huston & Sakkab, 2006; Lafley & Charan, 2008).

Incremental innovations as reported, were not achieving P&G's growth plans, thus contributing towards widening the growth gap that was explained by Pisano, 2015 in Section 2.1.1. The company reported that its R&D productivity had levelled off, as well as its innovation success rate; which is the percentage of new products that met financial objectives, only about 15% of innovations where meeting their revenue and profit targets (Brown & Anthony, 2011).

By firstly understanding the type of innovation that was needed to achieve the organisation's growth ambitions; which was identified as breakthrough innovations at that time, P&G was able to refocus from traditional Research & Develop (R&D) to what the company referred to as Connect & Develop (C&D). Through C&D, P&G had set themselves a target of acquiring about 50% of innovations from outside the organisation and the balance internally (Huston & Sakkab, 2006).

Through this reorganisation of the innovation system, P&G was able to systematise innovation by leveraging external collaborations and partnerships. As a result of the new collaborative innovation approach, the company has been able to triple its innovation success rate (Brown & Anthony, 2011), reduced R&D spending while at the same time increased revenues (Lafley & Charan, 2008).

2.2.2.3 Other organisations following suit

Many more organisations have followed suit on using collaborative partnership models for innovation (Balaneji, Turkyilmaz, Temizer, & Bulak, 2013). Amongst other collaborative innovation initiatives is Hewlett Packard (HP) 3D Printing materials innovation through HP's Open Platform, where the company aims to reach as many material developers for product development of HP's 3D Printing printers (Banerjee, Friedrich, & Morell, 2010; Trucco, Morell, & Friedrich, 2010).

Nestle has also recently announced its R&D Accelerator where external collaborators will be leveraged in order to increase Nestle's product speed-to-market (Nestle, 2019).

The increase in innovation ecosystems have also aided in increasing collaborative partnerships. Boston Consulting Group's annual innovation survey demonstrates this increase in innovation ecosystem Figure 2-9 (Ringel *et al.*, 2019).

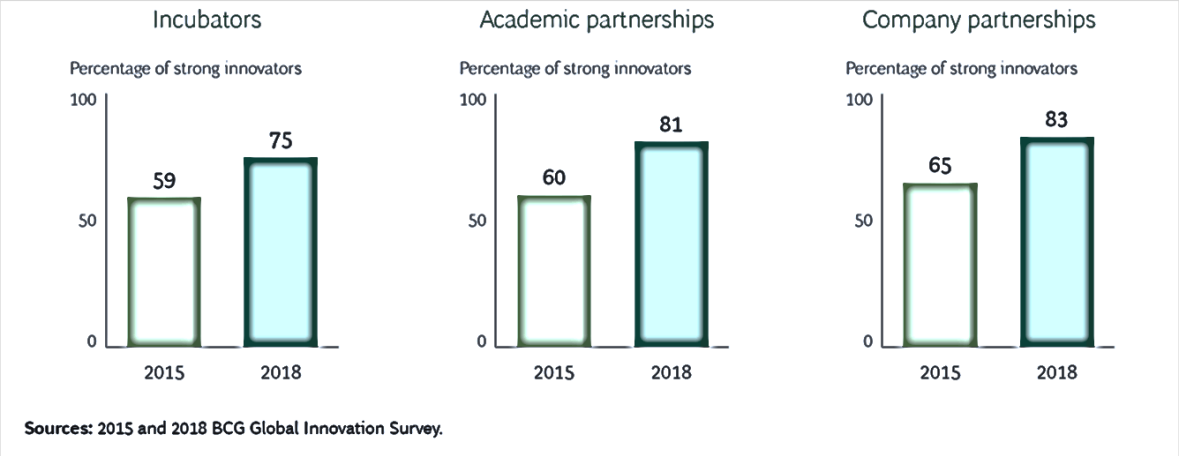


Figure 2-9: Innovators increasingly embracing external sources for idea through innovation ecosystems. Source: (Ringel et al., 2019).

2.2.2.4 Open Innovation approaches in the chemicals industry

In a study by Ibrahimov (2018), innovation approaches in the petroleum industry were investigated. The author recommended that for petroleum industries; which are usually dominated by large-scale firms, mostly selling commodity products where product developments are difficult; these companies according to the author should identify a strategic driver that would allow them to gain competitive advantage.

In addition, the author further posits that petroleum companies should explore leveraging other peer players in the market to find technological innovations, in order to accelerate and improve their quest for finding strategic drivers. Through this exploration, the author then promotes Open Innovation models within a supportive innovation ecosystem.

Ibrahimov (2018) study focussed largely on technological innovations. An exploratory opportunity exists to test Open Innovation for the selected products specific to this study from the produt innovation angle.

The chemicals and petrochemicals industries also have some trendsetters following Open Innovation approaches. Examples include:

Royal Dutch Shell: Shell's systematised way of innovation through Shell's GameChanger programme and TechWorks Open Innovation platforms are examples in point. Shell GameChanger is an accelerator programme that allows innovators to submit online their unproven ideas to solve problems in the energy sector to bring the gap between laboratory bench scale science to commercially viable solutions for the energy industry (Shell, 2020a; Verloop, 2006).

For technological innovations, Shell TechWorks Project leverages technologies of other industry players such as Technology Entrepreneurs and Start-Ups for cross-disciplinary cooperation in order to accelerate Shell's own transformation of technologies and solutions (Shell, 2020b).

Dow Chemicals: Is a leading science and technology company that produces chemicals, plastics and agricultural products. Dow Chemicals is recognised as one of the most innovative companies in the Chemicals industry. Dow leverages innovation advancements through several innovation channels such as the Customer Innovation Centre (facilitates interaction with external partners), Packaging Studio (for testing and co-developing packaging solutions with external partners), Strategic University Network (for joint research project developments on new technologies and latest scientific developments).

The organisation also have "Innovation Playbook"; which is the organisation's internal tool used to manage internal and external innovation projects across different business units and geographies (Mohan Chandran & Gupta, 2004).

BASF: Is one of the leading chemicals companies and recognised also as one of the innovative companies. The organisation states that venture capital activities are an

important elements of BASF's innovation strategy. To strengthen and complement their R&D activities, the organisation coorporates with external partners such as young companies and jointly develop various types of innovation such as disruptive business models (BASF, 2020).

2.2.3 Product innovation within the constraints of commoditisation

It is noteworthy to recollect that the polymers products under investigation are commodity products, as outlined in the previous section and shown in Figure 2-2. Commoditization is a phenomenon found in all industries, including Chemicals industry.

A review by McKinsey Consulting outlines that fewer niche applications remain within plastics as commoditisation increases, and product frontier continues to shift towards specialty and premium materials (Böringer & Simons, 2017), as illustrated in Figure 2-10.

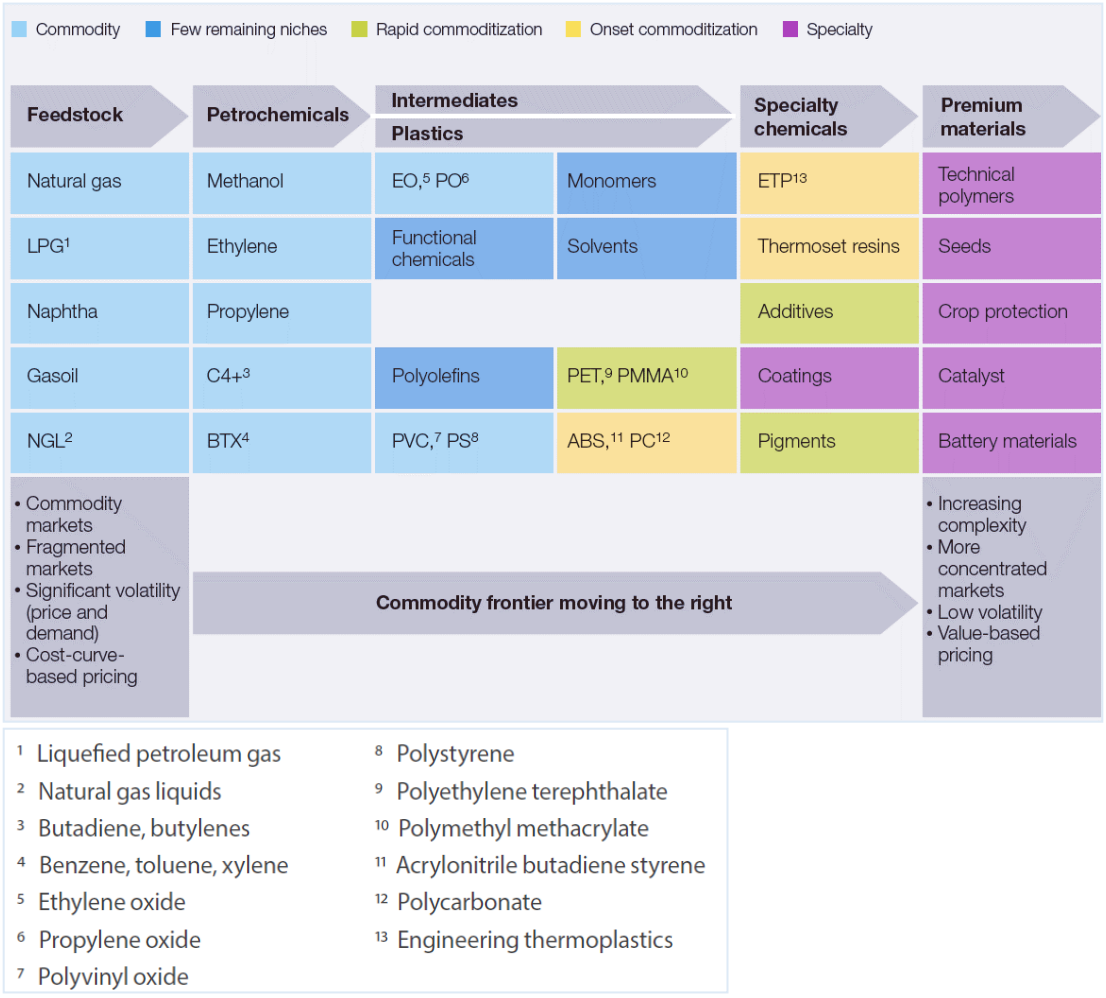


Figure 2-10: Commoditisation in the chemicals industry.
Source: (Böringer & Simons, 2017)

2.2.3.1 Business model innovation for commodity products

Generally, commodity product customers are known to not require as much technical support as specialty products. However, these customers have a greater preference for a reliable supply of product at low cost (Glaschke, Moder, & Schmitz, 2017).

Dow Corning is the pioneer in developing silicones since 1943 and had a market share of 35% around the 2000s (Lin & Senger, 2003). Around this period, the silicone market was rapidly maturing and becoming commoditised. Dow Corning evaluated ways to continue serving their silicone customers while maintaining their competitive advantage.

One of the key levers in escaping the commodity trap is innovation. However, new product development and innovation in the commodity industry is challenging. Innovation in this regard follows the route of least cost investments, a lean approach to operations, optimisation and standardisation of product formulations, and process improvements to maximise throughput; all these in an effort to balance overall low cost-to-serve targets (Glaschke *et al.*, 2017; Ibrahimov, 2018; Roland Berger Consulting, 2014).

Assessing the needs of this customer segment, Dow Corning realised that their silicone customers fell into above-mentioned category *viz.* less technical support and reliable product supply at low cost. Xiameter was thus founded, Dow Corning's "online-managed, low-cost, no-frills sales channel for its commodity silicones, offering competitive pricing to customers willing to buy in bulk, without research or technical support" (Burns & Zank, 2011).

Through this innovative model, Dow Corning was able to decrease the cost structure for silicone distribution since Xiameter required few staff to handle the business. Changes to orders and technical support are charged at additional costs (Burns & Zank, 2011; Lin & Senger, 2003).

2.2.3.2 Product innovation in other commodity industries

From a different industry, the computer software industry, Fabijan, Olsson, and Bosch (2016) conducted a study to identify factors that suppress innovation, when developing innovative software products based on three large-size software companies.

The study ascertained that what the evaluated organisations considered commodity, differentiated and innovative differed greatly from their customers perspectives. Contrary to what the companies considered innovative, the customers deemed commodity. As a result, allocation of R&D efforts had been mismatched and true innovation opportunities that could have been value creating were missed.

In the study, Fabijan *et al.* (2016) further revealed that the evaluated companies found it difficult to identify and understand the needs of their stakeholders. Without this intimate customer understanding, lack of product innovation strategy and pressures of keeping up with competition, the companies reportedly rather copied their competitors; as such basing themselves against the competition instead of their defined growth ambitions and strategies.

The findings from this study solidify the significance of value creating customer centric innovations. The findings further impress upon the importance of intimate customer understanding in product innovation. Additionally, it is evident that customer centric innovation cuts across different industries.

2.2.4 Customer-centric product innovation

A study by Tsimiklis *et al.* (2015) corroborates the importance of customer-centricity and placing the customer at the core of the value chain in product development. The research focused on the food and packaging industry; another mature, slow-growing and highly regulated industry; and typically quite conservative with regards to investments in new technologies (Monsef & Ismail, 2012).

New innovative food products designs were explored in the study. The designs had to afford consumers an integrated sensory experience of food and packaging, which encompass customisation, healthy eating and sustainability. At the same time, the

products had to reach the consumer in time, therefore speed-to-market as well as adequate product availability were integral considerations.

The success of the project was stated as embracing Open Innovation model and customer engagement being an integral part of product development. This, according to the researchers enabled new market reach.

Selden and MacMillan (2006) similarly impart that customer centric innovation has the potential to close the growth gap. The authors explained the growth gap as the difference between business growth plans and market expectations. The key step in closing the growth gap is cited as understanding what customer wants and using this information to drive innovation, instead of injecting substantial research funds in insular R&D labs.

The researchers developed a Customer Centric Innovation (CCI) model; which is supported by customer R&D strategy. The customer R&D strategy emphasise three key benefits according to the authors.

The first benefit is that the more a company is customer-centric, the longer it takes for competitors to figure out the competitive edge. Customer-centric innovation in turn enables companies avoid the trap of competing on price. Secondly, customer R&D improves employee engagement and loyalty.

And lastly, learning about what customer needs and addressing those needs effectively translates to sustainably closing the growth gap and increasing the market capitalisation.

Placing customers at the core of the value chain has been shown to create real value. Chemical companies are now waking up to working with customers as part of the product development and innovation ecosystem to co-develop sustainable solutions. Chemical companies that recorded profit margins growth and revenue growth in recent years are reportedly those that prioritised collaboration with customers to redesign products and enhance the speed of products and services as well as improving reliability and availability of products (Bascle *et al.*, 2012; Ringel *et al.*, 2015).

2.2.5 Concluding remarks

The foregoing review and analysis impress on two key common themes, emerging overwhelmingly apparent. These are customer centricity and collaborative innovation. Furthermore, these themes appear to cut across various consumer landscapes and industries, as such should not be taken lightly by organisations.

It is also evident from the review that the traditional linear R&D is becoming obsolete in addressing challenges expressed. One of the critical success factors in product innovation, as revealed in the preceding review, is co-developing products in collaboration with customers and other value chain stakeholders. Therefore, assessing appropriate collaborative product innovation models under the ambit of Open Innovation principles would therefore be significant to this study.

Also, crucially evident is the importance of understanding the type of innovation to be pursued *e.g.* breakthrough innovation, disruptive innovation, incremental or sustaining innovation *etc.*, then aligning the collaborative partnerships accordingly along the organisation's innovation ecosystem.

These aspects form the basis of the knowledge gap that this study will attempt to address towards determining the fitting product innovation strategies that can support *Organisation A*'s new business strategy.

2.3 Qualitative attributes or quantitative variables key to the research

The following discussions outline attributes and variables considered key to the research.

2.3.1 Innovation strategies

Many researchers have developed a vast body of knowledge in order to better improve the understanding of innovation. These included discoveries into the types of innovation as reported by Pisano (2015) and Schilling (2017), innovation frameworks by Sawhney, Wolcott, and Arroniz (2006) as well as Shenhar and Dvir (2007),

measurement metrics such as return on innovation reported by Aydinoglu (2007) and Jung and Waiboer (2007).

Other researchers provided insights into the distinguishing dimensions innovation leadership and traits to be recognised as a Top Innovator as stated by (Barry Jaruzelski, Chwalik, & Dehoff, 2018). The authors state the key characteristics exhibited by Top Innovators as the following:

- They have an innovation strategy
- Their innovation strategy is closely aligned with the business strategy
- They create an organisation-wide cultural support for innovation, with top senior management highly involved with innovation programs
- They practise customer-centric innovation *viz.* innovation is based on direct insights from customers and end-users

Furthermore, Barry Jaruzelski and Dehoff (2010), and Barry Jaruzelski *et al.* (2018) cite some of the innovation strategies that these Top Innovators pursue may include the below:

- Need Seeker: Engage current and potential customers to better capture their needs. Speed to market and first mover in the market are important attributes of this strategy. Products and services are generally co-developed with customers.
- Market Reader: Closely monitor competitor and customer landscape in order to become a fast follower of proven concepts.
- Technology Drivers: Align with the company's technological know-how and capabilities in order to drive new breakthrough or incremental technological changes.

Other variations of innovation strategies include Boston Consulting Group (BCG) innovation models outlined in Figure 2-11.



Figure 2-11: Boston Consulting Group Six Innovation models.
Source: (Manly, Grassl, & Wilson, 2017).

Evident from the foregoing outlines is that innovation has a myriad of dimensions and complexities ranging from the types of innovation to be pursued, frameworks to determine appropriate types of innovation, metrics used to manage and measure innovation ambitions, and more.

2.3.2 Components of innovation process

The process of innovation is not linear nor one dimensional, it is complex with multiple dynamics. It pertains to the mechanism of transforming inputs into outputs, the innovation framework Inputs-Process/Throughput-Outputs model is outlined in Figure 2-12.

Inputs are the resources used to create outputs through a selected transformation process. These can be tangible (*e.g.* people, capital investment, R&D expenditure) or intangible (knowledge, expertise).

The end results of an innovation system are the outputs. Outputs are the returns on the investments made. These can be publications and publication-related outcomes, patents, brand equity, new products. It is essential that innovation should not particularly be about creating new products only but about the creation of new value.

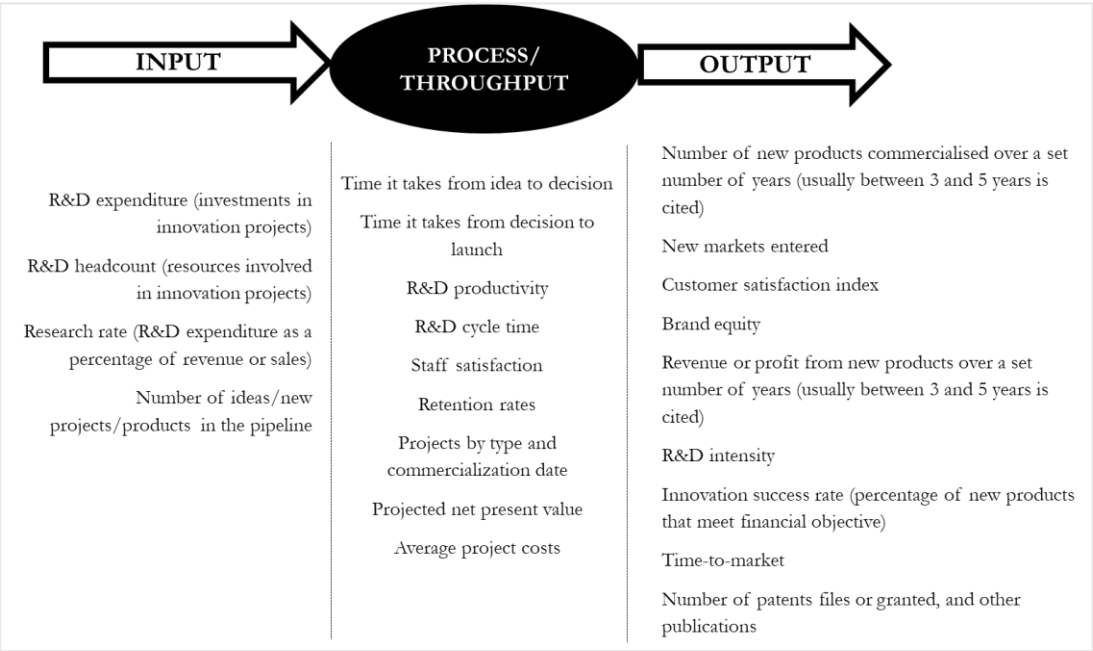


Figure 2-12: The process of innovation with some common metrics.
Source: (J. Andrew, Haanaes, & Michael, 2007; J. P. Andrew, Haanæs, Michael, Sirkin, & Taylor, 2009; Davila, Epstein, & Shelton, 2012; Fortuin, 2006; Barry Jaruzelski et al., 2018; Jung & Waiboer, 2007; Ringel et al., 2019; Santagate, 2016; ter Haar, 2018).

2.3.3 Measuring innovation

Although innovation remains a top priority for many companies, few companies measure their innovation efforts as closely as they measure other aspects of their businesses. While some companies barely attempt to measure innovation at all, others

do not have well defined innovation management targets, objectives and measurements (Jung & Waiboer, 2007; Santagate, 2016). Innovation metrics allows for organisations to assess if they are conducting enough innovation activities, and importantly if the right activities are being pursued. Therefore, key components of innovation should be identifed for an organisation and measured.

The common innovation metrics that are usually reported are reflected in Figure 2-12 above. These metrics also find use in the Chemicals industry as reported by (Jung & Waiboer, 2007). In relation to measuring innovation and profitability, Santagate (2016) argues that it is an imperative for organisations in the chemicals industry to have 40% of their revenue come from products developed in the past three years.

R&D spend is another widely debated measure of innovation. Barry Jaruzelski and Dehoff (2010) and Barry Jaruzelski *et al.* (2018) contend that innovation is not principally a reflection of R&D spend. This insight is further depicted in Figure 2-13, as outlined in the annual "Global Innovation 1000" survey; which analyses 1000 publicly held companies. Over a ten year period between 2007 and 2017, it was established that the most innovative companies outperformed the Top 10 biggest R&D spenders on a range of financial metrics such as revenue, gross margin and market cap growth (Barry Jaruzelski *et al.*, 2018).

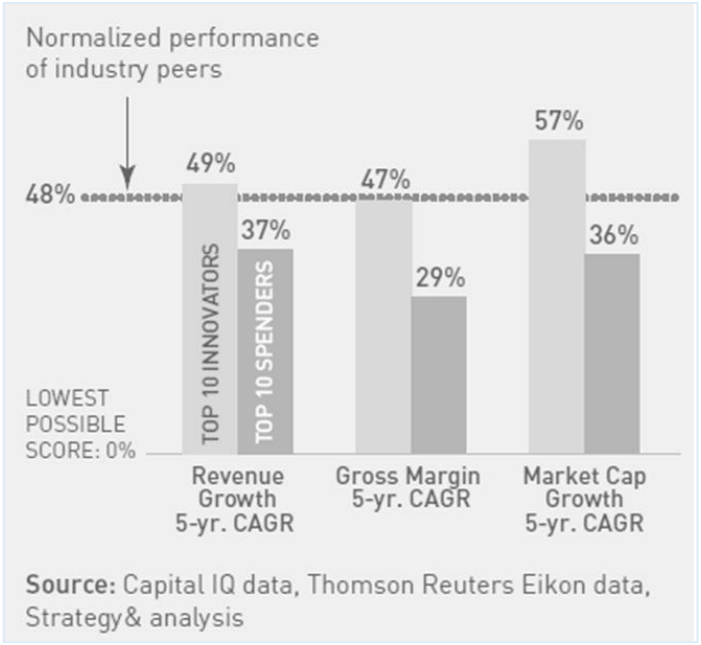


Figure 2-13: Research & Development spending versus innovating.
Source: (Barry Jaruzelski et al., 2018).

Another innovation metric that has emerged as an important source of competitive advantage in recent times is speed-to-market or time-to-market. An example in point is exhibited by P&G, shown is shown in Figure 2-14.

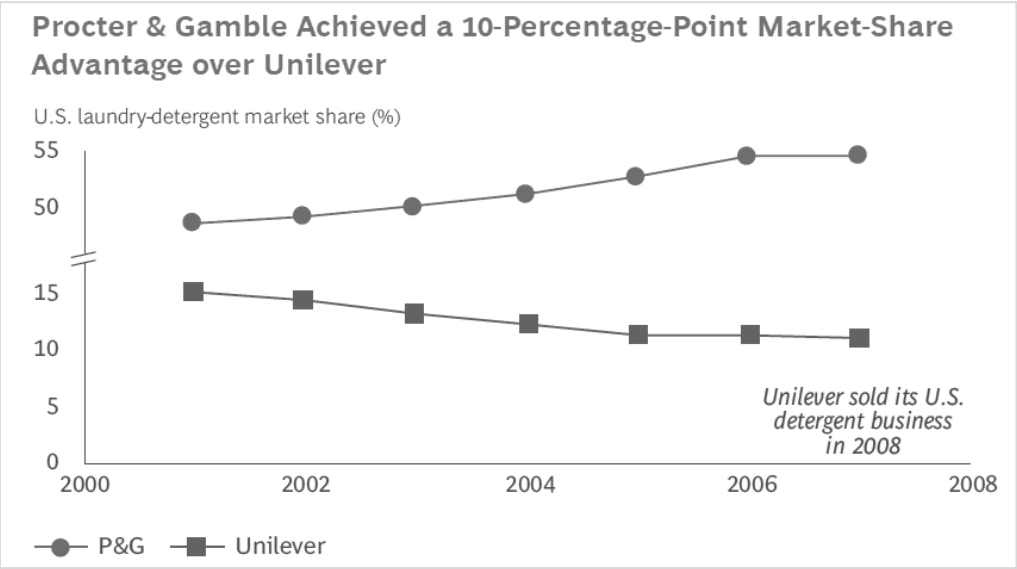


Figure 2-14: Procter & Gamble speed-to-market as competitive advantage.
Source: (Bascle et al., 2012).

The above figure illustrates how P&G's US detergents business was able to substantially increase its market share advantage when compared to their competitor Unilever. This was reportedly due to P&G's ability to half their product time-to-market from 36 months to 18 months. In the process, Unilever reportedly had to exit its detergent business in 2008. Unilever however learned from this experience and also later introduced "Speed is the Currency" campaign, and has since similarly improved its speed-to-market (Bascle *et al.*, 2012).

Innovation is inherently an iterative process, what gets celebrated as an output is usually a product of countless failed innovation attempts and dead ends. These failed attempts are generally not considered or measured as important innovation metrices. Emerging studies within the realm of innovation are now encompassing the notions such as "celebrating failures" and "failing fast" in order to encourage learning from previous mistakes and experiences (Kvalnes, 2017).

2.4 Framework(s) for interpreting research findings

The process of innovation, particularly at a company level has evolved over the years. Rothwell (1994) seminal work on the evolution of innovation provides a useful overview of the conceptualisation of innovation. The author outlines evolutionary innovation over five generations leading up to the 1990s – 2000s. Based on this work and the innovation demands of the 2000s and beyond, the sixth and latest generation innovation model has been defined by researchers such as, amongst others, Barbieri and Álvares (2016), Du Preez and Louw (2008), as well as Kotsemir and Meissner (2013); which is the Open Innovation model. Open Innovation, discussed earlier in Section 2.2.2.4 and Figure 2-8, was pioneered by H. W. Chesbrough (2003) in the early 2000s, with its basis on collaborations that complement internal knowledge with leveraging external sources.

Table 2-1 is an overview of the evolution of innovation models, compiled based on information from several sources (Aydinoglu, 2007; Barbieri & Álvares, 2016; Du Preez & Louw, 2008; Kotsemir & Meissner, 2013; Milbergs & Vonortas, 2004; Rothwell, 1994). Characteristic innovation metrics with the associated generations of innovation, as developed by Milbergs and Vonortas (2004) are also shown.

Table 2-1: Evolution of innovation
Source: Adapted based on information from sources (Aydinoglu, 2007; Barbieri & Álvares, 2016; Du Preez & Louw, 2008; Kotsemir & Meissner, 2013; Milbergs & Vonortas, 2004; Rothwell, 1994)

Innovation Generation	Model	Characteristics	Characteristic innovation metrics for the innovation generations
1st Generation (1950s – 1960s)	Technology Push	• Simple linear sequential process, emphasis on R&D and science. • Insular R&D activities, isolated from company and market. • Market receives the output/results of the R&D.	**Focus being on Input indicators:** • Technology intensity • R&D expenditures • Science and Technology personnel
2nd Generation (1960s – 1970s)	Market Pull	• Emphasis on Marketing, the market is the source of new ideas for R&D. • Stronger connection between R&D and operating units. • Systematic allocation and management of resources.	**Focus being on Output indicators:** • Patents • Publications • Quality change
3rd Generation (1970s – 1980s)	Coupling Model	• Emphasis on integrating R&D and marketing as an outcome of recognizing interaction between different elements and feedback loops.	**Focus being on Innovation indicators:** • Benchmarking innovation capacity • Innovation surveys • Indexing
4th Generation (1980s – 1990s)	Interactive Model	• Was developed to improve on the lack of functional integration in the linear models - Also referred to as the Integrative Model due to integrating within the firm. • Combination of push and pull model. • Emphasis on external networks, and close coupling with leading customers.	**Focus being on Process indicators (4th generation plus emerging focus):** • Knowledge • Intangibles • Networks • Demand • Clusters • Management techniques • Risk/return • System dynamics
5th Generation (1990s – 2000s)	Network Model	• Developed to respond to the influence of external environment with internal resources. • Emphasis on developing cross-functional and parallel integration within the organization to accumulate and increase internal knowledge. • Parallel and integrated nature of innovation development processes.	
6th Generation (2000s – present)	Open Innovation	• These are also network innovation models however instead of primarily focusing on internal idea generation and expertise, strategic partnerships are developed in order to advance the development of new innovations. • Advantage of having a much wider base of ideas and technologies to draw from to drive internal growth - Collaborative research and marketing initiatives. • A strategic tool to explore new growth opportunities at a lower risk. • Emphasis on speed of development and flexibility.	

According to Rothwell (1994), the evolving innovation models do not imply that one model gets substituted by the next. Most models work side by side each other, and they commonly share elements amongst each other.

2.4.1 Innovation frameworks

Together with the innovation models discussed above, numerous innovation frameworks have been developed and applied to address varying facets of innovation strategies, processes and overall management of innovation.

This section introduces some of the innovation frameworks considered relevant for the study. Using detailed findings provided by researchers and authors such as Aydinoglu (2007); Keeley, Walters, Pikkel, and Quinn (2013); Pisano (2015); Satell (2017); Sawhney

et al. (2006); Shenhar and Dvir (2007), the usefulness of the frameworks will be discussed. The strands of the frameworks that may be relevant to this study are also highlighted.

The selected frameworks outlined in Table 2-2 as well, were identified for their fit-for-purpose against the research analysis presented earlier in Figure 2-5. These selected innovation frameworks therefore emphasise or cover to a large degree, aspects referenced in the research analysis such as innovation strategies, customer focused innovation, considerations for commodity products in their mature product lifecycle, and innovations that considers environmental and/or regulatory pressures. Innovation frameworks selected for the literature review are illustrated and elaborated in Figure 2-15 to Figure 2-19.

Table 2-2: Selected innovation frameworks and their relevance to the study.

Innovation Framework	Relevance to study (Aspects of the *research analysis emphasized by the frameworks)				Comments/ aspects of interest
	Innovation strategy	Customer centric Innovation	Innovation within the constraints of commodity products	#Innovation within the constraints of environmental/ regulatory pressures	
The Ten Types of Innovation®		X	X		• Organization wide assessment of innovation abilities - provide a way to identify new adjacent opportunities beyond the product, that can unlock new ways of creating new value and competitive advantage. • New product development is but one aspect of innovation, value creating breakthrough innovations can occur beyond the product. • Innovations are no longer only confined to laboratories.
The Innovation Radar		X	X		• Emphasis on a broader view of innovation, 360-degree view of innovation (instead of a narrow dimensional focus of new product development, process innovation or traditional R&D). • Focus on anchoring innovation on customer outcomes viz. customer value creation.
The Diamond of Innovation		X	X	X	• Emphasis on customer satisfaction within project management. • Fulfilling customer needs is as equally an important aspect of a project as meeting deadlines and budget.
The Innovation Landscape Map	X	X	X		• Emphasis on having a well articulated and communicated innovation strategy, that is aligned with the organisation business strategy. • The framework considers how a potential innovation type fits with the organization's existing business model and technical capabilities. • Also guides on innovation types for maturing businesses can be explored.
The Innovation Matrix	X	X	X		• Emphasis on having a portfolio of innovation strategies designed to specific tasks, instead of having one locked-in innovation strategy. • Focus on problem solving viz. innovation is about solving problems, as such there are as many types of innovation as there are types of problems to solve.

*Research analysis as developed and presented in Figure 2-5

#Most frameworks do not specifically stipulate innovations under environmental or regulatory demands. The Diamond of Innovation is indicated for these types of innovations essentially due to the fact that there is provision for time critical based projects; which include business crises projects – environmental and regulatory demands have potential to pose disruptions to business operations that may reckon business crisis.

2.4.1.1 The Ten Types of Innovation®

Innovation has largely been equated with the development of products such as new products, new features, new versions of products. For this reason, organisations often consider R&D and laboratory type initiatives as the main and only innovation strands. New product development is but one aspect of innovation and more so, with the realisation that value creating breakthrough innovations can occur beyond the product. As Keeley *et al.* (2013) posit, innovations are therefore no longer only confined to laboratories.

The Ten Types of Innovation® framework was pioneered by the Doblin consulting firm (now part of Deloitte), under the leadership of Larry Keeley, to provide a way to identify the mentioned new adjacent opportunities beyond the product, that can unlock new ways of creating new value and competitive advantage (Keeley *et al.*, 2013). The key question the model aims to address is "How to help innovation to succeed instead of fail". As such, the framework can be used both as a diagnostic tool as well as an improvement model for organisations.

Figure 2-15 illustrates the components and elements of the Ten Types of Innovation® framework. The framework is structured around three focus areas and their sub-elements, colour coded categories as illustrated in the figure.

The centre of the model outlines the "Offering" or the core products, features, services and complementary offerings. To the left of the model is how the organisation is positioned to make profit or the "Configuration" dimension. Moving across to the right lies the "Experience" that the end-users receive.

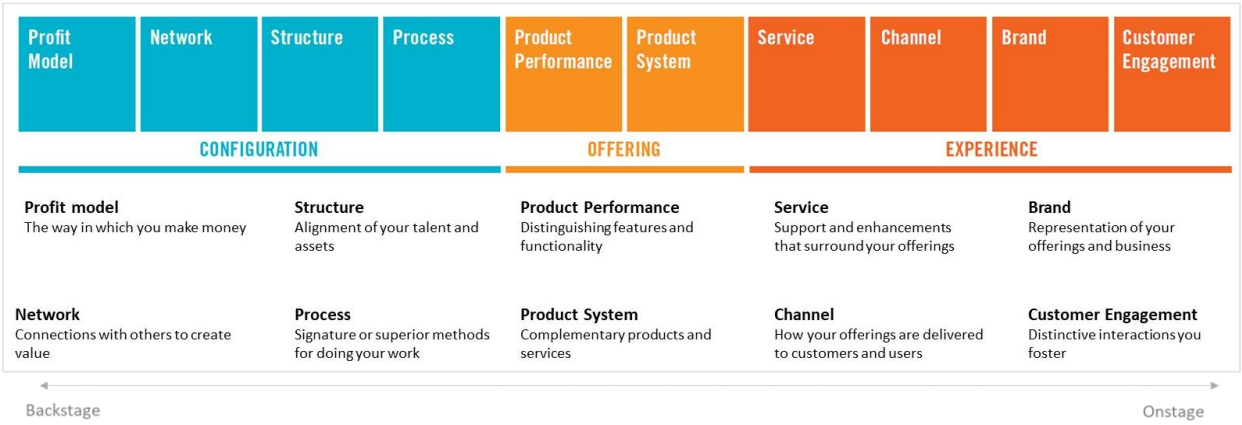


Figure 2-15: The Ten Types of Innovation.

Source: (Keeley et al., 2013).

The model can be interpreted from the left, where the categories are internally focussed and moving towards the right of the model, the dimensions become more end-user and customer focussed. As the authors cite, the left of the model can be viewed as the backstage while the right is onstage.

2.4.1.2 The Innovation Radar

With quite close similarities to the Ten Types of Innovation® framework, the Innovation Radar also punts the need for organisations to consider all aspects and dimensions of the business system when innovating. The key tenets of the "Innovation Radar" are encored on the basis that innovation is relevant only if it creates value for customers, and therefore the firm. It is then natural to ask, "how many possible dimensions of business innovation are there" and "how are they related"?

The researchers Sawhney *et al.* (2006) established the Innovation Radar, as an innovation framework that provides a 360-degree view of the organisation's innovation dimensions, efforts and opportunities. The framework presents and relates all the dimensions through which a firm can explore innovation opportunities.

According to the framework, there are four key dimensions that serve as business anchors. These are:

1) Offering - what offerings are the company providing
2) Customers - who are the customers served
3) Processes - how are the offerings provided
4) Presence - where does the organisation take its offerings to (points of presence used to take offerings to market).

Furthermore, there are eight other dimensions of the business system embedded between the four dimensions, that can serve as avenues of pursuit. Overall, there are a total of 12 key dimensions that constitute the Innovation Radar, as illustrated on Figure 2-16.

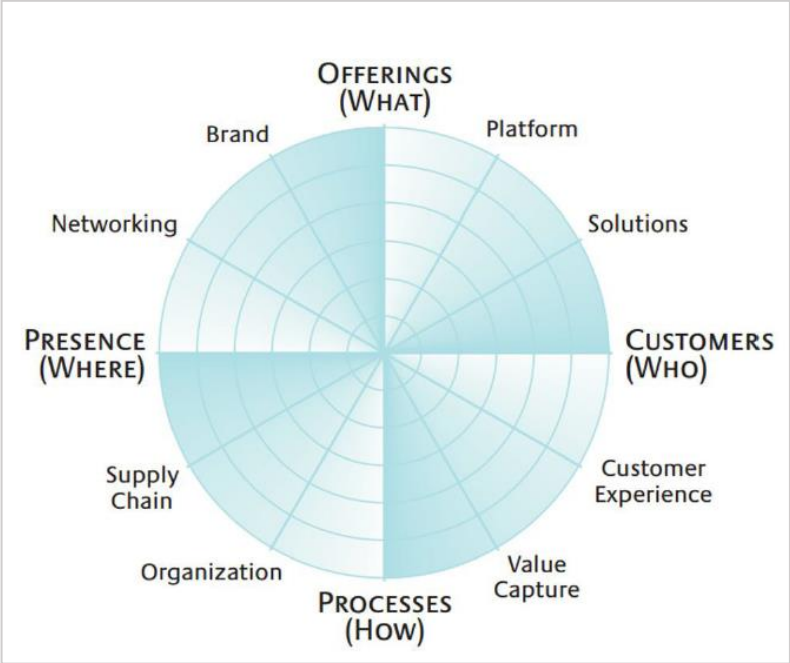


Figure 2-16: The Innovation Radar.
Source: (Sawhney et al., 2006).

The authors argue that the Innovation Radar assist organisations identify neglected innovation dimensions; which can be used as a basis of competitive advantage. The authors further highlight that this approach resolves the inertia of "this is what we've always innovated on" or "this is how everyone innovates" (Sawhney *et al.*, 2006).

The above discussed innovation frameworks are quite comprehensive in the innovation dimensions, at times considered for their perceived completeness in defining the types of innovation efforts and assessing adjacencies available for innovation opportunities. However, there is an exploration opportunity to address the actual details about how to go about managing the innovation efforts.

The Ten Types of Innovation® framework whose basis is addressing the question "How to help innovation to succeed instead of fail", it therefore appears that a complementary framework would be required as a guiding tool to address the innovation management aspects once the innovations efforts have been established. It is however also acknowledged that such management models would be dictated by the specificities and nuances of different industries and organisations specificities.

2.4.1.3 The Diamond of Innovation

With the notion that innovation is the commercialisation of an idea, the founders of the Diamond of Innovation Shenhar and Dvir (2007) postulate that there cannot be innovation without projects. Moreover, the authors posit that business success depends on projects and as such the success of the projects. Therefore, according to the authors innovation and project management go hand in hand.

Despite project management being a robust discipline with many competent professional practitioners, many projects still fail. This, according to the authors observations, is due to conventional project management principles that lack adaptability to the dynamic business environment. Furthermore, there is an observed misalignment of customers' needs and requirements in the conventional project planning and overall project management. This is evidenced by managers delivering projects on time and on budget, however many projects still not meeting customer needs (Shenhar & Dvir, 2007).

The Diamond of Innovation framework aims to map the project's novelty, technology, complexity and pace, while at the same time identifying and managing risk. Using the four dimensions encompassed by the framework, as shown in Figure 2-17; the framework can analyse and diagnose the gaps between current capabilities and the desired state to making a project a success.

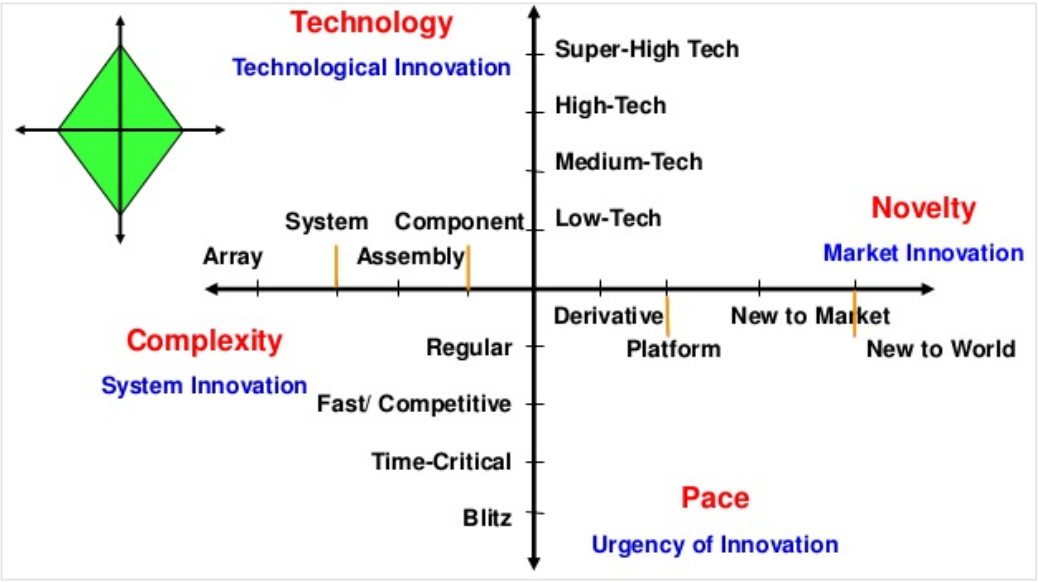


Figure 2-17: The Diamond of Innovation.
Source: (Shenhar & Dvir, 2007).

The four dimensions can be summarised as follows (Shenhar & Dvir, 2007):

1) "Novelty: How intensely new are crucial aspects of the project?

Novelty represents the level of market uncertainty and it impacts the effort and time it takes to clearly define the product's requirements. Novelty is divided into the following types: Derivative, Platform, New-to-the-Market, Newto-the-World.

2) Technology: Where does the project exist on the scale from low-technology to superhigh-technology.

Technology represents the level of technological uncertainty, the number of design cycles that may be required, the time it may take before design freeze. Technology can be sub-categorised into: Low-technology, Medium-technology, High-technology, Super High-technology.

3) Complexity: How complicated are the products, the process and the project.

Complexity depends on the size and complexity of the product and the resources required to complete it. Complexity impacts the degree of coordination and formality needed to effectively manage the project. Complexity also addresses the risk of the project since product failure rises proportionally with the technical complexity of the project. Complexity has the following levels: Material or Component, Assembly or Subsystem, System, Array or System of Systems.

4) Pace: Addresses the urgency to complete the project.

It impacts the time management and autonomy of the project management team. The subcategories under "Pace" are: regular, fast, time-critical or blitz. These include projects that may require to be initiated due to natural disasters, war, and other business critical initiatives. Environmental and regulatory demands can at time be considered business critical as these can hold license to operate for organisations".

2.4.1.4 The Innovation Landscape Map

The Innovation Landscape Map shown in Figure 2-18 is an innovation mapping tool developed by Pisano (2015) that aims to guide organisations on the type of innovation that would create and capture value. Pisano argues that this model can assist organisations decide how innovations fit with the company's existing technical capabilities and business model.

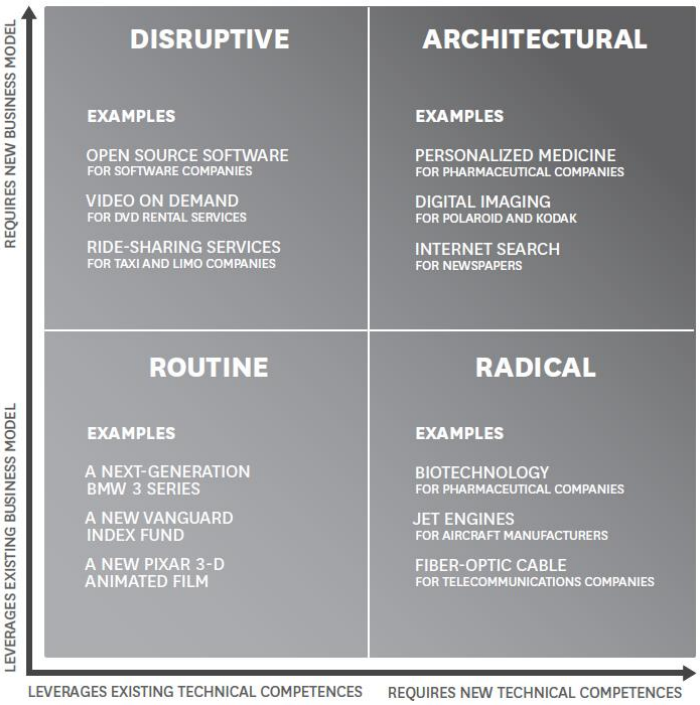


Figure 2-18: The Innovation Landscape Map.

Source: (Pisano, 2015).

The framework allows organisations determine how innovation will create value for customers, how such value will be captured, and which type of innovation should be pursued in that regard. The authors also caution that innovation strategies should change as the environment changes and these strategies be tested against the changing environment.

2.4.1.5 The Innovation Matrix

The Innovation Landscape Map by Pisano (2015) and the Innovation Matrix by Satell (2017) share close similarities as Figure 2-18 and Figure 2-19 illustrate. While Pisano (2015) posits that the Innovation Landscape Map aims to guide business leaders identify value creating innovation opportunities for both customers and the organisation through exploring the fit with the organisation's technical competencies and business model, Satell (2017) on the other hand departs from the position that innovation is about solving problems and this understanding is the beginning of defining one's innovation strategy.

The author essentially argues that there should be a portfolio of innovation strategies instead of one lock-in innovation strategy due to the fact that just as there are many problems to be solved, there will be equally as many innovation types.

The author further cites that the Innovation Matrix can be used to guide business leaders identify the appropriate portfolio of strategies to solve pertinent organisation problems by asking two key questions "How well can the problem be defined?" and "How well can the skill domain needed to solve the problem be defined?"

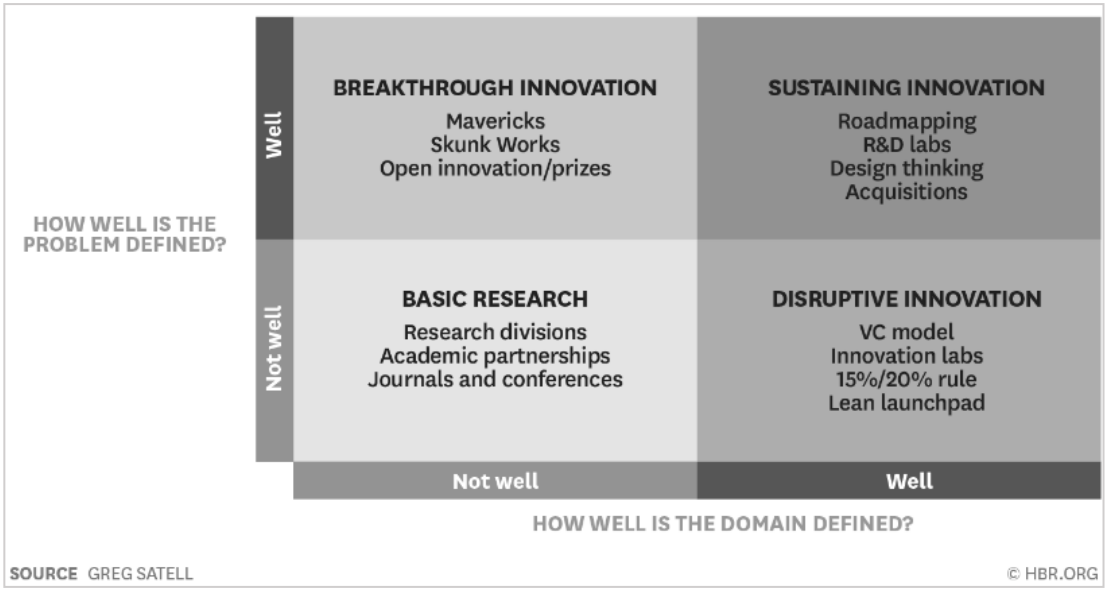


Figure 2-19: The Innovation Matrix.
Source: (Satell, 2017).

The key characteristics of the two innovation frameworks are summarised follows:

Sustaining innovations and routine innovations can be considered counterparts of each other since both leverage and improve on the existing competencies and capabilities within the existing business model and in existing markets. These types of innovations are usually continuous improvements, incremental in nature, and are essentialy about making good products better by providing refinements on existing products (Pisano, 2015; Satell, 2017).

Disruptive innovation is a concepts pioneered by Clayton Christensen (Christensen, 2013; Christensen, Raynor, & McDonald, 2015). Christensen posits that as companies focus on improving their products and services mostly for their their more demanding higher profitable customers, there is a market segment who would find the improved

products overly developed for their needs and demands. This market segment usually gets overlooked in this regard. As such, disruptive innovations happen at this market underserved segment.

Rather than making good products better, disruptive innovations transform products into innovations that are much more affordable and accessible that a greater number of consumers can access and have use to these innovations. Disruptive innovations occur in one of following two ways:

1) At the low-end customers or

2) Creating new-market footholds by turning non-customers to customers.

Disruptive innovations tend to focus on business model innovations rather than purely on product innovations. In this definition, the example of Dow Corning's Xiameter Burns and Zank (2011) mentioned earlier under Section 2.2.2.1 would thus fall in this category.

Radical Innovations involve revolutionary technological innovations. These types of innovation do not address an existing problem but create new demand, thus opening up new markets. These are usually technological or skill competency adjacencies to enable radical innovations.

Architectural Innovations combines the lessons, skills and overall technological know-how and applying within a different market. The risk involved in architectural innovation is low due to the reliance and reintroduction of proven technology, however this type of innovation can be challenging to as it stretches the existing technological know-how.

Basic research innovations are the traditional R&D laboratory type research. Basic research innovations are often pursued at universities as well as in corporate R&D research centers. This form of R&D is usually the feed for making scientific discoveries and intellectual property through proprietary knowledge such as patents. The nature of basic research innovation efforts is largely blue sky research, and can be highly uncertain and risky. Also innovation activities in the laboratories do not necessarily translate into customer value. As such, from the business perspective investment in basic R&D are often times challenged unless potential market value of new knowledge discoveries can be indicated.

The different types of innovation as discussed above, can at times become complementary rather than substitutes. The company's innovation strategy should therefore outline how the different types of innovation fit into the business strategy and resources allocated accordingly.

Additionally, understanding the product and organisation's position in the lifecycle is important since companies whose core business is maturing, incremental innovations may not sufficiently move the needles if the company is targeting greater growths. Such companies may need to explore opportunities through disruptive and radical breakthrough innovation (Pisano, 2015).

Performing an organisation's innovation landscape is an important requisite to developing appropriate innovation strategies and models. Furthermore, there are many diagnostic tools that give generalised approach which may not take into account different organisation nuances. It is therefore important to determine the appropriate innovation diagnosis framework.

As the study is premised around ascertaining the innovation landscape for the polymers products of the company selected, the Innovation Landscape Map as well as the Innovation Matrix frameworks bear the closest fit to the research intent. This research will therefore be evaluated against the lenses of these two frameworks.

2.5 Summary and conclusion

2.5.1 Summary of literature reviewed

The literature review section mapped out innovation strategies relevant to the aspects that emerged out of the outlined research analysis; which are product innovation strategies for polymers within the contraints of increasingly stringent regulatory and environmental landscape, as well as commodity products at a mature product lifecycle while at the same time being cognisant of consumer centricity.

From the literature reviewed, innovation models have been evolving constantly over the years. From the first generation innovation model which is the linear and inward looking traditional R&D, the sixth and latest generation of innovation has emerged in

the form of the Open Innovation, a more collobrative model leveraging internal and externally capabilities.

Co-developing products in collaboration with customers and other value chain stakeholders using Open Innovation models, is emerging strongly as one of the critical factors in product innovations. Interestingly, this observation is not unique to chemicals industries but appear to cut across various consumer landscapes and industries.

Open Innovation models have enabled organisations to increase their innovation success rate, reduce R&D spending and at the same time increased revenue, as exhibited by P&G (Brown & Anthony, 2011; Lafley & Charan, 2008).

Furthermore and significantly, value chain collaborations and co-development of envrionmentally sustainable product solutions was exhibited as one of the most critical and successful interventions towards resolving the envrionmental and regulatory product pressures faced by plastics products.

It should also be recalled that the products under investigation are commodity products, price-based decisions are thus key considerations for product developments as well as customer perspective of value-add. Business model innovations were indicates as one of the innovative ways in addressing businesses with commodity-type products.

Even though many organisations consent that innovation is a top priority, and innovation metrics enable organisations to assess if they are pursuing the right activities, literature reveals that few companies measure their innovation efforts as closely as they measure other aspects of the business. Some companies barely attempt to measure innovation at all, while others do not have defined innovation management targets, objectives and measurements (Jung & Waiboer, 2007; Santagate, 2016).

Also evident from the literature reviewed was the importance of understanding the appropriate type of innovation an organisation should pursue for their specific growth ambitions and strategic alignment. Such examples of the types of innovations include

routine or sustaining innovation, disruptive innovation, breakthrough innovation, architectural innovation, radical innovation and basic reaserch, as outlined by (Pisano, 2015; Satell, 2017).

The Innovation Landscape Map as well as the Innovation Matrix frameworks bear the closest fit to establishing the requisite innovation landscape for the study as well as establishing the type of innovation; which is one of the questions that this research aims to address. Because the two frameworks are quite closely similar, it is anticipated that their findings will be related.

Therefore, the key parameters out of the literature review that will call for focussed exploration for this study are:

- Assessing appropriate types of innovation and their supporting networks such as collaborative innovation ecosystems.
- As part of the overall innovation process, determining how innovation efforts are managed and measured for the products under investigation.

2.5.2 Proposed research strategy, design, procedure and methods arising from the literature reviewed

This study seeks to understand the nature of innovation strategies within *Organisation A*'s polymers products. The study aims to establish perceptions and culture of innovation; an in-depth enquiry that can go beneath the surface is therefore considered to provide more meaningful discoveries. Therefore a qualitative case study research approach is proposed to be employed for the collection, processing, and analysis of the empirical evidence for this study.

3 RESEARCH STRATEGY, DESIGN, PROCEDURE AND METHODS

This chapter identifies and describes research approach, design as well as procedure and methods that were employed in this research to collect, process, and analyse empirical evidence. Broadly, the chapter has three objectives; namely, to identify and describe the research strategy (Section 3.1), the research design (Section 3.2), as well as the procedure and methods (Section 3.3). The chapter also describes the reliability and validity measures (Section 3.4) that this research applies to make it credible as well as the technical and administrative limitations of the choices made (Section 3.5).

3.1 Research strategy

The significance of innovation has well been deliberated throughout the document. So important is the concept that it is a top-three management priority according to (Ringel, Baeza, Grassl, Panandiker, & Harnoss, 2020). At the same time, innovation has arguably become one of the overused buzzwords. In its popularity and wide applicability, the word "innovation" has resulted in the proliferation of its meaning.

In order to move beyond the fad, it is important to uncover perceptions regarding innovation; which may possibly influence the way innovation is conducted and the associated choices for the type of innovation for the case under study. This was achieved by dimensionalising how innovation is perceived and undertaken within the business unit entities associated with polymers products within *Organisation A*, against the backdrop of the new business strategy.

Therefore for a richer discovery, a qualitative research approach is selected for the collection, processing, and analysis of the empirical evidence for this study.

According to Hennink, Hutter, and Bailey (2020), one of the distinctive features of qualitative research is that it allows researchers to identify issues from the perspective of the study participants and understand the meanings and interpretations that the study participants attach to behaviour, events, or objects.

This methodological approach is deemed best fitting for the purpose of the study as it allows for the human behaviour factor to be integrated into the study and enables researchers to examine people's experiences in detail.

3.2 Research design

Research design outlines the stepwise process followed during data collection and the analysis of data, through a logical connection between the research questions and the research conclusions.

This study entails carving out one business unit from the entire organisation. The case or unit of analysis is the carved out business unit sectors associated with the products under study of interest.

To the best knowledge of the researcher, and according to the literature reviewed, as well as internal discussions with selected few key stakeholders within the organisation; there has not been a similar or related study previously conducted. Furthermore, because the investigation is based on supporting the newly announced business strategy, this study can therefore be considered a revelatory or baseline setting investigation. Therefore, a single case was pursued for the study.

Yin (2003), Merriam (1998) and Stake (1995) are renown foundational methodologists in the area of case study research; whose methodological concepts have had great impact in the case study design, as stated by (Yazan, 2015). Yin (2003) defines a case study as an empirical inquiry that investigates a contemporary phenomenon within its real life context using multiple data sources.

Stake (1995) describes qualitative case study as a study of the complexity and particularity, coming to understand its activitiy within important circumstances.

Merriam (1998) on another hand states that qualitative case study "is an intensive, holistic description and analysis of a bounded phenomenon such as a programme, an institution, a person, a process, or a social unit".

Many more explanations exist and bear similar hues to the above classifications. Such as Kaarbo and Beasley (1999) who explain that in a case study, a real-time phenomenon is explored within its naturally occuring context, with the consideration that the context will create a difference, as cited by (Rashid, Rashid, Warraich, Sabir, & Waseem, 2019).

This ties in with the fundamental aims of this research; as the contextual setting is deemed relevant to the phenomenon under study.

For these reasons presented the above, the research design selected for this study is a single case qualitative case study research.

3.3 Research procedure and methods

This section documents the actual procedure and the methods employed in this research to collect, collate, process, and analyse empirical evidence. Broadly, the following are detailed: the data and information collection instruments (Section 3.3.1), the target population and sampling of respondents (Section 3.3.2), the ethical considerations during the research process (Section 3.3.3), data and information collection process and storage (Section 3.3.4), data and information processing and analysis (Section 3.3.5) as well as the background description of the respondents who provided empirical evidence for this research study (Section 3.3.6).

3.3.1 Research data and information collection instrument

Qualitative research uses research methods such as content analysis, documents, archival records, visual methods, life histories, observations, focus groups, and in-depth interviews (Yin, 2009). Yin further posits that interviews; which are essentially steered conversations, are considered one of the most important and powerful sources of case study evidence.

A semi-structured interview schedule was conducted for this study; which enabled the research to go beyond the surface in examining participants' experiences.

There are several studies with similar aspects to this study, these include aligning innovation to business strategy, product innovations, customer centric and collaborative innovation. Some of the studies were conducted via both qualitative and quantitative

research approaches, while others were based on multiple case research. Albeit a varied composition of studies, these studies provide a rich source of guidance in preparing questions that were deemed useful for this study.

Such studies provided a source of insight in preparing the research instrument for this study. Although not an exhaustive list, examples of these studies included "*Innovation management in the chemical industry*" by Jung and Waiboer (2007), BCG annual surveys "*Measuring Innovation*" by J. Andrew *et al.* (2007) and J. P. Andrew *et al.* (2009), "*The Global Innovation 1000*" survey by Barry Jaruzelski *et al.* (2018), "*Aligning innovation to business strategy*" by Fortuin (2006), "*Developing a Product Innovation and Technology Strategy for Your Business*" by Cooper and Edgett (2010), "*Making innovation work: How to manage it, measure it, and profit from it*" by Davila *et al.* (2012) and "*Overcoming firm-level challenges in Open Innovation*" by (Popov, 2018).

3.3.2 Research target population and selection of respondents

3.3.2.1 Research target population

The target population for this research constituted of employees of *Organisation A* involved in and associated with the development, production, marketing, sales and support of polymers products.

The selection of the target population was guided in greater parts by a study conducted by Fortuin (2006). The author sets out to ascertain the alignment between innovation strategy and business strategy for technology-based companies.

The study also defined key players responsible for formulating innovation strategy, and enabling implementing and evaluating the innovation strategy, as well as alignment with the organisation's internal and external environment. The author explains these key role players as a triangle of innovation network, constituting of "Headquarters (HQ), Corporate R&D (R&D) and Business Units (BUs)". Figure 3-1 below illustrates.

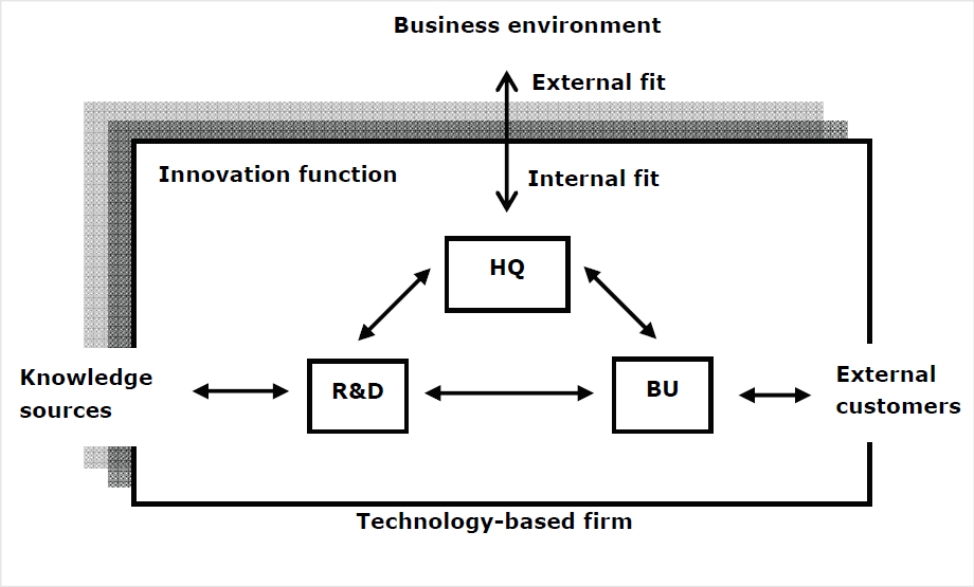


Figure 3-1: Innovation strategy and business strategy alignment framework for technology-based firms. Source: (Fortuin, 2006)

Strategic alignment is stated as a function of the degree of internal and external fit, where internal fit pertains to "proactively attuning the innovation resources, competencies and capabilities in the HQ-R&D-BU triangle and external fit refers to proactively attuning the innovation function to the business environment". Internal links includes innovation resources, competencies and capabilities while external links involves universities, customers, suppliers and buyers.

Great relevance is drawn from this study by Fortuin (2006) as the aim of this investigation is to determine innovation strategies for the case under study and assessing how these innovation strategies would support the new business strategy. The framework in Figure 3-1 therefore provides useful guidance with regards to the target population and sampling that was considered for this study.

3.3.2.2 Sampling and selecting respondents from the target population

Sampling strategies for qualitative case studies follow non-probabilistic purposive or theoretical considerations. Purposive sampling was followed for this study. With purposive sampling, the researcher seek out participants with specific characteristics and traits (Barglowski, 2018).

Sampling was conducted based on participants who were considered well experienced in the development, production, marketing and overall support of the products under

study. The sample included top senior management, middle management, researchers, analysts and advisors supporting the products under study.

The appropriate number of interviews is guided by factors such as the size of the unit of analysis, the phenomenon under investigation, the scope of the study, and the timeframe available.

According to Baskarada (2014), less than 15 interviews per case study organisation is considered insufficient. However, other researchers hold different views to this argument, indicating that data saturation, where no further new insights are extracted from participants; can be reached even at six interviews with context considered (Guest, Bunce, & Johnson, 2006).

Fusch and Ness (2015) however, advise on striking a balance between the two data concepts presented by Dibley (2011); which are rich (quality) and thick (quantity) data. Thick data relates to a lot of data; while rich data is multi-layered, well-nuanced, detailed, and intricate. Fusch and Ness (2015) bring forth the acknowledgement that one can have a lot of thick data that is not rich; equally, one can have rich data that is not sufficient; hence the significance of the balance between the two data aspects.

For this study, a total of 18 interviews were conducted; which provided sufficiently thick data as well as rich data.

3.3.3 Ethical considerations when collecting research data

Approvals to conduct this research were received from the company under study. A pseudo name "*Organisation A*" has been adopted when referencing the organisation under study. Participants were also given pseudo names, where quotations from their interviews were made.

3.3.4 Research data and information collection process

As mentioned earlier, data and information collection were conducted through a semi-structured interview schedule. Due to the prevailing Covid-19 pandemic and lockdown measures, the interviews were conducted virtually on-line, where the interviews were recorded, with consent of the study participants. An interview schedule on average

lasted about 60 minutes. A database was established where information was stored, secured, and available for auditing.

3.3.5 Research data and information processing and analysis

3.3.5.1 Research data and information processing

In qualitative research, coding is considered one of the key steps in data processing and analysis (Baskarada, 2014). To this end, data are fragmented into manageable parts, categorised according to patterns and themes thereafter reconstructed to formulate and present a congruent storyline.

Coding is an iterative and incremental process thus can be performed at differing levels of data analysis and abstraction. This is further alluded to by the Governance Accounting Office, GAO (1990), who posits that the concept of *observe, think, test, and revise* (OTTR) is fundamental to qualitative case study data collection and analysis, as cited by Baskarada (2014).

Manual coding using Microsoft (MS) Word and Excel were selected for the study. Information deemed important was highlighted and indexed with a comment. The comments were thematic statements rather than shorter or one word codes. This was done against the backdrop of researchers and methodologists highlighting the significance of labeling portions of data with an extended thematic statement rather than shorter codes (Saldaña, 2013). Themetic coding therefore provides a profile of this process.

The importance of returning to the case research questions and with an extension to research propositions, when analysing data is important as this encourages a focussed data analysis as this eliminates analysing data that is out of scope of the research questions. For this reason, the comments were thus prefaced with the associated research question.

The codified comments where then grouped together according to the associated research questions for further coding iteration to eventual establish the categories and themes. As this study was an exploratory research with no preset findings or theories, an inductive themeing coding method was followed.

Operationalisation of research data

Figure 2-12 presented earlier illustrates common research varibales in the innovation process (Input-Process/Throughput-Output). Some of these variables were instrumental in operationalising the research data associated with the main concepts of this study. The Questionnaire in *Appendix 1.1.1* demonstrates the thought process followed to operationalise the research data.

3.3.5.2 Research data and information analysis

Data analysis is a process of making sense out of the data (Merriam, 1998). Yin (2003) posits that data analysis entail the "examining, categorizing, tabulating, testing, or recombining evidence to address the initial proposition of the study"; while Merriam (1998) on the other hand, states that data analysis involves "consolidating, reducing, and interpreting what people have said and what the researcher has seen and read".

The data analysis process started with transcribing the interview sessions. This was then followed by hours upon hours of multiple readings of the interview transcripts, under GAO (1990)'s "*observe, think, test, and revise"* (OTTR) guiding principles, as well as Merriam (1998)'s lens of "consolidating, reducing, and interpreting"; in order to ascertain relevant information that can lead to the development and formulation of the study narrative.

Data analysis selected for the study followed Saldaña (2013) cycles of coding methods. These are "*First Cycle Coding"* and "*Second Cycle Coding"* methods. The coding method identified for the study was "Themeing the data", as guided by Saldaña (2013)'s "*First Cycle Coding*" method. "Themeing the data" is one of the seven categories of "*First Cycle Coding"* method. The categories include "grammatical methods, elemental methods, affective methods, literary and language methods, exploratory methods, procedural methods", and the seveth being "Themeing the Data".

From the "*First Cycle Coding"*, twenty themetic codes were generated. These data were exposed to the "*Second Cycle Coding*", for further analysis. This second cycle of data analysis allowed for the identification of relationships, underlying and cross-cutting meanings between and across codes.

Saldaña (2013) identifies six categories of "*Second Cycle Coding*". These are "Pattern Coding, Focused Coding, Axial Coding, Theoretical Coding, Elaborative Coding and Longitudinal Coding".

Pattern coding was identified and used in the "*Second Cycle Coding*". Pattern coding summarises or groups explanatory or inferential codes into smaller sets, in identifying emergent themes or constructs, as cited by (Saldaña, 2013).

Based on these ascertained relationships between codes and underlying meanings across codes, three categories and six themes were established out of the" *Second Cycle Coding*". The categories and themes are further detailed in elaboration in Chapter 4.

3.3.6 Description of the research respondents

As mentioned earlier, the purposive sampling was conducted based on participants who are well experienced in the development, production, marketing, sales and overall support of the products under study. A diverse group of participants, in terms of their roles, function, experience and expertise in polymers products within the business, was selected. The study participants constituted of senior management, management level, researchers, analysts and advisors supporting the products under study, with more than 5 years' experience in the products under study.

Figure ***3-2*** illustrates the composition of participants.

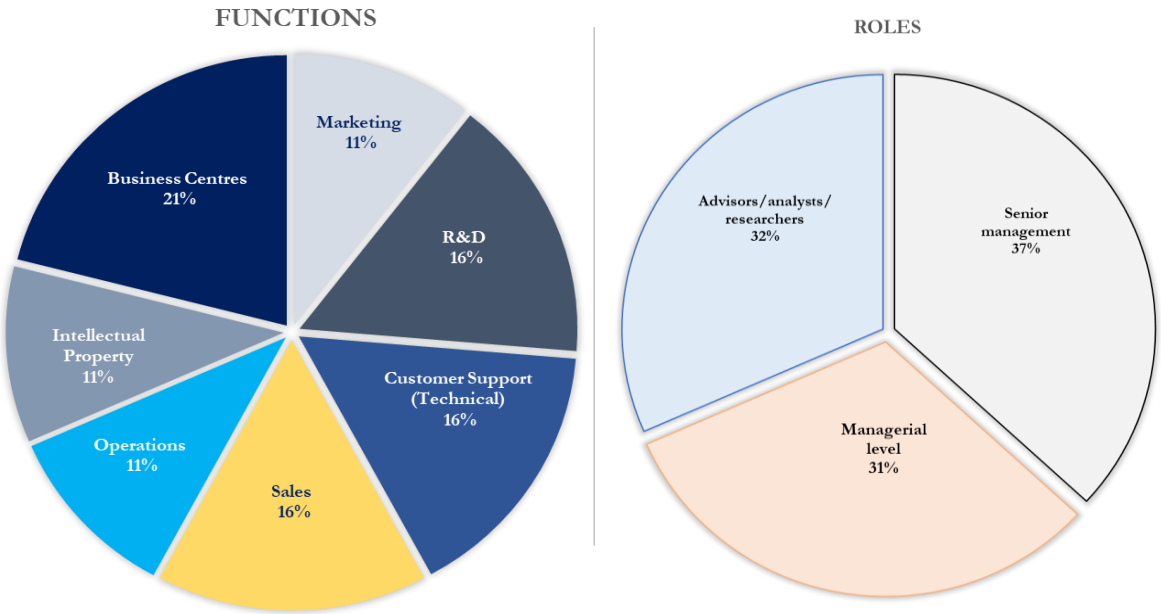


Figure 3-2: Composition of study participants.

3.4 Research strengthens—reliability and validity measures applied

The quality of empirical studies, including case studies; depends on the rigour and assessing the trustworthiness of the data.

Methods for achieving trustworthiness and critically appraising empirical results for qualitative case study research include credibility (internal validity), transferability (external validity), dependability (reliability), and confirmability (objectivity) of results (Baxter & Jack, 2008; Creswell, 2013; Merriam, 1998; Stake, 1995; Yin, 2003).

Triangulation is one of the primary validation strategies used in case study researches (Baxter & Jack, 2008). The method entails using multiple sources of evidence.

Stake (1995) positions four triangulation approaches, these are triangulation of data source, theory, methodology and investigator or researcher.

In their qualititative organisation-based single case study, for their triangulation strategy; Gaya and Smith (2016) engaged a select number of participants; who were senior managers, in the trangulation of the results to ensure multiple data sources.

A similar triangulation strategy was also pursued for this study. To ensure that the emerging data were appraised by multiple data sources, triangulation of the empirical data was conducted by three independent engagement sessions with five senior managers and two middle managers. The team was selected based on their extensive experience in the products under study, their business experience as well as their overall industry know-how.

Reliability relates to demonstrating the repeatability of the results obtained by the data collection procedure. In principle, other investigators should be able to follow the same procudure and obtain the same results.

Merriam's strategies for ensuring reliability include the investigator explaning their position with regards to the study, triangulation, as well as using an audit trail (Merriam, 1998). Strategies reported by Yin (2009) on the other hand include creating the case

study protocol, and developing a database for the case study. A case database allows investigators to establish an audit trail from data collected, through to analysis right up to final conclusion.

The case protocol approach with case database was followed for this research to guide the study and ensure enhanced integrity, credibility and reliability of the investigation as well as mantaining a chain of evidence. Contents of the case study protocol typically include the data collection instrument, procedures, general research rules followed, interview transcripts, preliminary analyses, other relevant components such as investigator notes *etc.*

3.5 Research weaknesses—technical and administrative limitations

Due to the prevailing Covid-19 lockdown situation, interviews could only be conducted via virtual online means, therefore no face-to-face interviews were possible.

4 PRESENTATION OF RESEARCH RESULTS

The section presents and discusses the research finding of the study. From the data analysis, three categories together with six themes were identified. These findings of the study are encapsulated in Figure 4-1. The three categories together with six themes were identified, outlined as follows:

Category 1: "*The changing consumer landscape*"

Themes: **Theme 1.1**: Sustainable product solutions

Theme 1.2: Innovative customers demanding innovative producers

Category 2: "*External demands vs. Internal capabilities*"

Themes: **Theme 2.1**: Key business drivers: Commodity focus

Theme 2.2: Competing priorities

Category 3: "*Innovation culture*"

Themes: **Theme 3.1**: Systematising product innovation

Theme 3.2: Risk-aversion

The themes were ranked according to the percentage of respondents who identified with a particular themes.

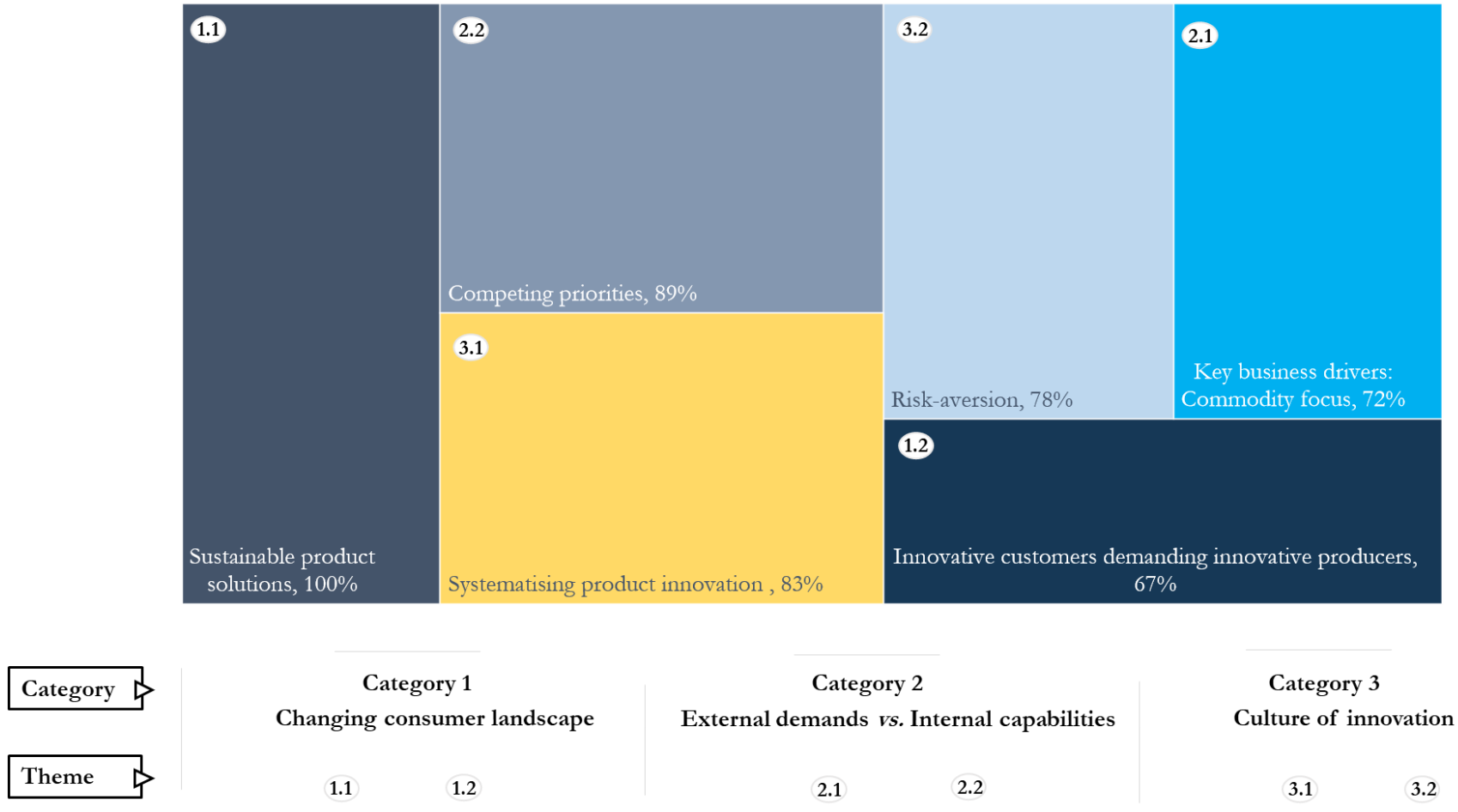


Figure 4-1: Emerging categories and themes.
Percentage indicates the percentage of participants who identified with a particular theme.

4.1 Research question 1

RQ1: *What are the perceptions held within the business regarding innovation for polymers products*?

In relation to the Research Question 1, the perceptions gathered regarding innovation of polymers products are addressed by **Category 1: Theme 1.1 and Theme 1.2**.

4.1.1 Category 1: The changing consumer landscape

A significant proportion of the participants emphasised the changing consumer landscape where polymers products are under intense scrutinity from the environmental, legislation and societal pressures with regards to the increasing plastics footprint in the envrionment and other externalities such as oceans. These concerns, according to the participants thus call for more innovative and environmentally friendly alternatives.

4.1.1.1 Theme 1.1: Sustainable product solutions

Participants perceived that the intense focus on environmentally friendly and sustainable products commands for innovative product solutions.

Although the majority of participants (83%) felt that product innovation is important for polymers products, a small proportion of participants (17%) felt that innovation may not necessarily be critical for polymers, particulalry that polymers of interest are commodity products. However, even these participants acknowledged that the changing consumer landscape presents market disruptors that necessitate product innovations.

All the participants (100%) as such identified that sustainable product solutions will be needed to meet the changing consumber landscape. Therefore, product innovation for this demand is perceived to be crucial.

4.1.1.2 Theme 1.2: Innovative customers demanding innovative producers

Participants (67%) further highlighted that customers nowadays are more informed about product choices available at their disposal. In that manner, customers themselves

are thus becoming more innovative and they are therefore expecting the same from their suppliers.

Some of the points supporting the above two themes are reflected by the following participants inputs.

Interview question	Participants inputs
"How important is innovation to polymers products?"	**Participant E:** "*So, in my view, I think it's very important if you look at it the way the megatrends are going at the moment in terms of, you know, banning of single use plastics and things like that...*" …"*So, I actually think innovation is very important for the polymer space. Otherwise we're going to have products that nobody wants*".
	Participant U: "*Innovation is very important. We've got end-users downstream. They are innovative and for them to be innovative they need producers or suppliers that are keeping up with developments*".
	Participant A: "*I would say, it's not critical, from a commodity perspective. But there are certain market disrupters that may come about at any particular time that necessitate innovation to take place". …" The whole sustainability of polymers perspective that has become a major market disruptor, that we would not have really invested in or done any pre-work in, prior to maybe three years ago.*"

The perceptions held within the business regarding innovation for polymers products ranged from an overwhelming majority's acknowledgement of the market pressures that needs innovative ways to adress the changes, to scepticisms that innovation is not considered a business imperative for the products under study.

The scepticisms seemed to stem from the perspective that the products are commodities, thus product innovation is not critically important. These reflections are further highlighted by the following inputs.

Interview question	Participants inputs
"In your view, how do you think innovation for polymers products is understood within the business?"	**Participant I:** "*Within business, I think in our company it's [innovation] fairly muted" …* *…" I think that we were very comfortable in our commodity zone and commodities did very well for a very long time. And, perhaps it's a mindset which hasn't adopted to the modern way of thinking as quickly as some of our competitors or others in the polymer fields have*".
	Participant K: "*Innovation is not so much widely aspired to [within our business]".* *…" You know, we are always focused on, um, you know, making the most common easy to produce products which, having done that coming up against stiff competition, cheaper alternatives out there.*"

The foregoing findings confirm Proposition one; which is:"Polymers are considered mature commodity products, therefore no intentional focus on product innovation is pursued".

De Smet (2016); MacArthur *et al.* (2016); Mrowiec (2018) have alerted on the changing consumer landscape. Some (polymers) plastics products have been identifed as problematic products for the environment, these include single use plastics. Furthermore, the authors have cited that innovative ways would need to be found to come up with more environmentally and sustainable alternative product solutions.

It has also been shown that possibly all the polymers value chain participants are impacted by the changing consumer landscape (see Figure 2-6 and Figure 2-7), and they would therefore be required too, to come up with alternative sustainable product solutions. Product innovation for polymers would therefore be required to address the changing consumer landscape.

4.2 Research question 2

RQ2: *What types of innovation are pursued for the products under investigation*?

To ascertain the landscape against which innovation efforts are pursued for polymers products within the organisation, **Category 2** together with **Theme 2.1** and **Theme 2.2** emerged from the data analysed.

4.2.1 Category 2: External demands *vs.* Internal capabilities

This category highlighted the need for a balance to be struck between satisfying external demands from customers for example, against business internal capabilities.

Although participants acknowledged that *Organisation A* is aware of the importance of innovation, sentiments emerged from the analysis; which indicated that product innovation efforts for polymers may be perceived as a disruption to business activities.

These were outlined by key business drivers (**Theme 2.1**) that needed to be satisfied, as well as priorities that may at times be competing (**Theme 2.2**). These parameters are further elaborated in the following subsections.

4.2.1.1 Theme 2.1: Key business drivers - Commodity focus

It was evident that the respondents have an awareness of business dynamics that are vital for the success of the business. Chief amongst these, as highlighted by 72% of participants, were key business drivers that were dictated by the field of play being commodity markets.

Respondents highlighted the forces faced by being a commodity player and the associated business considerations such as cost management and margin pressures that come with being a player in the commodity markets.

These business factors were considered to potentially stifle innovation since innovation efforts must be justified under the strict scrutiny of cost management, low cost to serve, and product price considerations, due to price sensitive nature of commodity customers.

Some of these thoughts are captured in the response below:

Participant W: … *"I think there's a lot of these business factors which, in our particular instance stifles innovation in a way per say, when it comes to the [products] grades"* …

These challenges are however, not unique to *Organisation A*. As outlined earlier in Section 2.2.3 *Product innovation within the constraints of commoditisation*, suppliers of commodity products face price and margin pressures and can find themselves competing primarily on price (Böringer & Simons, 2017). Also as mentioned earlier, Roland Berger Consulting (2014) and Zysman (2014) caution companies of what they refer to as the commodity trap, where suppliers can find themselves spiralling further downhill on increasing price and margin pressures. The authors further alert that one of the key levers to escaping the commodity trap is through innovation.

This paradigm was expressed in the response from the following participant:

Participant K: …"*It [innovation] is extremely important because we are trading in a commodity market".*

"You know the way polymers are being manufactured today, it's become much more commoditised. So, it's a competition of who can make them more cost effectively, but the end product is the same, so you've got to put in some innovation"…

4.2.1.2 Theme 2.2: Competing priorities

In assessing the types of innovation efforts pursued, it emerged that there are competing priorities within the business units that are involved in and associated with the development, production, marketing and selling of the products under study, as identified by 89% of participants.

Illustrating this, are the following points shared by the participants:

Interview question	Participants inputs
" What are the drivers of innovation for polymers products?"	**Participant T:** *"Ok, so, in our environment, I'm not saying there's no innovation because a lot of our innovation is about achieving throughput at the plant…." And, because of that, the product innovation is taking second chair, because often product innovation comes at a cost of production efficiency.* *So, until [Organisation A] gets alignment between that [product innovation and production efficiency], product innovation in the polymers space is going to be a bit tricky".*
	Participant G: "*…That is our challenge, these chemistry-related innovative projects, because they are seen as disruptive rather than as big value add".* *…" So, they [Production Facilities] view innovation and trials as disruptive actually to the business".*

As highlighted above, other types of innovation such as manufacturing process innovation are considered more value adding than product innovation efforts.

Because business drivers such as production efficiencies take top priority, and in an attempt to strike the balance between internal capabilities and external demands, product innovation efforts are perceived as a disruption and mostly get deprioritised.

As such, product development efforts with minimal interruptions to operations are thus embraced. These, as highlighted by the following participant, are largely incremental and sustaining efforts.

Participant E: …"*And, if any innovation happens, it's basically to prolong the maturity phase or get incremental growth…*"

The findings from this category and its themes therefore confirm Proposition two, that "Only incremental and sustaining innovations are pursued; which then potentially suppresses other innovation types".

4.3 Research question 3

RQ3: *How does the organisation assess if sufficient and relevant innovation activities are being pursued and advanced*?

In establishing how innovation is managed, measured, and incentivised for polymers products within *Organisation A*, **Category 3**; together with **Theme 3.1** and **Theme 3.2** were established.

4.3.1 Category 3: Innovation culture

It became evident throught the collected and analyses data that product innovation aspirations were rather on the low end of the spectrum within *Organisation A*, for the products of interest. The culture of innovation, as demonstrated by **Theme 3.1** and **Theme 3.2**, was reportedly not heightened for polymers products.

4.3.1.1. Theme 3.1: Risk-aversion

Participants viewed the business to hold a certain aversion for risk, towards polymers product innovation, as polymers product innovation was viewed to bring a degree of risk with it. This view was held by (78%) of respondents, and echoed as indicated below by the following participants:

Participant T: …" *There's no appetite for risk within [Organisation A] anymore. And, unfortunately, innovation comes with a certain degree of risk. And there's no appetite for risk at the moment*".

Participant Q: …"*I think recently, [Organisation A] is not very comfortable to change or to change what we produce.*
…And so, I would say that the willingness of change or innovation, I think it's difficult and I don't think there's appetite to change certain things"….

4.3.1.2 Theme 3.2: Systematising product innovation

Strong sentiments were also raised by respondents, outlining a lack of out-rightly communicated innovation strategies and processes that systematically support product

innovation. As a result, the environment was viewed to be unsupportive of polymers product innovation.

According to 83% of respondents, without systematising the process, innovation for the polymers products will remain but a wish. A reflection on this was noted as below:

Participant U: …"*Much as there are a lot of senior managers saying innovation is important, there are no strategies for innovation, there are no measures".*
…"If people don't really put processes in place and put innovation as a key deliverable in their KPIs [Key Performance Indicators], and we all know what doesn't get measured simply doesn't get done"…

Participant G: …"*They [innovation efforts] need to be incorporated in the short term incentives of [Product Facilities] so that [Production Facilities] can support whoever the technical people are that want to make the changes.*
…" I think unless we take it down to short term incentives with clear goals, it will be long term"…

With regards to how innovation was incentivised, participants felt that there were no incentives for innovation, as highlighted below:

Participant A: "*I think projects take enormous length of time to get off the ground. And that, to me is a very clear indicator that [Organisation A] does not listen to the customer and they do not take innovation seriously".*

Participant K: "*We do not incentivise product marketing…*
…."Even if it's not monetary but cheering on, guys go for it! No…What we have seen [are] reasons why it's going to interrupt our lives in the plant".

Participant G: …"*And it is sad because if your are not careful, as a [Production Facilities-based scientist], you end up working as a [Production Facilities-based engineer]. Because, you feel good.*
And why do you feel good? It's [because] that kind of work is probably incentivised.
So you have to be very disciplined [to not end up working as a Production Facilities-based engineer]".

The above assertions from **Theme 3.1** and **Theme 3.2,** point to an environment that may seem unsupportive of product innovation for the polymers products, where other types on innovation such manufacturing process innovations are considered more value adding thus they are more supported.

The findings from Category 3 and the two themes can be summed up by the assertions rendered by the following participant, expressing the desire for a culture embracing and supportive of innovation.

Participant V: "*What we need more than anything else is an innovation culture. So, I need a strategy to drive innovation. I don't need an innovation strategy or maybe I'm just playing with word…I need a strategy and a structure to support innovation*".

4.3.2 Conclusions on findings

The findings of this study highlighted what faced by product innovation for polymers comes up against within *Organisation A*.

The results revealed that participants acknowledge that the changing consumer landscape with regards to more environmentally friendly and sustainable products, will demand product innovation within the polymers products.

While product innovation in that context may seem like a fail-proof intervention to address the evolving landscape, the findings also highlighted important constraints associated with these types of polymers, as commodity products. These included cost pressures and price elasticities of product demand, because for the customers of these products, price is the primary buying criterion. Price elasticity of demand refers to the measure of the sensitivity that buyers of a product exhibit to a change in the price of the product (Kannegiesser, Günther, van Beek, Grunow, & Habla, 2009).

These multiple considerations dictate that the set business drivers first be significantly satisfied in advance of product innovations, thus perhaps manifesting as what was perceived as competing priorities within *Organisation A* when it comes to internal capabilities and external demands.

The competing parameters were perceived by most participants as a demonstration of an environment that was unsupportive to polymers product innovation. Moreover, a heavy leaning towards incremental and sustaining product innovation efforts was established. However, these appeared to be ad hoc and reactive in the absence of well outlined innovation strategies and processes, and also seemed to be compounded by a risk averse culture of the business.

5 THE CONSULTANCY REPORT AND RECOMMENDATIONS OF RESEARCH FINDINGS

5.1 Introduction

This consultancy report is developed to ascertain innovation strategies that can support and are aligned with *Organisation A*'s recently announced business strategy.

The products selected for the study *viz.* polymers products, as outlined througout the report, are currently facing considerable negative attention relating to environmental and societal scrutiny, in part due to their increasing waste footprint in the environment and other externalities.

Added to this, the products are commodity products with increasing product and market maturity. Cost and margin erosion are constant realities for the producers and suppliers of these commodity products, as competition is largely price-based.

The previous section reflected on the findings from the analysis of the data collected, against the backdrop of the research questions. This section aims to provide recommendations and opportunity areas based on the findings of the study.

5.2 Recommendations of research findings

As indicated in the previous section, six themes and three categories were established. With the focus on the themes, the Top three themes **(Theme 1.1: Sustainable product solutions, Theme 2.2: Competing priorities and Theme 3.1: Systematising product innovation)** will form the bases of the recommendations for the consultancy report.

Figure 5-1 captures the themes established, and also highlights the Top 3 themes of focus, based on the percentage of respondents. Figure 5-1 further outlines the opportunities identified for the Top three themes, with these elaborated in the sub-sections that follow.



Figure 5-1: An overview of the study recommendations.

5.2.1 Sustainable product solutions

As highlighted in this report, and also asserted by the participants; the consumer landscape is evolving and demandingsustainable product solutions that are more environmentally friendly. Circular Economy principles bear guidance in this regard (MacArthur *et al.*, 2016; Mrowiec, 2018).

With customer centricity as one of *Organisation A*'s strategic focus areas for the new business strategy, it is therefore conceivable that *Organisation A* will observe increasing demands from customers for more sustainable product solutions, in line with the changing consumer, regulatory and environmental landscape.

Environmental issues, particularly plastics sustainability matters, have been noticed to require collaborative and partnership approaches. Furthermore, as these challeges affect all the polymers (plastics) value chain participants, in the quest to address the problems, customers tend to prefer to co-develop their required product solutions with producers or suppliers, as shown earlier in Figure 2-7.

Recommendations/Opportunity areas

5.2.1.1 Open Innovation Strategies

Innovation that is collaborative and has charaterisitcs such as co-development of products with parties involved *inter alia*, has its basis on Open Innovation. As reflected earlier in Table 2-1, Open Innovation is the latest generation of innovation, and has gained recognition across different industries (Banerjee et al., 2010; H. Chesbrough, 2017; H. W. Chesbrough, 2006; Ibrahimov, 2018; Ozkan, 2015).

In order to address the theme "**Sustainable product solutions**", an opportunity is presented for *Organisation A* to set itself in the path of collaborative product innovation, through Open Innovation strategies. In so doing, *Organisation A* will at the same time be addressing its strategic ambition of customer centricity. Importantly also because the market served is primarily market driven or market pull, collaborating with market participants will thus enhance relevance in the market.

5.2.1.2 Some important considerations for Open Innovation

Intellectual Properties

Intellectual Property (IP) protection methods and Open Innovation could appear to be strategies at odds with each other since one set out to protect knowledge while the other requires knowledge sharing.

The inherent nature of Open Innovation requires a paradigm shift from traditional tenets of IP rights such as knowledge creation and protection, to more open approaches of knowledge sharing and co-development, as cited by (Popov, 2018).

Loss of competitiveness and core competencies are viewed as some of the main concerns that sharing of IP may pose, as knowledge is disseminated to broader environments and potentially reach unwanted audience. As such, some IP strategies are often seen as disablers of Open Innovation efforts (Alexy, Criscuolo, & Salter, 2009).

It is therefore crucial that when expolring Open Innovation, IP strategies are aligned and integrated to afford organisations the best possible opportunities for value creation through leveraging innovation ecosystems.

Organisation A would therefore need to take these aspects of IP frameworks into close considerations within the context of Open Innovation strategies.

In an effort to aid organisations determine the most suitable IP strategies for different Open Innovation efforts, frameworks have been developed by several researchers in this regard. Amongst these are studies by (Alexy *et al.*, 2009; H. Chesbrough & Ghafele, 2014; Grimaldi, Greco, & Cricelli, 2021).

One example of such a framework that can be used to determine the most fitting IP strategies on different Open Innovation environments is by Alexy *et al.* (2009); illustrated in Figure 5-2.

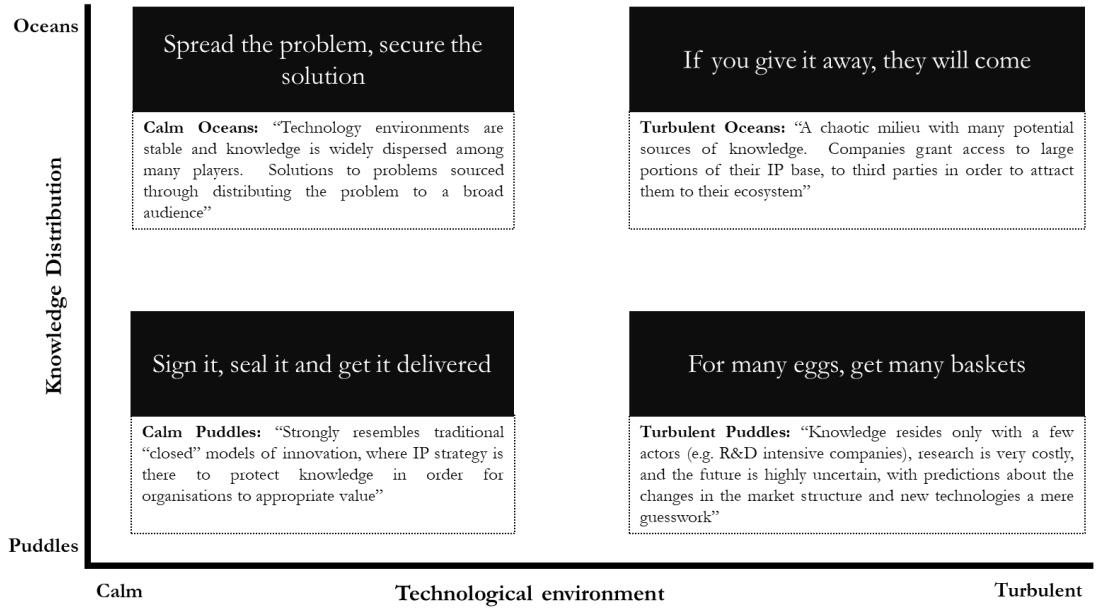


Figure 5-2: Intellectual Property strategies in different Open Innovation environments. Two critical determinants viz. knowledge distribution and technological environment, of the appropriate IP/Open Innovation strategies. Adaptation from (Alexy et al., 2009).

The model indicates possible IP/Open Innovation strategic combinations and outcomes. The authors emphasise two critical factors for consideration *viz.* the technological environment and the knowledge distribution among potential partners.

Innovation ecosystem: Partner selection

Partner selection is another important consideration when embarking on Open Innovation strategies. Due to high failure rates associated with partner selection, choosing the right partner has been indicated as one of the most crucial initial stages in the Open Innovation process, as this would determine the outcomes of the collaboration (Fortuin & Omta, 2008; Popov, 2018).

Popov (2018) states that leading companies in Open Innovation see collaborating partners as an extension of the organisation as a whole, therefore partners are in fact viewed as strategic alliances. To establish a chance at a successful strategic alliance, such companies have defined set of criteria for selecting potential partners, a partner selection playbook.

5.2.2 Competing priorities

Literature reveals that many organisations do not have well-communicated innovation strategies, or rarely articulate their innovation efforts to align with business strategies (Jung & Waiboer, 2007; Pisano, 2015).

Moreover, literature further emphasises that without innovation strategies, different parts of an organisation can find themselves pursuing conflicting priorities even in the existence of a clear business strategy (Cooper & Edgett, 2010; Pisano, 2015).

Another research study titled "*Commodity eats innovation for breakfast: A model for differentiating feature realization*", by Fabijan *et al.* (2016) also established that the case companies that were studies had no clearly articulated and communicated innovation strategies across the organisations, which created conflicting priorities particularly during project handovers.

The study further asserts that in the absence of the innovation strategy, the companies resorted to myopic interventions of mirroring their competitors when developing new products. These findings corroborated Pisano's position in the article titled "*You need an innovation strategy*"; which has been repeatedly stated throughout this document (Pisano, 2015).

The above assertions are exemplified by the theme, "**Competing priorities**", as emerged from this study.

Recommendations/Opportunity areas

5.2.2.1 Inter-functional collaboration strategies

The challenges faced by *Organisation A* to satisfy external demands such as the changing consumer landscape and customer demands, while at the same time balancing these with internal capabilities of the organisation such as cost management, were highlighted by participants. These competing dynamics, as significantly observed by the participants, reflected the *Organisation A* as being internally focussed, even within the different functions of the organisation.

As viewed by the participants, this behaviour promoted siloed ways of working or distanced inter-functional collaborations. On analysing the data, this was observed to be mostly due to different functions being driven by differing business and performance drivers. Therefore, a greater emphasis on cross-functional integration is recommended.

Because polymers product innovation is not perceived to form part of these key performance drivers, product innovation projects therefore get deprioritised as they were not considered business imperatives. It can be recalled from the findings of the study in Chapter 4 that polymers product innovation projects were perceived as a disruption to business.

In order to demonstrate that polymers product innovation projects are as value-creating as other types of innovation, it is recommended that project selection criteria be jointly developed by the business stakeholders involved in and responsible for the development, production, marketing and sales of polymers products.

These inter-functional collaboration strategies however require clearly defined goals and objectives. To this end, project selection criteria would therefore need to consider a cross cutting approach that converge the key business drivers across the different functions, while aiming to strike a balance between the organisation's capabilities and external demands.

The inter-functional collaborative efforts would also raised awareness across different departments, in relation to providing a broader understanding of different priorities and business drivers; particularly pertaining to commodity business.

At the same time, these collaborative efforts would provide blind spot checks to assess overly internally focussed practises within the business.

5.2.2.2 Innovation and Strategic Sweet Spots

One of the ways that can assist *Organisation A*'s decision makers to strike the desired balance between being overly internally focussed and satisfying external customers, is by assessing potential polymers product innovation projects through the three lenses of

innovation *viz.* Desirability, Feasibility, Viability; also referred to as the "*Innovation Sweet Spot*"(Orton, 2017). Figure 5-3 illustrates the three lenses of innovation.

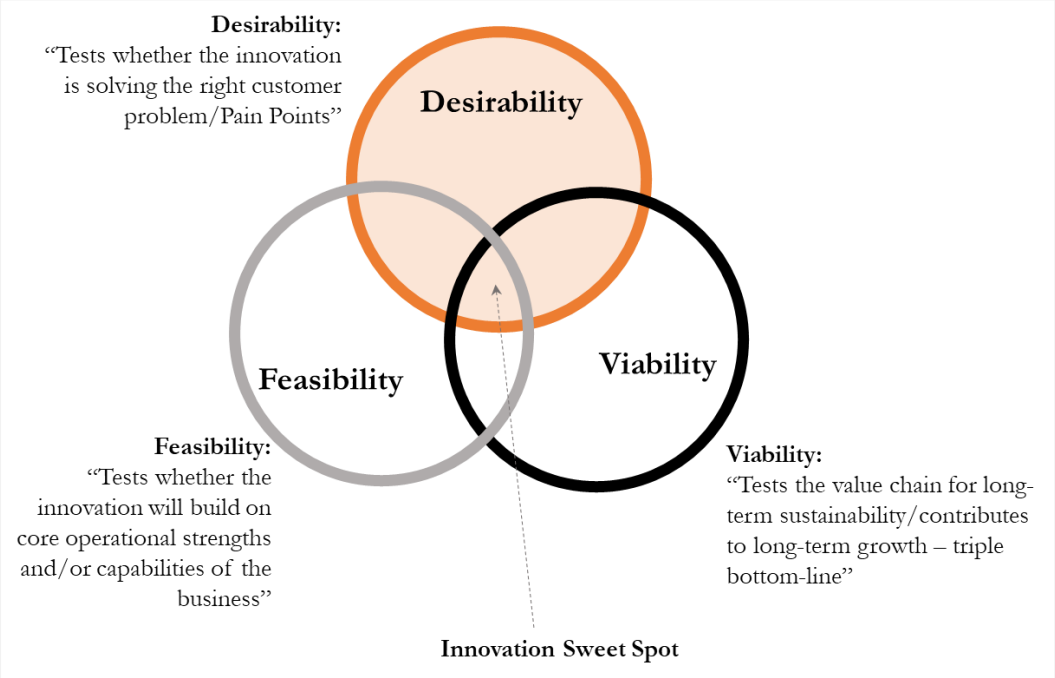


Figure 5-3: The three lenses of innovation, Innovation Sweet Spot. Adapted from (Orton, 2017).

The three lense assessment will not only scrutinise the internal capabilities of the organisation but it would at the same time fulfil the customer centric ambitions of the new business strategy, as well the sustainability aspect of product innovation.

The significance of striking a balance between one's internal capabilities and external demands within the context of where one operates is further emphasised by Collis and Rukstad (2008) with a similar model, the "Strategic Sweet Spot", outlined in Figure 5-4.

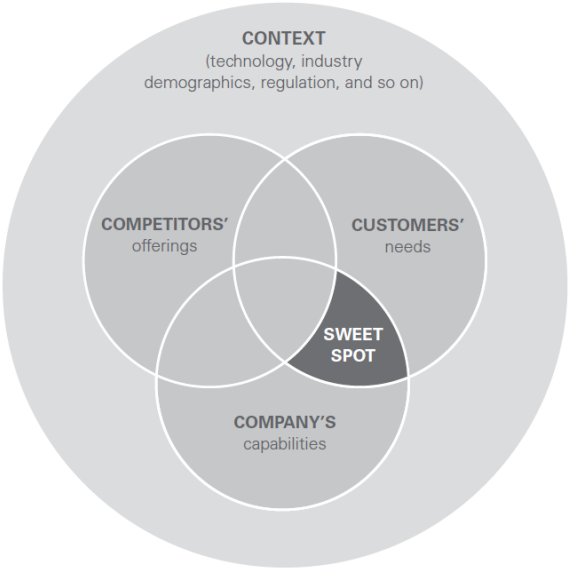


Figure 5-4: Strategic sweet spot.
Model by (Collis & Rukstad, 2008).

The authors explain the "*Strategic Sweet Spot*" as a point where an organisation "meets customers' needs in a way that rivals can't, given the context in which it competes".

5.2.3 Systematising product innovation

Innovation, as repeadly reported throughout this report, has become one of the top strategic priorities across many industries, ranking among the Top-three agenda for senior managers (Ringel *et al.*, 2020). At the same time, it is also reported that many organisations do not have systems and processes in place to monitor their innovation efforts.

This was also established from the findings of this study, as participants indicated the lack of well-articulated innovation strategies and processes for polymers product innovation.

An opportunity thus is presented out of the findings of the study, for *Organisation A* to improve on its articulation and communication of innovation strategies that are aligned with the business strategy and strategic focus areas.

Recommendations/Opportunity areas

5.2.3.1 Managing innovation: systems and processes

Irrespective of the type of innovation, innovation needs to be managed properly and needs an innovation strategy that is aligned to the business strategy.

As outlined earlier in Figure 2-12, innovation is a process that requires propoer process management. The steps: Inputs/Process(Throughput)/Outputs provide the management trail for innovation (J. Andrew *et al.*, 2007; J. P. Andrew *et al.*, 2009; Davila *et al.*, 2012).

The basis of systematising the process of innovation is to ensure that enough activities are progressed, and importantly those activities are the right type of activities to satisfy business ambitions. Furthermore, a structured approach to innovation can also maximise the organisation's ability to exploit its hidden and adjancent innovation potentials.

Ultimately innovation efforts should have a direct link to value creation, both financial and non-financial. Therefore measuring innovation efforts and ensuring that they can be translated into increased value, is an important aspect of innovation management.

Establishing appropriate innovation measurement metrics can be cumbersome, there are many to choose from as these innovation metrics have also been evolving over the years. As an example in point, the number of patents has been considered a proxy for innovation for many years, with this view changing over recent years (National Academies of Sciences & Medicine, 2017).

Relatively recent metrics such as product vitality, time-to-market, R&D productivity, Research Quotient, innovation success rate; are but a few newer emerging innovation metrics.

The BCG report on "Measuring Innovation" outlines some of the effective ways that organisations can track and measure their most important aspects of "return-on-innovation" (J. Andrew *et al.*, 2007). The authors recommend to organisations to measure their innovation efforts through the lens of the cash curve.

Figure 5-5 depicts an extraction of the referenced innovation measurement tool.

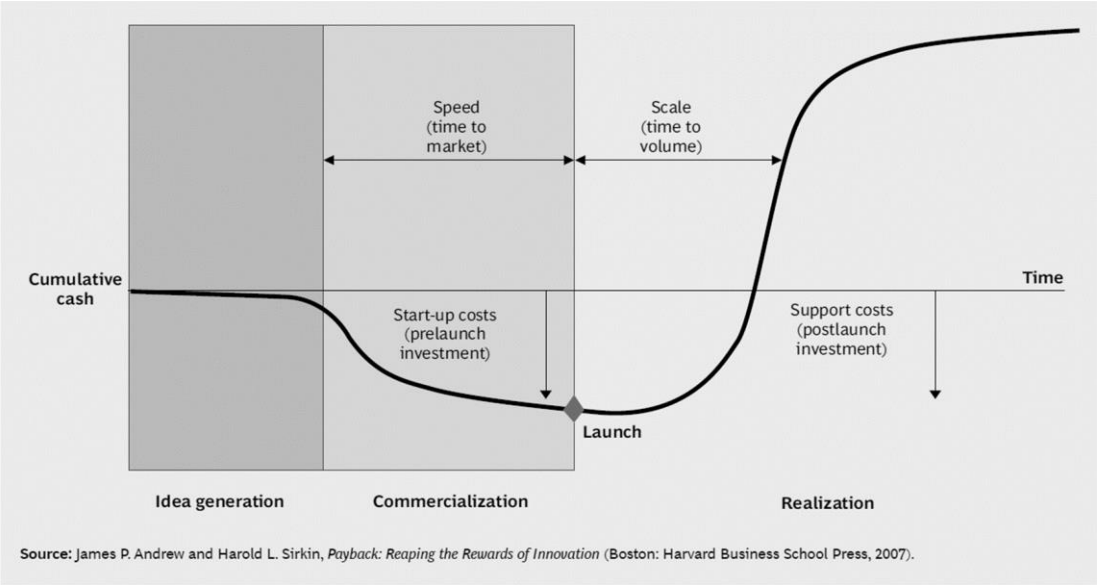


Figure 5-5: Cash curve tool, as a lens through which innovation measurements can be based. Model as cited by BCG (J. Andrew et al., 2007).

The curve exhibit four distinct measurement parameters, *viz.* "start-up costs or prelaunch investment; speed or time to market; scale or time to volume; and support costs or postlaunch investment" (J. Andrew *et al.*, 2007). These measurements viewed together with the innovation process framework, as shown in Figure 2-12, will enable the organisation to develop appropriate metrics to manage the innovation process.

The degree to which these four parameters can be measured will be dictated by the organisation's strategy and operational imperatives, as well as key risks that can be captured.

Due to the revealed risk averse culture of *Organisation A*, the ability of this innovation measurement tool to capture aspects of risk, makes this tool a particularly feasible consideration for *Organisation A*.

5.3 Concluding remarks

The overarching posture central to the findings of the study was the necessity to leverage *Organisation A*'s internal capabilities while at the same time satisfying the

external demands within the context where the company operates, so as to remain relevant within the changing landscape.

Based on the findings of the study, three key strategies or opportunity areas were identified for *Organisation A*. These are summarised as follows:

1. **External collaborations: Through exploring Open Innovation strategies**

It is apparent that with the changing consumer landscape, the polymers value chain participants are increasingly co-creating and co-developing product solutions with their suppliers and producers in order to come up with sustainable product alternatives.

Opportunities for Open Innovation strategies present themselves for *Organisation A*, in responding to the changing consumer landscape while at the same time addressing its business strategy ambition of customer centricity.

While Open Innovation offers many benefits, it would also be prudent for the organisation to acquaint itself with other important considerations that may be brought by Open Innovation, such as partner selection.

Also, the organisation's IP structures would need to be aligned with the requirements of Open Innovation, for this type of collaborative strategies to be successful.

2. **Internal collaborations: Through forging inter-functional interactions**

It was ascertained that polymers product innovation efforts were considered a disruption to business due to conflicting priorities with business drivers. Inter-departmental collaborations are considered a way to improve on these frictions.

Through these inter-company collaborative strategies, relevant stakeholders can jointly develop project selection qualifying criteria; which takes into consideration approaches that converge the key business drivers across the different functions.

Furthermore, the inter-departmental collaborations can serve as blind spot checks for overly internally focussed practises within the business.

Using models such as the three lense assessment of innovation, "*Innovation Sweet Spot*" can be asscertained; where a balance between internal capabilities and external demands can be ascertained.

3. Innovation management systems

Regardless of the type of innovation pursued, innovation requires proper management, against an innovation strategy that is aligned to the business strategy. Structured approaches to innovation enable organisations to maximise their abilities to exploit their latent and adjacent innovation potentials.

It is also important to identify appropriate innovation metrics and constantly measure innovation efforts. Using frameworks such as BCG's cash cost curve, appropriate innovation measurement metrics can be established.

The measurement tool takes into account key risk aspects; which is an important consideration with relation to *Organisation A*'s risk averse culture, as identified from the findings of the study.

It should also be mentioned that the above discussed proposed opportunity areas are based on the holding assumption that product innovation for the products under study, is considered an important business imperative for the *Organisation A*'s business prosperity.

It is also acknowledged that there may be other categories of innovation pursued by the organisation; which may rank higher in priority than product innovation for the products under study. In such cases, it would be for the organisation's discretion to consider the most fitting innovation efforts to be pursued for its business ambitions.

6 SUMMARY, CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS

6.1 Summary

Within the context of *Organisation A*'s recently announced business strategy, it was the intent of this study to ascertain innovation strategies that will support the new business strategy, particularly within the ambit of market focus and customer centricity as these are some of the key focus areas of the new business strategy.

Establishing *Organisation A*'s product innovation pulse was therefore core to the study. The products under study, polymers products; were purposefully selected due to the unique challenges they face.

The first of these challenges being the increasing environmental, legislative and societal pressures and demands for more sustainability and circular usage of the products, in an attempt to reduce the growing waste footprint associated with the products in the environment.

In this manner, a number of product segments have been identified for fundamental redesign as these are considered hard to recycle. New product innovations are thus anticipated and progressed by industry participants (De Smet, 2016). This has as a result galvanized value chain wide collaborations and partnerships in addressing the challenges (Mrowiec, 2018).

As it was established from the study, customers are becoming more innovative and require the same from their product suppliers. *Organisation A ,* as a polymers producer and therefore a key value chain player, would therefore be expected to take heed of these developments, particularly in light of the organisation's customer centricity ambitions.

The second challenge faced by the products under study is being commodity products at the mature lifecycle phase and most serving mature markets. The products therefore come up against market specific considerations, product price being forefront on

customers purchasing decisions. By extension, this therefore becomes a key cost structure consideration for producers.

As product innovation is seen as an additional production cost, associated product innovation efforts generally receive exceptional scrutiny within the organisation, as the study revealed.

The study further revealed two views regarding product innovation. On the one hand, product innovation efforts are perceived as a disruption to business processes. The other view was that the organisation as overly risk averse and unsupportive of product innovative ambitions, therefore may be perceived as not heeding the demands of customers.

Organisation A as a result finds itself stretched in striking a balance between its internal capabilities as dictated by the business dynamics of operating within a commodity environment, as well as external demands through the changing consumer landscape.

These observations seemed to also emanate from the lack of well communicated innovation strategies and innovation management systems.

6.2 Conclusions and Recommendations

The main objective of the study centred around how innovation was pursued and undertaken for *Organisation A*'s polymers products. In answering this question, the organisation's product innovation pulse was ascertained. This innovation landscape was outlined against the backdrop of the new business strategies. At the same time, the most fitting product innovation strategies for the new business strategy were assessed.

The study revealed that the perceptions held within business were that polymers products innovation was not a forefront imperative for the business.

According to most of the study participants, this manifested as a business that was unsupportive of product innovation endevours, a business that was overly risk-averse, interally focussed, and only rewarded other types of innovation such as manufacturing

process innovations. As a result, only incremental, sustaining innovations that would not disrupt business were embraced.

The underpinning constructs for these perceptions, from the business pespective were the constraints inherent with operating within the commodity business context, with mature products, where margins and cost pressures are a reality. Competing priorities then present themselves where a balance between internal capabilities and external demands has to be struck.

This becomes a significant consideration in light of the evolving polymers consumer landscape, demanding possible redesigning of products to more environmentally friendlier and sustainable alternatives. With product innovation seen as cost, commodity product producers are ever cautious of low cost-to-serve targets for the products that are already under margin pressures as competition is largely price-based.

At the same time, producers need to also be aware of the commodity trap, where they can find themselves spiralling further downhill on increasing price and margin pressures (Roland Berger Consulting, 2014; Zysman, 2014).

Understanding the product and organisation's position in the lifecycle is an important consideration when companies whose core business is maturing; where incremental or sustaining innovations may not adequately move the needle if the company is targeting greater growths. As Lafley and Charan (2008) as well as (Pisano, 2015) posit, such companies may need to explore opportunities through different types of innovation, such as disruptive innovation (Christensen, 2013).

Open Innovation strategies offer *Organisation A* opportunities to revolutionise product innovation by applying the principles of bringing external innovation internally. And importantly, these strategies can also enable the organisation to enable customer centric innovations.

Certain important considerations present themselves when exploring collaborative partnership strategies. Chief amongst these being the treatment of Intellectual Property within the realm of knowledge sharing as compared to the traditional knowledge

protection. Supportive IP frameworks would need to be developed for such collaborative partnership undertakings.

It is also recommended that closer inter-company and inter-functional collaboration strategies be promoted as one key way to address the issue of conflicting priorities and perceived value creation. With these internal collaborations, business entities involved in and associated with the development, production, marketing, selling and support of polymers products could jointly define value creating criteria for product innovation projects.

This undertaking can afford *Organisation A* an opportunity to also ascertain its "*Innovation Sweet Spot*"; where a substantiated balance between internal capabilities and external demands can be established, through the three lenses of innovation *viz.* Desirability, Feasibility, Viability (Orton, 2017).

The benefits would include employees across the different functions better appreciating the business drivers that need to be satisfied within the realm of a commodity business, while at the same time allow for a blind spot assessment where the organisation may be overly risk-averse and internally focussed.

Also evident from the study was the absence of well communicated innovation strategies and systems. In the absence of such, different ends of the business may appear at odds with each other. Therefore to support all these recommended endevours and rally the organisational efforts towards achieving the business strategy ambitions in an aligned manner, well articulated innovation strategies would need to be established and communicated.

In ensuring that the right innovation efforts and right amount of innovation activities are progressed, appropriate innovation metrics would need to be established.

It should also be mentioned that the above proposed strategies and opportunity areas are based on the holding assumption that product innovation for the products under study, is considered an important and integral business imperative by the organisation.

It is also acknowledged that there may be other categories of innovation pursued by the organisation; which may rank higher in priority than product innovation for the products under study. In such instances, it would therefore be for the organisation's discretion to appropriate the most fitting innovation efforts to be pursued for its business ambitions, with a key emphasis being on well articulating such innovation efforts.

6.3 Limitations

The study is limited to polymers products for the organisation under study. Therefore the findings of the study are limited to these specific products under the business environment of *Organisation A*. It is also acknowledged that the results may not necessarily be translated to other products within *Organisation A*'s wide product portfolio.

As outlined, the products of interest are commodity products, it may also be a worthy follow-up investigation to explore how *Organisation A* approaches product innovation for other commodity chemical products within its portfolio of products, with an awareness of course that different dynamics would exist for the different markets that those products may be serving.

Similarly, as this study's focus was solely on *Organisation A*, the findings of the research may not necessarily translate proportionately to other organisations with similar polymers products. Further research may consider deep dive investigation and benchmarking with other peer organisations.

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APPENDICES

Appendix 1.1: Data collection instrument

Appendix 1.1.1: Data collection instrument

Data collection instrument
• How important is innovation to the polymers products? • How do you understand innovation within the business unit? • What are the drivers of innovation for polymer products? • How have these evolved over time? • How do resource allocation, competencies, and capabilities support innovation efforts?
• How does R&D fit into the innovation process for polymers products? • What drives R&D projects and initiatives for polymers products? • What are the defined objectives for product innovation? • What type of innovation efforts are pursued? • How important are customer inputs in the innovation process? • How is customer feedback obtained and incorporated in the innovation process? • How is the product lifecycle and product maturity taken into account during product innovation for polymers products? • How are regulatory, environmental and societal demands taken into account during polymers product innovation? • How does IP support innovation efforts for polymers products?
• How is innovation managed and measured – what innovation metrics used? • How satisfactory are the innovation measures used? • How is innovation incentivised?

Appendix 2.1: Biography of the researcher

Marang Norah Maithufi has a PhD in Polymer Chemistry from Technische Universiteit Eindhoven, The Netherlands. The study focused on the development of polymeric materials aimed to improve cold flow properties of middle distillate fuels.

Marang has over 16 years' experience in the petrochemicals and chemicals industries, with roles spanning strategy and business analyst, research scientist in Research and Development (R&D) environments, product development and product quality improvements with interest in innovation and sustainability.

Appendix 2.2: Ethic documentation

Appendix 2.2.1: Ethics Clearance and Protocol document

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

SCHOOL OF GRADUATE SCHOOL OF BUSINESS ADMINISTRATION ETHICS COMMITTEE
CONSTITUTED UNDER THE UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER WBS/BA2272810/354**
PROJECT TITLE	Determining product innovation strategies that will support Organisation A's new reset business strategy
INVESTIGATOR	Dr Marang Maithufi
SCHOOL/DEPARTMENT OF INVESTIGATOR	MBA (Consultancy Project)
DATE CONSIDERED	24 November 2020
DECISION OF THE COMMITTEE	Approved unconditionally
RISK LEVEL	LOW RISK
EXPIRY DATE	30 JUNE 2021

ISSUE DATE OF CERTIFICATE 15 December 2020 **CHAIRPERSON** __ _____
(Dr MDJ Matshabaphala)

cc: Supervisor: Mrs Mupfawa

Appendix 2.3: Ethics documentation

Appendix 2.2.2: Participant consent form





PARTICIPANT CONSENT FORM

Title of project: "*Product innovation strategies that support an organisation's reset business strategy*".

Name of researcher: Marang Norah Maithufi

I, ……..……..……., agree to participate in this research project. The research has been explained to me and I understand what my participation will involve.

Please circle the relevant options below.

I agree that my participation will remain anonymous	**YES**	**NO**
I agree that I may be audio and/or video recorded during the interview	**YES**	**NO**
I agree that the information on the audio/video recordings may be used anonymously in the research report	**YES**	**NO**
I agree that the researcher may use anonymous quotes in his/her research report	**YES**	**NO**
I understand that the video and/or audio recordings and transcripts will be stored in a password protected computer	**YES**	**NO**

Name of participant: ……. Name of researcher: ……...

Signature of participant: …… Signature of researcher: .....……

Date…….……... Date: ……

Appendix 2.2.3: Participant information sheet



Participant Information Sheet

Good day

My name is Marang Norah Maithufi, I am an MBA student at Wits Business School, University of the Witwatersrand, Johannesburg. As part of my studies, I have to undertake a research project. The aim of this research project is to determine product innovation strategies for a selected company, referenced as *Organisation A*. For confidentiality reasons, a pseudonym of "*Organisation A*" has been adopted in referencing the organisation under study.

As part of this project, I would like to invite you to take part in an interview. Due to the prevailing Covid-19 conditions, the interview will take place virtually via one of the business meeting platforms such as MS Teams. The interview will take approximately 60 minutes. With your permission, I would also like to record the interview session.

There will be no personal costs to you if you participate in this interview. You will not receive any direct benefits from participation but there are also no disadvantages or penalties if you choose not to participate or if you withdraw from the study. You may withdraw at any time or not answer any question if you do not want to. The information shared will be held in confidence, securely and not disclosed to anyone else.

Your identity will be kept anonymous. I will be using a pseudonym to represent your participation in my final research report. If you have any questions during or afterwards about this research, feel free to contact me on the details listed below.

If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrec-medical.researchoffice@wits.ac.za

Yours sincerely,

Researcher: Marang Norah Maithufi

Supervisor: Shungu Mupfawa