Innovation Management: From a Conceptual Framework to the Design and Development of an Idea Management Tool



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Supervisor: Dr Theuns Dirkse van Schalkwyk

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Abstract

Large corporations are often disrupted by innovative organisations and then they lose their competitive advantage. For organisations to survive today's competitive marketplace, it is crucial for them to be innovative. Therefore, it is important for organisations to manage their innovations effectively to ensure that their business grows and remains relevant.

Managing innovation is not an easy task and requires that many different components of an organisation and its market should be in place and are managed well. Organisations should not take innovation lightly, but they should ensure that it is managed with care, just as they manage any other resource.

Many times, organisations do not know where to start managing their ideas and innovations so that they can increase their competitive advantage. The research seeks to find all the different factors within the organisational and external domains that need to be taken into consideration when dealing with innovation. The different factors are used to develop a conceptual framework that describes the different concepts and their relationships with one another. The concepts are obtained from literature and then categorised and synthesised to form the conceptual framework.

The conceptual framework does not aim to be an improvement of existing innovation models, but rather to give an understanding of the factors that need to be taken into consideration when organisations want to start the journey of managing their innovations.

In order to validate the conceptual framework, an idea management tool is developed that assists with the implementation of an innovation strategy and framework at an organisation that wants a more defined and official innovation management process.

The result of the research is a conceptual framework that can be used by organisations to assist with the development and implementation of an innovation strategy. It could also give a better understanding of the innovation management sphere and where to start, in order to implement it. The framework also highlights where idea management tools can be useful within the process to assist organisations with managing innovations effectively.

Opsomming

Groot besighede verloor dikwels hul mededingende voordeel teenoor ander innoverende organisasies wat binne dieselfde mark as hulle funksioneer. Om in vandag se kompeterende mark te kan oorleef, is dit noodsaaklik vir organisasies om innoverend te wees. Dit is dus belangrik vir organisasies om innoverende idees op 'n effektiewe manier te bestuur en sodoende te verseker dat hul besigheid groei en relevant bly.

Dis nie 'n maklike taak om innovasie te bestuur nie, en dit vereis dat sekere belangrike aspekte in plek moet wees vir innovasie om in die mark en besigheidsplek te kan floreer. Innovasie is nie 'n kwessie wat besighede ligtelik moet opneem nie, maar dis iets wat bestuur moet word met dieselfde sorg wat enige ander hulpbronne bestuur sou word.

Organisasies weet egter nie altyd waar of hoe om hul idees en innovasies te bestuur om hul mededingende voordeel te kan bevorder nie. Die navorsingstuk ondersoek verskeie faktore binne die besigheidsomgewing en eksterne omgewing wat in ag geneem moet word wanneer innovasie ter sprake is. Die verskillende faktore word later gebruik om 'n konsepsuele raamwerk te skep om die verskillende konsepte asook hul verwantskappe met mekaar te verduidelik. Die konsepte word deur die beskikbare literatuur oor die onderwerp geidentifiseer en gekategoriseer om die raamwerk te skep.

Die doel van die raamwerk is nie om bestaande innovasie modelle te verbeter nie, maar eerder om die verskillende faktore uiteen te sit wat oorweeg moet word wanneer 'n organisasie beoog om hul innovasies beter te bestuur.

'n Innovasie-bestuur sagteware stelsel is geskep om die validasie van die konsepsuele raamwerk meer prakties te kon doen. Die raamwerk en stelsel is getoets by 'n organisasie wat die behoefte het om hul innovasie-bestuur proses te verbeter, en dit het die organisasie gehelp om die waarde van 'n innovasie strategie en stelsel te kon raaksien.

Die navorsing het bewys dat 'n konsepsuele raamwerk organisasies kan help om 'n innovasiestrategie te formuleer en te implementeer, asook om innovasie bestuur en die implementering daarvan beter te verduidelik. Die raamwerk lig ook uit hoe innovasie-bestuur hulpbronne organisasies kan help om hul innovasies beter en meer effektief te kan bestuur.

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1. Introduction

1.1. Introduction

Businesses continually look for ways to improve their business model, products, customer relations, efficiency, and ultimately their profits – they want business growth. It has, however, become a challenge for companies to remain relevant, as markets are changing more than ever before and it gets easier to obtain knowledge.

Innovation is considered to be essential for organisations to stay relevant. Tidd & Bessant (2014) state that innovation contributes to the competitiveness of an organisation and is a strategic resource that organisations can use to reach their objectives. Organisations that mobilise knowledge, technological skills and experience to create novelty in their offerings – whether it is a product or a service – see growth and success within their organisation time and again.

In the 1950s, Professor Moses Abramovitz from Stanford University went on a quest to discover why companies and governments experience growth. His findings were contrary to the popular belief of the time that the main drivers of growth are capital and labour inputs. Thus, if companies/organisations were to increase capital and labour, growth would be the response. Abramovitz found that this was true, but that capital and labour only contributed 15% to growth, leaving the remaining 85% unaccounted for (Abramovitz, 1956). Later, other economists conducted a similar study, but with different methodologies, and they came to the same conclusion of an 85% residual. This residual convinced many economists that technological innovation has a significant impact on growth (Rosenberg, 2004).

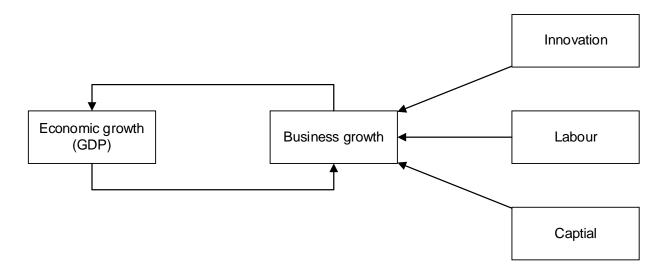


Figure 1.1: Inputs for growth

An increase in innovation is not only important for organisations, but for individuals too, as the well-being of the citizens of a country runs in parallel with the Gross Domestic Product (GDP) of the country, which can be sparked by business growth. An increase in GDP will mean that the overall well-being of the population will increase, which will also result in higher tax revenue, a decrease in unemployment, and an improvement in business confidence. GDP is the measure for economic growth; economic growth is vital for business growth, and business growth is vital for economic growth (Jordaan, 2013). An innovative business can therefore have a positive impact on the economy, and in return, create an economic environment in which the organisation can grow to an even greater extent.

Innovation has been the subject of numerous research studies. It is not a concrete object or subject, but rather an abstract concept that defines a phenomenon. Klein and Sorra (1996) define innovation as a new technology/product, service or process that improves individual and organisational performance.

The challenge for leadership within organisations today is to have a successful innovation process that is embedded in their business model. It is important for leadership to understand the innovation process, as well as the external and internal factors that can spark more innovation within the organisation (Tidd & Bessant, 2018). Organisations need to find the right balance between traditional structures that ensure continual growth, and the willingness to adapt to change to remain relevant. Organisations that have robust innovation processes in place, will be leaders in their respective industries (Desouza, Dombrowski, Awazu, *et al.*, 2009). Companies cannot rely on chance when it comes to innovation; innovation needs to be managed just like any other resource or process in an organisation.

Isomäki (2018) wrote the following:

"Innovation simply does not have room to grow if all systems are built on the notions of predictability, deadlines, and optimisation."

Organisations need to look for new ways to enhance innovation continually, but this requires a clear strategy and determination from leadership and employees to reach their goals. The research topic originated from the perception that companies struggle to be innovative, due to a lack of understanding of the importance of the innovation management processes.

1.2. Problem statement and research questions

1.2.1. Problem statement

Innovation is not something that simply occurs. There are various factors that organisations need take into account for innovations to thrive within the organisation. There are several factors related

to innovation management that organisations need to consider when they set out to create a more robust innovation management process, such as innovation process models, innovation strategies, idea management, external- and internal factors influencing innovation, etc.

Most existing organisations ended up where they are, because they were innovative at some point in time (Kim & Mauborgne, 2004). It is, however, quite common that large organisations become less innovative over time, and that start-up companies do not implement robust innovation management processes. Some examples of large organisations that failed to remain competitive are Woolworth, Blockbuster Video, and Montgomery Ward. All these companies lost significant market shares after more innovative organisations dethroned them from their respective industries (Deeb, 2014).

The purpose of this research is to develop and validate a conceptual framework that shows the relationships between the different concepts within the innovation management body of knowledge, or more specifically, the concepts that impact and drive the innovativeness of an organisation. The framework will focus on concepts both internal and external to an organisation. The researcher hopes that this framework will be a useful tool that organisations can use to implement innovation management strategies, processes and systems more effectively.

An idea management tool will also be developed based on requirements that may come from literature and the conceptual framework. The tool's role will be to assist with the validation process by acting as a system that could facilitate the implementation of innovation management at an organisation. The tool will not integrate the conceptual framework as a whole, but rather the parts of the framework that would be applicable for such a tool.

1.2.2. Research contribution

The high-level research contribution of this study is a conceptual framework that can assist organisations with having a more structured and goal-oriented approach to innovation management. The framework could help organisations achieve this by showing the different concepts and innovation-drivers within innovation management and how they relate to each other. The framework does not only focus on the innovation process, but also on all the aspects that could influence the innovativeness of an organisation.

The low-level research contribution is that the conceptual framework was validated using a case study at an active organisation. The framework was used by a young and innovative software company that develops a dynamic modelling solution to the actuarial and financial industry. The observations and feedback derived from the validation process are based on a practical implementation of the framework at an organisation that operates in a highly competitive market. The framework and case study were deemed to make valuable contributions to their innovation

management process that is required to keep them competitive. This finding gives some credence that the framework contributes to the innovation body of knowledge.

1.2.3. Research questions

The following set of questions will guide the research:

- 1. What is innovation management?
- 2. What are the main drivers that increase the innovativeness of organisations?
- 3. What components are present in the innovation management process?
- 4. How do the different components relate to one another?
- 5. What innovation process models have been developed and how can they be implemented?
- 6. What would an idea management tool entail?
- 7. What is the role of an innovation strategy in an innovation management process?
- 8. What will a system look like that benefits both employees and their organisation?

1.2.4. Importance of the research problem

The importance of innovation has been proven time and again. The development of systems that increase the innovativeness of organisations will lead to a competitive advantage for the organisation, as well as for the country in which the organisation is based. Essentially, an improved innovation management process could increase the chances of competitive advantage, business growth and economic growth (Abramovitz, 1956).

1.3. Research objectives

The proposed research objectives will answer the research questions discussed above. The research questions are categorised into phases, where the categorisation is based on the research approach that will be discussed in the next section.

- Phase 1:
 - Perform a literature review to find answers to the research questions.
- Phase 2:
 - Develop a conceptual framework of innovation management.
 - Define the requirement of an idea management tool.
 - Design and develop an idea management tool.
- Phase 3:
 - Validate the conceptual framework and tool.

1.4. Research approach and methodology

A conceptual framework will be developed to assist organisations in understanding the role of innovation management, as well as the relationship between the different components of innovation management. Jabareen (2009) describes a conceptual framework as a network consisting of concatenated concepts that provide a complete understanding of a phenomenon. The researcher will thus set out to identify the different concepts of innovation management, in order to broaden the reader's understanding of the topic at hand.

The research strategy will have a qualitative approach and will be based on the conceptual framework analysis (CFA) process described by Jabareen (2009). This process is based on the Grounded Theory methodology which was first developed by Strauss & Corbin (1998).

The research will be performed in four stages. First, research will be done to gain knowledge of the innovation management phenomenon. Second, a conceptual framework will be developed parallel to the design and development of an idea management tool. Finally, the fourth stage will validate the conceptual framework and tool.

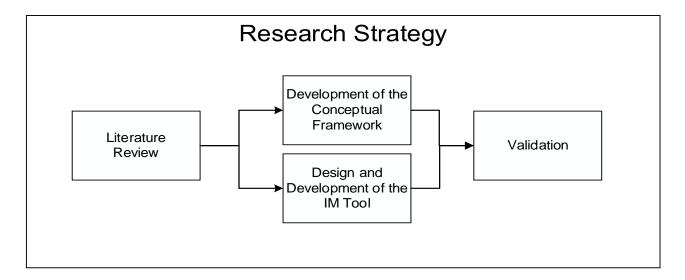


Figure 1.2: Research Strategy

The overarching research methodology will be the conceptual framework analysis, while the design and development of the idea management tool will follow the Design Science methodology. Finally, the conceptual framework will be validated using a case study.

The research strategy depicted above will be implemented in this study. The CFA methodology was selected as Jabareen (2009) constructed this research method in such a way that multiple bodies of knowledge can be investigated and used to construct a multi-disciplinary conceptual framework. The research paper will consist of the following eight different phases as described by (Jabareen, 2009):

Phase 1: Map data sources

During this phase, sources of different disciplines found in innovation literature that gives a better understanding of the phenomenon, will be mapped out. A literature review will be performed in this phase of the research.

Phase 2: Reading and categorisation

Concepts that have been gathered in the literature review will be categorised according to their discipline. This phase establishes a constructive representation of each discipline.

Phase 3: Identify concepts

This phase allows for concepts within the CFA process to become visible within the literature. The selected literature must be read numerous times to establish a good understanding of the subject.

Phase 4: Deconstruction & categorisation of concepts

The attributes, characteristics, assumptions and role of each concept will be identified during this phase. Each concept will be divided into four different columns, i.e. the name of the concept; a description of the concept; a categorisation of each concept according to its epistemological, ontological, or methodological role; and the references of each concept.

Phase 5: Integrating the concepts

Merge the concepts that have similarities. This will allow for fewer concepts which make the information easier to manage and to synthesise the concepts.

Phase 6: Synthesis

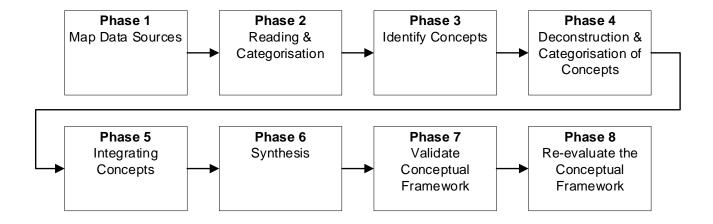
The concepts must be synthesised into a theoretical framework. This phase is iterative and should be repeated until the framework is sensible.

Phase 7: Validate conceptual framework

Consult other scholars and practitioners regarding the framework. It should make sense to them as well.

Phase 8: Re-evaluate the conceptual framework

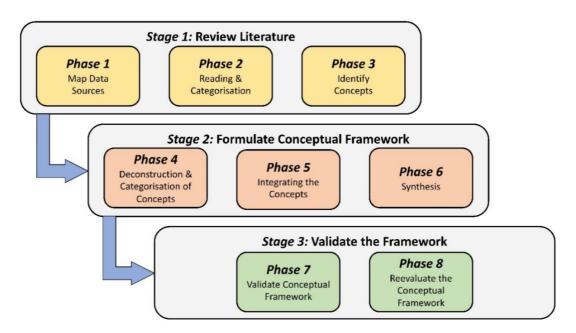
Revise the framework as new insights and literature arise.



Adapted from: (Jabareen, 2009)

Figure 1.3: Conceptual framework analysis

The Grounded Theory methodology is the foundation of this conceptual framework analysis (CFA) methodology. The phases of the CFA methodology are depicted in Figure 1.3 and they have been adapted to form the strategy for the research. Figure 1.4 shows where each phase of the conceptual framework analysis fits into the various phases of the research.



Adapted from: (Jabareen, 2009)

Figure 1.4: Research strategy

1.5. Scope and limitations of the research

1.5.1. Scope

The scope of this research project is to first gain an understanding of the innovation management field. The research will lead to a conceptual framework and the design and development of a software tool.

1.5.2. Limitations

The research questions have the potential to lead to subjective answers, which is not desirable. The bias, however, can be minimised to reach a higher level of objectivity. Time available to implement and validate a conceptual framework and idea management tool might be limited, as adequate implementation might require several years to observe the outcomes thereof.

1.5.3. Assumptions

The research originated from the assumption that some employees do not share all their ideas which could lead to possible innovations. The assumption is based on the perception that some employees would rather start their own business than share their ideas, or they will not share an idea at all, because they believe that they will not be rewarded for their contribution. Thus, the researcher wants to research the innovation management phenomenon, to gain an understanding of how organisations can ensure that they are innovative, and that their employees can also reap the benefits.

1.6. Conclusion

This chapter introduced the reader to the subject of the project, and it defined the problem statement along with the research strategy that the researcher will use. The objective of this research paper is for the researcher to gain knowledge of innovation management and to develop a conceptual framework using the conceptual framework analysis (CFA) methodology. An idea management tool will be designed and developed with the purpose of validating the framework and making improvements to it. It will also serve in a pilot with an organisation in managing their innovation processes and creating a space where employees can share their ideas and knowledge. A literature review of innovation management will follow in the next chapter.

2. Literature review

Innovation has been part of the human DNA since the need for survival began. But only recently did academics realise that the reason behind growth in the global economy is owed to innovation. Therefore, there is no doubt that innovation is an essential factor in gaining social and economic value.

The need to increase and manage innovation is growing rapidly. Some organisations are actively seeking to remain at the forefront of innovation, while others lack the urgency, which could steer their business into a steady decline. In their book "Making Innovation Work", Davila, Epstein and Shelton (2006) identify seven innovation rules that could steer organisations towards successful innovation:

- 1. Exert strong leadership regarding innovation strategy and portfolio decisions;
- 2. Integrate innovation into the company's underlying business mentality;
- 3. Align innovation with company strategy;
- 4. Manage the natural tension between creativity and value capture;
- 5. Neutralise organisational 'antibodies';
- 6. Include people and knowledge in the organisation both internally and externally; and
- 7. Create the right metrics and rewards for innovation.

These 'rules' could serve as a guideline for what innovation management might look like and identify the important aspects of the innovation management process. This chapter will review the available literature to gain an understanding of the innovation management phenomenon, and it will serve as the foundation of the conceptual framework analysis.

2.1. The impact of innovation on economic and business growth

Organisational activities must yield some return. It is of no value to an organisation to implement a strategy that will not lead to growth. First, the question needs to be asked: Does innovation lead to business growth, and if so, how does it happen? Business growth is not only crucial for companies and small businesses, but also for the government – and that which is important to the government should also be important to the citizens of the country.

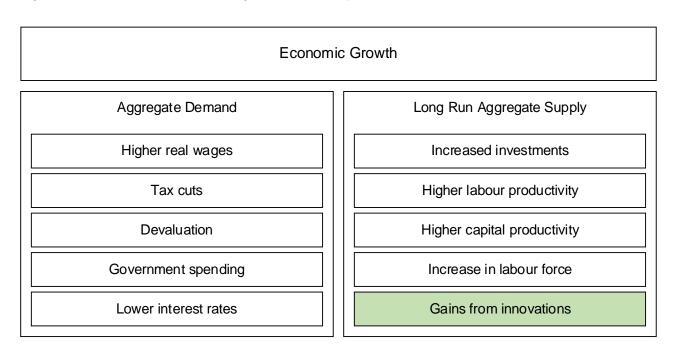
Tidd and Bessant (2018) write:

"While competitive advantage can come from size or possession of assets, the pattern is increasingly coming to favour those organisations that can mobilise knowledge and technological skills and experience to create novelty in their offerings (products/services) and how they create and deliver those offerings."

Economic growth is essential for the social and economic welfare of a country. It is measured as Gross Domestic Product (GDP) that measures the market value of all final goods and services delivered within a specific time frame. The higher the GDP of a country, the higher the well-being of the citizens in the country.

Two factors influence economic growth according to Pettinger (2016): Aggregate Demand (AD) and Aggregate Supply (Long Run Aggregate Supply, LRAS). Aggregate demand refers to the total demand for services and goods in a country, whereas LRAS is the value of services and goods that companies can provide to a country's economy (Economics Online, 2020).

Figure 2.1 lists some of the drivers of economic growth where it is evident that innovation contributes to aggregated supply. This means that an increase in innovation within organisations will lead to economic growth. It has been found that shifts in LRAS mainly take place due to technological innovations (Dutt, 2006). Tidd and Bessant (2018) state that innovation not only matters for organisations, but for the well-being of the economy too.



Adapted from: (Dutt, 2006)

Figure 2.1: Building Blocks for Economic Growth

In 1956 Professor Moses Abramovitz published a paper that investigated the increase of aggregated output per capita. In addition to this, he tried to establish whether capital input or an increase in labour had the highest impact on economic growth. He measured economic growth by using the output of the American economy, and the growth with respect to capital and labour inputs. The data used ranged between 1870 and 1950. His study concluded that the traditional measures for

economic growth – capital and labour – only contributed to 15% of the economic growth, leaving a residual of 85% (Abramovitz, 1956).

According to Rosenberg (2004), a colleague of Professor Abramovitz at Stanford University, other economists conducted similar studies using different methodologies. They came to a similar residual percentage that could not be explained. The size of this residual then convinced many economists that innovation, specifically technological innovation, was the driver of economic growth.

Statistics Canada also found that the following factors describe successful organisations (Tidd & Bessant, 2018):

- Innovation has consistently been found to be the most important factor associated with success.
- More substantial growth can be seen in innovative organisations than in organisations that are not innovative.
- Organisations that have the largest market share are usually those who are innovative.

Consequently, it is abundantly clear that innovation plays a significant role in advancing economic growth. When the economy of a country is thriving, it leaves space for businesses to grow as well. Business growth and economic growth walk hand in hand and can push each other forward or hold each other back. The one cannot progress without the other. But an increase in innovation does not necessarily mean that a company will experience growth, and expenditure on research and development (R&D) will not inevitably lead to successful innovations, according to Rosenberg (2004). That is why innovation management is important to ensure that the correct innovation projects are pursued.

2.2. Innovation

Innovation is a word that has become popular over the last century, not because it is a pleasant word to say, but because the necessity and importance of innovation has been realised by businesses and governments. Innovation is a crucial part of ensuring that an organisation has competitiveness, growth and profitability (Gerlach & Brem, 2017; Rossela, 2015).

Kim and Chung (2017) also state:

"Organisations often adopt innovations as their top priority to survive the severe global competition and the rapidly changing business environment."

Nevertheless, the question remains unanswered as to what innovation is and how it is defined.

2.2.1. Defining innovation

The definition of innovation is something that every researcher in this field must define from the start when writing a research paper on the topic. It is vital to have a clear understanding of what innovation means before the research commences. Unfortunately, the dictionary definition of innovation is not adequate. Merriam-Webster (2016) defines innovation as "the introduction of something new". This definition implies that if something is new and is introduced in any sort of setting, it can be classified as an innovation. This definition of innovation is unclear and can cause much confusion. This thesis does not aim to do an in-depth analysis of the definition of innovation, but this section will, however, pinpoint different definitions of innovation based on previous research.

Tomas Alva Edison, one of America's most successful innovators and the inventor of the lightbulb, understood well that the challenge of innovation is not invention. He knew that it is not only important to be able to come up with a good idea, but also to make the idea work technically and commercially (Tidd & Bessant, 2018).

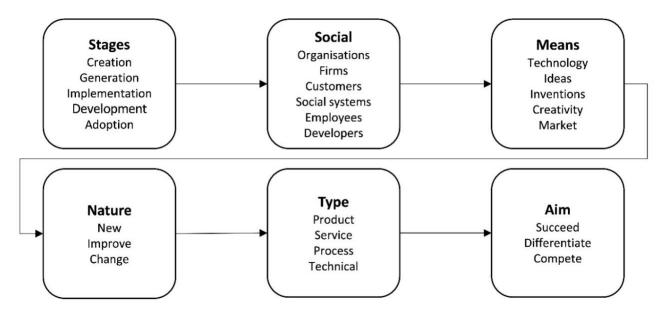
Baregheh *et al.* (2009) wrote a paper that aimed to find a multidisciplinary definition of innovation. Their search identified sixty different definitions that fit into the following seven categories: business and management, economics, organisation studies, innovation and entrepreneurship, technology, science and engineering, knowledge management, and marketing. By performing a content analysis and word count of the papers, the authors could get an idea of what attributes form part of the definition of innovation. The attributes that the authors found are as follows:

- Nature of innovation: Is the innovation new or improved?
- *Type of innovation*: Is the innovation a product, a service or a process?
- Aim of the innovation: What is the result that the innovation aims to achieve?
- Social context: Refers to all the stakeholders involved or who will be affected by the innovation.
- *Means of innovation:* The resources that the innovation requires.
- Stages of innovation: The steps taken during the innovation process.

The authors found that the definitions take a greater interest in the type, social impact, means and the stages of innovations than in any of the other attributes.

Baregheh et al. (2009) define innovation as follows:

"Innovation is the multi-stage process whereby organisations transform ideas into new or improved products, services, or processes, to advance, compete and differentiate themselves successfully in their marketplace."



Adapted from: (Baregheh et al., 2009)

Figure 2.2: Definition of innovation visualised

Katz (2007) also searched for a common definition of innovation. The definitions he found had some repetitive themes, and thus he created a single definition which follows the same key principles that Baregheh *et al.* (2009) follow when defining innovation. Therefore, the definition of innovation that will be taken forward throughout this research paper will be that of Baregheh *et al.* (2009).

Katz (2007) defined innovation in the following way:

"Innovation is the successful generation, development, and implementation of new and novel ideas, which introduce new products, processes, or strategies to a company. Or the enhancement of current products, processes or strategies leading to commercial success and possible market leadership, and create value for stakeholders, driving economic growth and improving standards of living."

2.2.2. Taxonomy of innovation

It is important for organisations to be able to categorise innovation projects, as this allows them to manage the projects and risk portfolio more efficiently. Just like the many definitions of innovation, the different categories of innovation point to the complexity of the subject.

The categorisation of innovation can be useful from a strategic and process-related point of view: the innovation strategy determines where the organisation wants to innovate, and the innovation process shows how the organisation innovates. When an organisation knows what type of innovation they are dealing with as well as the category under which it falls, the organisation will be able to formulate and execute a strategy more accurately, as different innovations require different strategies and management (Zapfl, 2018). The categories identified in the literature are as follows.

- Schumpeter's 5 Types of Innovation
- Object of the innovation
- Degree/novelty of innovation
- Impact on the market
- Trigger for innovation
- Impact on core design

Schumpeter's five types of innovation

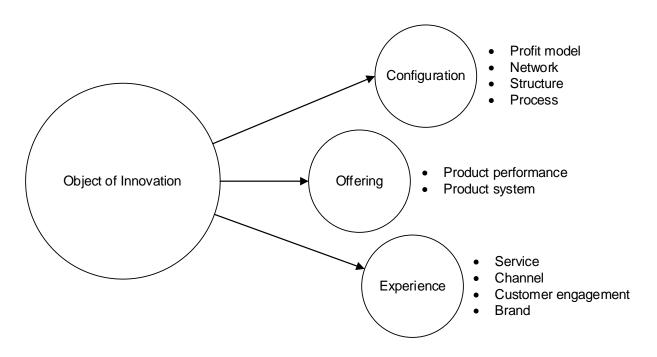
Joseph Schumpeter, who is often referred to as the founding father of innovation, defined five types of innovation according to the different outcomes that each type can achieve. According to Schumpeter, innovations are measured by the commercial or economic gain that is achieved through these types of innovations, which include the following (Śledzik, 2013):

- Introduction of a new product or the quality of the product;
- A new process of producing the products;
- Entering or opening new markets;
- · Obtaining new sources of raw materials or supply; and
- Disrupting current industry structures.

Du Preez, Essman, Louw, *et al.* (2015) further simplified these innovation types into three categories: product, process and strategy innovation. They also suggest that an innovation can best be described as a combination of these different types of innovations, and not necessarily as a single type of innovation.

Object of the innovation

The object of innovation refers to the area in a business where innovation is taking place. The innovation categories – product, process and strategy – as identified by Du Preez, Essman, Louw, et al. (2015), would be a typical response to this innovation category. Although these categories can be adequate to a certain extent, a more specific approach is necessary to ensure that organisations know what type of innovations they are dealing with, as well as the area of business that would benefit from these innovations. In "Ten Types of Innovation: The Discipline of Building Breakthroughs", Keeley (2013), the author specifies ten types of innovations that offer a more specific way of identifying the object of innovation. These innovation types can be categorised into three areas: configuration, offering and experience, as shown in Figure 2.3. Keeley states that the Ten Innovation Types can be a useful tool to help organisations diagnose and further develop the innovations that they are working on.



Source: (Keeley et al., 2013)

Figure 2.3: Ten Types of Innovation

- Configuration of internal matters of an organisation:
 - Profit Model how the organisation makes money.
 - Network the collaboration with other entities to create value.
 - o Structure the alignment of the organisation's resources.
 - o Process the method with which an organisation conducts its work processes.
- The organisation's offering:
 - Product Performance the features and functionality that distinguish the organisation from its competitors.
 - o Product System additional products or services that an organisation can offer.

Customer experience:

- Service –the improvements and the support of offering that an organisation lends to their customers.
- o Channel the delivery of the offerings to the customers.
- Brand the representation of the organisation's offerings and overall business.
- Customer Engagement the interactions the organisation fosters between their offerings and their customers.

Degree of the innovation

The degree of innovation can be divided into two types: radical innovation or incremental innovation. Radical innovation refers to an innovation that involves a significant change to a product, service or process (Zapfl, 2018). It requires the development or application of new technologies that improves the organisation's competencies significantly. The knowledge required for such innovations often only exists outside of an organisation and it is usually possessed by academics or lead-users (Oerlemans, Knoben & Pretorius, 2013).

Incremental innovation, on the contrary, involves continuous improvements to existing products, services or processes. McDermott & O'Connor (2002) defines incremental innovation as the extension to current product offerings. When an innovation is incremental, it implies that a dominant design already exists in the marketplace (Oerlemans *et al.*, 2013).

Incremental innovations are usually perceived as being low risks (Yamakawa, Yang & Lin, 2011), and as a consequence organisations tend to focus more on this type of innovation and neglect radical innovations. This puts organisations at risk to be overthrown by radical innovations that take over the market. It is thus essential for organisations – especially larger organisations – to balance their innovation portfolios (Bounfour, Leslie, Lettice, *et al.*, 2004).

Impact of the innovation on the market

The impact that innovations have on the market can either be sustaining or disruptive – both have their advantages and disadvantages. Sustaining innovations are more likely to be adopted and the risk associated is relatively low. Disruptive innovations are more likely to fail, but if it succeeds, the reward can be significant.

A disruptive innovation – also known as a breakthrough innovation – usually tends to be rejected by mainstream consumers at first, because they do not find the innovation useful. Christensen (1997) states that this initial rejection of disruptive innovations can make it difficult for customer-focused organisations, because it allows for important innovations to fade.

Sustaining innovations are innovations that improve a current implementation – such as a process, product, or service – to extend the implementation's lifetime. Such an addition adds value to the product, process or service, and it prolongs the benefits that the customers experience (Katz, 2007). Contrary to disruptive innovations, sustaining innovations are more customer-focused.

Disruptive innovations

- Creates a new market
- Breakthrough innovation
- Unpredictable market
- Higher risks

Sustaining innovations

- Focus on existing market
- Improvement of existing product or process
- Not a game changing invention
- Market is predictable
- Lower risk

Adapted from: (Christensen, 1997; Katz, 2007)

Figure 2.4: Disruptive vs sustaining innovations

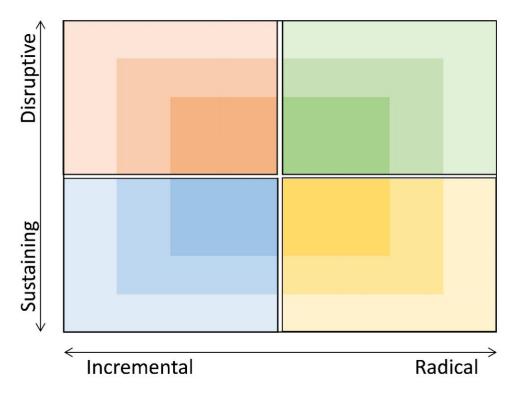
Competitive advantage can best be obtained through the generation of disruptive innovations. Innovation managers should find a balance between the number of high-risk innovations and low risk innovations in their organisations' innovation portfolio. The Christensen Institute ("Disruptive Innovations", 2017) defined three attributes that describe successful disruptive innovations:

- An innovation that makes a product or service more accessible and/or affordable to a wider audience.
- A business model that focuses on non- or low-end consumers as well.
- Coherent value networks where all stakeholders gain advantage from the disruptive innovation.

Impact on market vs degree of innovation

In the book "The Innovator's Dilemma", (Christensen, 1997), there is a differentiation between the impact innovations have on the market and the novelty of the innovations. The impact that innovations have on the market can be separated into disruptive and sustaining innovations. The novelty of innovations can be separated into radical and incremental innovations. Innovations do not have to be either disruptive or sustaining, and radical or incremental; they can be somewhere in between (Du Preez et al., 2015).

Figure 2.5 depicts a matrix that illustrates the correlation between disruptive/sustaining and radical/incremental innovations. The y-axis represents the impact that innovation has on the market, and the novelty of the product, service or process is represented by the x-axis. This matrix creates a spectrum within which innovations can fit, and it shows that innovations do not have to be solely radical, incremental, disruptive or sustaining – they can be located somewhere on the spectrum where they are classified as more than just one type of innovation. Du Preez *et al.* (2015) state that innovation is not black or white, but it can occur in many shades of grey.



Source: (Du Preez et al., 2015)

Figure 2.5: Newness vs Impact

Triggers for innovation

There are two types of triggers for innovations: technology-push and market-pull. Technology-push implies that the introduction of new technologies create innovation. The demand of the market can also introduce innovation called market-pull (Ameka, 2013). These triggers have an influence on how the organisation will develop a product and how resources will be assigned (Dixon, 2001).

Technology and technology-oriented companies, especially in the business-to-business domain, are traditionally more influenced by new technologies. Companies in the business-to-consumer sector, however, tend to focus more on the needs and expectations of the end-user, and as a consequence, they place a greater emphasis on market-induced impulses (Lubik, Lim, Platts, *et al.*, 2013).

Impact on core design

A product, service or process has core designs that determine the ways in which they operate. When the design changes, the way that they operate change as well. These changes can be either architectural changes or modular changes.

An architectural change is a change in the configuration of the entire system of an organisation and the interaction of the different components with one another. Architectural innovations have similar attributes than radical and disruptive innovations, but when an innovation leads to architectural changes, it does not necessarily mean it is radical or disruptive in the market because as the innovation becomes available for many customers, there might be several players who adapt the innovation together (Magnusson, Lindström & Berggren, 2003).

A *modular* change is the redesign or improvement of a component of the system that does not change how the entire system is configured or operates. Modular innovations, opposed to architectural innovations, have similar attributes to sustaining and incremental innovations (Magnusson *et al.*, 2003).

The Henderson-Clark model shows the relationships between radical, incremental, architectural and modular innovation. They argue that the traditional categorisation of innovation is incomplete and it could be misleading, and thus they created a new model that can be used for the categorisation of innovation, as depicted in Figure 2.6 (Henderson & Clark, 1990).

		Core Concepts	
		Reinforced	Overturned
Linkages between Core oncepts and Components	Unchanged	Incremental Innovation	Modular Innovation
Linkages be Concepts and	Changed	Architectural Innovation	Radical Innovation

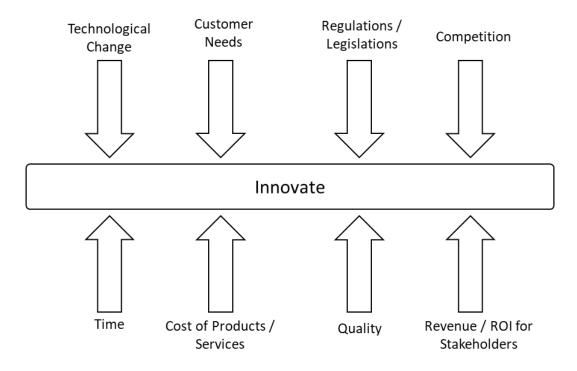
Source: (Henderson & Clark, 1990)

Figure 2.6: Henderson-Clark innovation type framework

2.2.3. Drivers for innovation

Innovation drivers can have several meanings. In this research paper, innovation drivers refer to concepts inside or outside an organisation's domain that could have an impact on the innovation activities of the organisation. Customer needs are an example of an innovation driver, because it creates opportunities for organisations to meet those needs in an innovative way.

Innovation drivers of an organisation can originate internally or externally. Some of the drivers do not only support organisations, but induce pressure for organisations to be innovative. Some of the reasons why organisations might experience pressure to innovate, can be seen in Figure 2.7.



Source: (Du Preez & Louw, 2007)

Figure 2.7: Pressure to Innovate

External drivers:

- Technological change is an external driver that induces pressure to innovate by the constant
 evolvement of technology through research and development activities. It usually comes from
 external domains, but by being innovative, an organisation can place similar pressure on their
 competitors.
- Customer needs are changing constantly and adapt according to the market in which an organisation competes. This creates pressure for an organisation to meet those needs.
- Regulations and Legislations change the way in which business may be conducted, and the
 standards of the products or services that are delivered by organisations. Organisations must
 adapt their products and services by being innovative, to ensure that their products and
 services adhere to the regulations and rules stipulated by the government and governing
 bodies of an association.
- Competition is the group that an organisation must gain competitive advantage over to ensure that they maintain and grow their share of the market. It has been proven that innovation leads to competitive advantage and business growth.

Internal drivers:

Time to introduce an offering to the market before an organisation's competitors must be
reduced. This places a lot of pressure on organisations and requires them to be innovative
in the way that they develop their offerings, as well as the speed with which they deliver
innovative solutions.

- Cost of Products / Services refers to the costs involved for organisations to deliver their
 offerings to their customers. By lowering the cost of offerings, an organisation would also
 need to lower the cost of developing the product or service, to ensure an adequate return on
 investments for them. This could be a major challenge for organisations, but it can push them
 to solve these problems creatively.
- Quality of products and services should always be in the process of improvement. The
 pressure of delivering higher quality products has numerous advantages for all stakeholders.
- Return on Investments is one of the major drivers for organisations to be more competitive in the market that they operate, and to pursue new uncontested markets.

Taalbi (2017) mentions four origins of innovation in the study "What drives Innovation? Evidence from economic history". Taalbi's origins of innovation include institutionalised search, market opportunities, technological opportunities and problems, and these origins can also be seen as drivers of innovation. Table 2.1 gives a detailed description of each of the four drivers.

Table 2.1: Origins of innovation

Driver	Description
Institutionalised search	This refers to innovations that originate solely from the improvement of existing product characteristics and in accordance with known performance trajectories.
Market Opportunities	Innovations originating from this driver occur due to the need to address customer requirements or uncontested markets. These innovations do not necessarily originate from a problem observed by the organisation.
Technological opportunities	New technologies or scientific knowledge that are introduced to the industry could lead to new innovations.
Problems	Innovations can originate as a response to different types of problems. The problems can, among others, be categorised into environmental, organisational and economic problems.

Source: (Taalbi, 2017)

Motivation is one of the crucial aspects required for innovation. Without employees, leaders, managers and other stakeholders that are motivated to contribute to the organisation's innovativeness, it will be difficult to see a steady stream of innovative ideas rising within an

organisation (Koudelková & Milichovský, 2015). Motivation can be categorised as intrinsic and extrinsic.

- Intrinsic motivation refers to motivation that a person experiences on a personal level.
- Extrinsic motivation refers to motivation that a person gains through a reward, or by way of avoiding punishment.

External Role Players

Apart from the influence of internal role players in the innovation process – portfolio managers, innovation leaders and project managers (Dobni & Klassen, 2018; Louw, Schutte, Seidel, et al., 2018) – there are also external role players that induce the pressure on organisations to innovate. These role players are governments, academia, and the industry/market (Du Preez et al., 2015). The following table shows how these groups impact innovation.

Table 2.2: External role players and their impact on innovation

Governments Governments provide incentives, funding and other resources necessary to stimulate innovation within a country. The goal is to increase the overall competitiveness of the country against the rest of the world. Academia Academia in the form of universities, colleges and research institutions, perform primary research that form the knowledge base from which organisations can create new innovative solutions and offerings. Industry/market The products and services delivered within an industry or market could drive new innovations.	Role Player	Description
perform primary research that form the knowledge base from which organisations can create new innovative solutions and offerings. Industry/market The products and services delivered within an industry or market could	Governments	to stimulate innovation within a country. The goal is to increase the
·	Academia	perform primary research that form the knowledge base from which
	Industry/market	·

Source: (Du Preez et al., 2015)

Du Preez *et al.* (2015) also state that it is extremely important for organisations to collaborate with these role players.

2.2.4. Departments

Innovations can stem from different departments within an organisation. The generic departments within organisations are usually Human Resources, Research & Development, Finances, and Marketing. Within each of these departments, innovations can improve their effectiveness as well as their contribution to the organisation.

2.3. Innovation management overview

To argue that innovation is not important for organisations to survive in this day and age, would be a difficult task. It equips organisations with a competitive advantage and will ensure that they remain relevant. But the successful management of innovation remains a challenge for most organisations (Du Preez & Louw, 2008). The Boston Consulting Group concluded that most enterprises realise the importance of innovation and spend many resources on innovation, but many of these investments do not, however, deliver a satisfactory return with regards to profit or competitiveness (Du Preez & Louw, 2008). The problem is not due to the lack of inventions, but rather to the poor management of the innovation process.

This section will discuss innovation management and how it can be performed through the innovation process, innovation funnel, and the role of idea management in the innovation process.

2.3.1. Innovation process

Ven (2016) defines the innovation process as an approach that facilitates creativity and the complex management process of changing creative ideas into innovations. To be able to manage innovation, the innovation process must be clearly defined/designed by an organisation (Van Zyl, du Preez & Schutte, 2007). The definition of innovation makes it clear that there are differences between an invention and an innovation. For inventions to become innovations, a clear process must be followed. In the literature, numerous innovation processes have been documented and they range from simple to complex. As innovation management became more studied over time, the processes became more complex. Innovation processes vary between organisations, and there is certainly not a 'one-size-fits- all' solution (Dobni & Klassen, 2018).

Tidd & Bessant (2018) introduce a simple innovation process that consists of the search, select, implement and capture phases. Search is where the organisation looks for new opportunities, both internally and externally. Select is the phase where the organisation decides what opportunities they should respond to. Implementing is where the idea has been developed and released into the internal or external market. Finally, the capture phase is where the organisation reaps the benefits and/or learn from the process.



Source: (Tidd & Bessant, 2018)

Figure 2.8: Tidd's innovation process

Du Preez *et al.* (2015), on the other hand, defines a process that consists of five phases: invention, feasibility, implementation, operation, and disposal. Figure 2.9 shows a simple representation of this innovation process. Several innovation process-models have been researched and developed over the last century. Some of these models will be discussed in the following section of this chapter.



Adapted from: (Du Preez et al., 2015; Tidd & Bessant, 2018)

Figure 2.9: Simple Innovation process.

2.3.2. Innovation funnel

The innovation process naturally receives numerous ideas, and as the process goes on, the ideas become less. Thus, the process can be seen as a funnel. Figure 2.10 depicts an innovation funnel. At the start there are many ideas, and as the process continues, the ideas that become innovation becomes less and less. The goal of innovation management is to eliminate ideas that will not succeed to the market, as early as possible in the process (Marais, 2010), which is not an easy task.

Morris (2011) uses an interesting metaphor to describe innovation management. He says that ideas are the seeds for innovation. In the same way that a farmer can only harvest after much preparation has taken place, organisations cannot start by simply collecting raw ideas. They must ensure that the right preparation has been done – which will warrant that the ideas collected are worth further evaluation. Like all processes, the innovation process requires time, resources, capabilities, knowledge and structure to ensure that it gets the desired outputs that would lead to competitive advantage and ultimately to growth (Du Preez *et al.*, 2015).

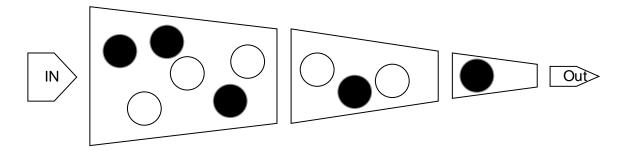


Figure 2.10: Innovation funnel

It is important to note that there is not one innovation process that will work for all organisations – organisations should find the innovation process best suited for them. The innovation process can be developed as part of building an innovation strategy (Du Preez *et al.*, 2015). There are several innovation models that can be used as reference to develop an innovation process.

2.3.3. Innovation roles

Leadership roles and other roles within an organisation that actively drive innovation is crucial for the success of the organisation's innovation initiatives. Dobni & Klassen (2018) found that innovation initiatives become most successful when the leadership of the organisation supports a culture of innovation combined with systematic approaches that strengthen the innovative behaviour. The overarching leadership of the organisation is crucial for the adoption of an innovation culture.

Louw, Schutte, Seidel, *et al.* (2018) define three key innovation roles that can ensure less misunderstanding within the innovation process. These roles include the portfolio manager, innovation leader, and the project manager. These roles should be clearly defined so that responsibilities do not overlap one another, and that responsibility gaps do not occur (Louw *et al.*, 2018). The hierarchical structure defined for these roles are as follows: the portfolio manager is responsible for the innovation leaders and they are then responsible to manage at least one project manager per project.

Portfolio manager

The role of the portfolio manager is important in the innovation process, since the portfolio manager is responsible for defining the strategic direction and management of the organisation's innovation process. The portfolio manager should therefore coordinate the innovation portfolio according to the organisation's strategy and the resources that are available (Louw *et al.*, 2018).

Innovation leader

The innovation leaders, according to Louw *et al.* (2018), are responsible for managing the project managers. They are the contact point between the customers and the rest of the innovation network. Gliddon (2006) defines three categories of innovation leaders, namely expert, core and supplementary. The level of the innovation leader is dependent on their competencies. An expert innovation leader will have the ability to identify new innovations. A core innovation leader, on the other hand, will focus on the fundamentals of a problem or phenomena, on knowledge transfer to colleagues, or is curious and will ask probing questions in order to gather as much information as possible. A supplementary innovation leader identifies needs by performing a needs analysis, values higher education, and makes use of research methodologies to gain more knowledge. Innovation leaders, therefore, motivate others to come forward with creative ideas or solutions.

Project manager

The role of the project manager, according to Louw *et al.* (2018), is to drive the innovation process. The project managers are the ones who actively pursue innovation projects and refine the concepts of the projects. In some cases, the project manager will also be the initiator or ideator of the innovation project.

In summary, it is important that as part of the innovation management process, an organisation defines these roles and allocate the right actions to each role. The purpose of the portfolio manager is to decide what projects will be pursued, and to allocate the right number of resources to each of the projects. The decisions made by the portfolio manager should be based on the innovation strategy, the risk analysis of the projects, as well as other innovation- related indicators. The innovation leaders are managing the project managers and should be the catalyst within the organisation that initiate discussions that could lead to new ideas or solutions. Project managers drive the innovation projects through the innovation process by refining the concepts and managing the development of the innovation.

2.3.4. Idea management

Idea management is a key tool in innovation management (Gerlach & Brem, 2017). Idea management is a systematic approach by which organisations can manage new ideas from their stakeholders. Brem and Voigt (2007) define idea management as:

"a subprocess of innovation management with the goals of effective and efficient idea generation, evaluation and selection."

Dorow, Dávila, Varvakis, *et al.*, (2015) write that within the idea management research domain, confusion may arise between the concepts of idea management, ideation and idea generation. They concluded that idea generation and ideation are the same: these concepts both refer to the process of creating new ideas. Idea management, on the other hand, is the management of ideas throughout the organisation's innovation process.

Organisations that have idea management systems in place are more likely to have successful innovation management behaviour (Boeddrich, 2004). Gerlach & Brem (2017) write that idea management is the building block for innovation management, as it utilises the creativity of the employees as the starting point of all innovations and ideas. Gerlach & Brem (2017) reference a report that was conducted to determine the effect of idea management systems on idea generation in Germany. The report (Wehler, Gutknecht, Schmelter, et al., 2015) found that the number of ideas submitted to dedicated idea management systems between 2006 and 2014, tripled per employee from the time that such systems were introduced – proving that there is great value in having an idea management system (Wehler et al., 2015).

Wood (2003) suggests that organisations who want to be successful and innovative, should have an effective idea generation system in place where potential ideators feel motivated to voice their ideas. These organisations should also have a process in place that allows them to process ideas quickly, so that the ideators can receive prompt recognition for participating in the idea management program. An effective evaluation process that ensures that the right ideas are selected for the next phase of the idea management or innovation process, is another requirement for organisations to

be innovative. Finally, organisations should ensure that ideas are being implemented and that those who played a role in the success of the ideas should receive recognition and are rewarded for their participation.

Gerlach & Brem (2017) developed an idea management model that outlines the different aspects of the idea management process. In this model, the researchers identify the following six phases of idea management: preparation, idea generation, improvement, evaluation, implementation and deployment. These phases are similar to the innovation models that will be discussed in the next section.

Table 2.3: Idea management phases

Phase	Description
Preparation	The implementation of this phase depends on the type of idea generation that the organisation wants. It is subject to whether the need is to solve a specific problem, or if any type of idea is welcomed. This phase includes the 'marketing' of the idea management program to catch the attention of possible ideators. The programs can be marketed with emails, posters and workshops.
Idea generation	During this phase the organisation should make use of creativity workshops and encourage teamwork to get the most out of their employees. Activities that enhance creative thinking and the generation of creative ideas should thus be pursued.
Improvement	Once ideas are captured, the concepts behind each idea should be improved. This can be done by having discussion groups between the stakeholders or sessions where employees share their ideas with one another to identify the strengths and weaknesses of ideas.
Evaluation	This phase is where ideas are selected according to different criteria such as novelty, originality, feasibility, risk, return on investments, etc. It is important to evaluate each idea according to the different types of innovation that exist, as this will help organisations estimate the risk involved in pursuing such an idea. Organisations can also have more than one idea management system in place to distinguish between technological and business ideas. It is also important that the employees receive some sort of feedback for the ideas that they submit. Idea management programs create the space for employees to grow in the ability to be creative and innovative through the feedback and

recognition that they receive when submitting ideas. This can result in a better and more satisfying work environments (Rijsdijk, van den Ende, Langeveld, et al., 2016).

Implementation

Implementation plays an important role in the success of the idea management process. The implementation of ideas gives ideators confidence in the innovation process, as well as motivation to create more ideas, since they can see the impact that their ideas have in their work environment. This phase, together with the evaluation phase, is similar to the portfolio management phase of the Fugle innovation management model, since resources and responsibilities are assigned to ideas during these phases.

Deployment

This phase refers to the outcome of the idea and whether a product or a service is promoted and introduced to the target market.

Adapted from: (Gerlach & Brem, 2017)

Ideators should have the motivation to generate and submit ideas to their organisation's idea management systems. In some cases, the ideator could be a client who should also have the motivation and drive to suggest new ideas to their service provider or vendors. Organisations should ensure that potential ideators are not discouraged from participating (Gerlach & Brem, 2017). Wood (2003) conducted research on idea management and found that there are several reasons why the potential ideators do not participate in the idea management programs. Some of the reasons include the following:

- The potential ideators are unaware of the platform that they have to share their ideas.
- The leaders of the potential ideators are not supportive of the idea program.
- Potential ideators feel that they do not have any ideas or that their ideas are inadequate.
- The potential ideators might feel that the rewards are not worth the ideas they submit. They
 might also fear that their ideas will be rejected, laughed at, or not recognised at all.
- The duration between the submission of an idea and receiving feedback is too long.
- The potential ideators might fear that they will not receive any form of recognition or credit for their ideas.
- Some potential ideators are attached to their ideas and dread the thought of others implementing and working on their ideas.

According to Gerlach & Brem (2017), one of the biggest challenges that organisations face with idea management, arises during the evaluation or idea selection phase. In their research they learned that the speed and thoroughness with which the idea selection team performs their task, plays a crucial role in motivating possible ideators within the idea management program. Wood (2003) also suggests that poor evaluation of submitted ideas could discourage employees. Wood further found that the primary reason for the poor evaluation of ideas is that idea evaluators are afraid of failure. This comes from the impression that those who promote a successful innovative idea are not recognised, but those who promote a bad idea that leads to failure, are barely forgotten.

The idea management program that is implemented in an organisation should therefore be well planned and should fit in with the innovation strategy. It is not so much about the type of idea management model that is being implemented, but rather the successful execution of that model. Thus, it is important that an organisation should design the idea management program well and include all relevant stakeholders in the process (Wood, 2003).

2.4. Innovation models

Innovation models are used to help understand the innovation process and they serve as the plan that steers the management of the innovation process. Innovation models have evolved over time as knowledge of innovation processes increased among scholars and participants in different industries.

2.4.1. Evolution of innovation models

Du Preez, Louw & Essmann (2009) describe the evolution of the innovation models in their research. They found that the first innovation models were particularly simple and linear, but that as time passed, the models became more complex and required more resources and time to manage a particular innovation process. Their description of the evolution of innovation processes can be seen in the table below.

Table 2.4: The Evolution of innovation processes

Type of Model	Description	Generation
Technology Push	This model is linear and sequential and focuses on the development of new technologies.	1 st
Market Pull	This is a linear model that focuses on using the needs of the market to obtain new ideas for R&D.	2 nd

Coupling Model	This model integrates Marketing and R&D and recognises the need for feedback loops between the different elements of the innovation process.	3 rd
Interactive Model	This model is a combination of technology push and market pull models and it allows the different activities within the innovation process to take place in parallel with one another.	4 th
Network Model	This model places emphasis on obtaining and accumulating knowledge. It also considers interaction with external elements outside of the organisational domain.	5 th
Open Innovation Model	This model is like the network model, but places value on internal and external idea generation, as well as internal and external paths to market.	6 th
Extended Frameworks	These models are new generation models that combine the good aspects of all the above-mentioned models.	7 th

Source: (Du Preez et al., 2009)

Several innovation models have been developed over time. The first models were very linear and sequential, but the latest models allow for more integration between the different parts and elements of organisations as the models evolved. The following generic phrases mentioned below will guide the development of the conceptual framework developed in the next chapter.

Most innovation models have five phases in common (Uys, 2010):

- Idea generation and identification;
- Developing concepts from the ideas;
- Evaluating and selecting concepts;
- The development of the innovation; and
- Implementation of the product, process, or service.

In research all the different phases from the vast number of innovation models can be categorised into these five generic phases.

Not all the different models will be discussed in this section, but only the most popular models developed by researchers. As with idea management models, innovation models serve as a blueprint for the innovation process and shows organisations what their innovation process would look like. It

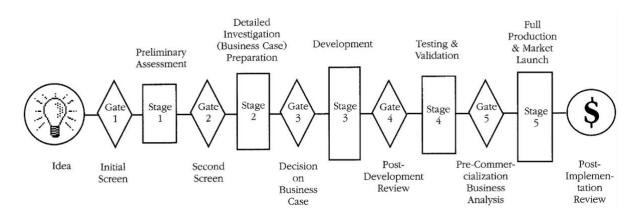
is important to note that the success of innovation programs within organisations are not dependent on the selected or developed model, but rather on the successful implementation and management of the model.

2.4.2. Stage gate model

According to Cooper (1990), the stage-gate system recognises innovation as a process and that all processes can be managed. The stage-gate system simply applies process management methods to the innovation process.

The concept that distinguishes the stage-gate model from other innovation process models is the different gates. The gates essentially serve as quality control checkpoints where the organisation verifies that the innovations adhere to the predefined standards. During the stages all the work gets done, and the gates check the quality and decisions that are made there (Cooper, 1990).

Cooper (1990) makes it clear that the stage-gate model is not a fixed model, but usually consists of four to seven stages and gates. Each organisation should design and specify their own innovation process that suits their culture, strategy and business model best. See the Stage-Gate Innovation Model in the figure below.



Source: (Cooper, 1990)

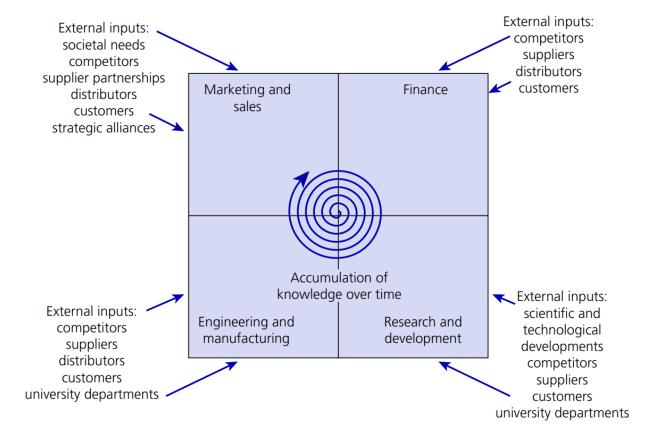
Figure 2.11: Stage-Gate Innovation Model.

It is important for innovation managers to understand that each stage becomes more expensive than the preceding stage, but also provides more information. The gates guard the entrance of each stage and hold a set of criteria that an idea or project must comply with before it can continue to the next stage. It is crucial to get as much information early in the process when it is not as expensive to bring changes to the project. Well defined criteria for each gate and excellent execution thereof are the ingredients of a successful innovation process (Cooper, 1990).

2.4.3. Network model

The network model is part of the fifth-generation innovation models that attempted to explain the complexity of the innovation process and how the external environment impacts the process (Du Preez & Louw, 2008).

Network models focus on communication between all the external and internal role players and stakeholders of the innovation process. An example of a network model is depicted in Figure 2.12. Trott (2017) suggests that network models place emphasis on knowledge accumulation as part of new product development (innovations) and that the knowledge should be obtained from a wide variety of sources.



Source: (*Trott, 2017*)

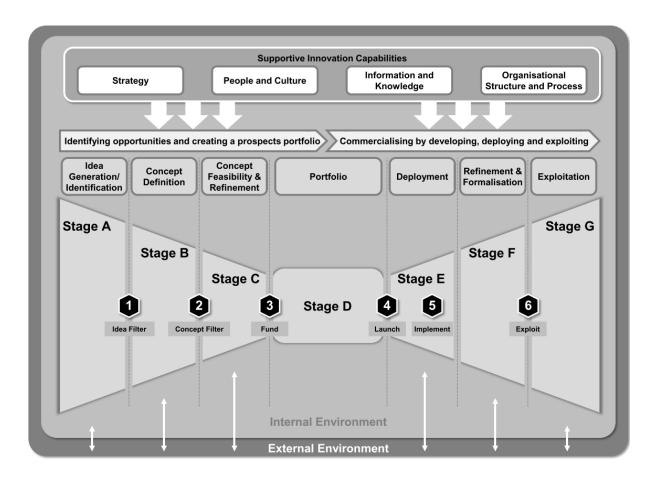
Figure 2.12: Network Model

The model also depicts an interaction between the different business units. This interaction allows for the accumulation of knowledge over time, which then becomes a catalyst for new innovative ideas (Trott, 2017).

2.4.4. Fugle model

The Fugle model is one of the most recent innovation models and was developed by Louw et al. (2018). The model is the latest combination of innovation models and it features some of the best characteristics of the models that were developed before it.

The two main characteristics of this model are its Funnel and Bugle. The Funnel component of the model represents the stages before the portfolio management stage, and it focuses on creating an innovation portfolio of prospects. The Bugle (exploitation) component is where the innovation projects are commercialised, and it represents the stages that follow the portfolio management stage. The exploitation (Bugle) component of this model is not present in other innovation process models. Du Preez & Louw (2008) argue that exploitation is the only mechanism for competitiveness and therefore it should be included in the model. The Fugle model also implements the stage-gate model throughout its innovation process. It uses the gates and filters to make strategic decisions throughout the innovation process.



Source: (Louw et al., 2018)

Figure 2.13: The Fugle Model

The model consists of seven stages and six gates. These are just an outline and can be adapted according to each organisation's structure and methods to develop products or services. The purpose of the funnel and bugle are respectively:

- 1. Identifying opportunities and creating a prospects portfolio, and
- 2. Commercialising by developing, deploying and exploiting.

The purpose of the funnel is to create opportunities by gathering information, generating ideas and capturing the ideas. Concepts are then created from the ideas, after which the feasibility of the concepts is assessed. Throughout the first phase there are gates where the portfolio manager and innovation leader(s) have to assess the quality of the outputs of the stage prior to the gate. It is important that standardised processes are specified at the stage gates and that the deliverables, criteria and results coming from the gates should be considered when specifying the processes (Louw *et al.*, 2018).

The outcomes of the first phase are clearly defined concepts that align with the strategic goals of the organisation (Louw *et al.*, 2018). These concepts then move into the innovation portfolio where innovation initiatives of the organisation are managed. Du Preez & Louw (2008) describe innovation portfolio management as the holistic management of an organisation's innovation projects. In this stage, resources are assigned to the projects and the risks associated with the projects are also assessed.

The second phase is the most expensive part of the process where the projects are launched and innovations are exploited. During this phase, the uncertainty associated with the innovation projects should decrease (Cooper, 1990). It is crucial to ensure that when a project is launched, all the necessary quality checks in the form of stage gates should have been performed. The objectives of this phase are to deploy the projects and to exploit the innovation in order to generate more value from it (Louw *et al.*, 2018).

Opposed to the process model, the Fugle model also takes into consideration the impact that internal and external domains have on the innovation process. It also shows the influence of supportive capabilities, which include the innovation strategy, people and culture, information and knowledge, and organisational structures and processes (Du Preez & Louw, 2008).

2.5. Innovation strategy

Before organisations can define their own innovation process, they must first create an innovation framework that they can use as a point of reference. The framework can be created once the organisation understands their strategy. This section discusses why an innovation strategy is needed, the different approaches an organisation can take in formulating their innovation strategy, as well as the strategy cascade framework constructed by Lafley & Martin (2013) in their book "Playing to win: how strategy really works".

2.5.1. Purpose of an innovation strategy

An innovation strategy refers to a plan that is put in place to ensure market share growth. Each organisation will have a unique strategy that fits in with its business model and culture. However, sometimes the business model and culture will have to be adapted to create the space for new opportunities. The organisation's innovation strategy must support the business model and its culture must support innovation. The structure of the organisation, the strategy and the communication of the strategy with the employees are crucial requirements for successful innovation (Ferreira, Fernandes, Alves, *et al.*, 2015).

The goal of innovation is to create a competitive advantage for organisations (Klein & Sorra, 1996). An innovation strategy is a plan to generate new ideas, but also a plan to harness marketing, operations, finance and R&D to achieve the innovation goal (Kylliäinen, 2018).

Reactive innovators refer to organisations that react to the innovations delivered by their competitors, thus they try to catch up with the leaders in the industry. Proactive innovators on the other hand, are the first ones to create a competitive advantage by disrupting the market (Liem, Khuong & Khanh, 2019). Being proactive or reactive can be a strategic choice, but by simply having an innovation strategy in place, an organisation can be seen proactive in their approach to gain a competitive advantage.

2.5.2. Approaches to innovation strategies

There are various approaches that organisations can choose from when developing an innovation strategy. Different approaches from the authors Ojomo & Wilcox (2021), Porter (1985) and Kylliäinen (2018) will be discussed in this section. It is noteworthy that these approaches overlap to some extent.

Six Approaches to Innovation Strategies

Ojomo and Wilcox (2021) performed a study that found that there are six approaches to innovation strategies that organisations can follow. These strategies are described in Table 2.5.

Table 2.5: Six approaches to innovation strategies

Strategy	Description
Reduce the barriers to	Reducing the barriers to consumption can be divided into four
consumption	categories: reducing money-related, access-related, time-related,
	and skill-related barriers. Reducing money-related boundaries
	means that an organisation would decrease the cost of their
	products or service to make it accessible for a different market.

By reducing the access-related barrier organisations, would make their offering available in locations where it was not previously available. By making the time to obtain or use an offering less, the organisation could encourage non-consumers to consume it. By reducing the skill-related barrier, an organisation makes the use of the product simpler.

Employ breakthrough technology

Organisations can implement breakthrough and novel technologies that are not commonly used in the industries. Novel solutions could improve the efficiency of a business and therefore provide a competitive advantage.

Develop a new value network

By redefining business activities or costs structures, an organisation could make their offering available to more consumers without compromising their profitably.

Integrate internally

Organisations could produce or develop certain components of their offerings in-house as opposed to outsourcing it like their competitors. For example, Apple started to develop their own processors, thereby avoiding the global shortage.

Integrate externally

Integrating externally would mean that organisations perform or undertake a service that is usually the responsibility of the government. They assume this role to avoid any hinderance that the lack of infrastructure might be for their processes.

Manage government relations

Organisations might need to spend a lot of time and resources to manage their relationships with the government to avoid any hinderance in their processes. In some cases the government might make it very difficult for organisations to progress, therefore organisations may need to spend time to address the issues.

Adapted from: (Ojomo & Wilcox, 2021)

Porter's generic innovation strategies

Porter also defined different approaches to innovation strategies. Porter's generic strategies (Porter, 1985) consist of three strategies that can help organisations achieve above-average performance relative to their industries, and they can help them understand their strategic position in the market. These three strategies are described in Table 2.6.

Table 2.6: Porter's generic innovation strategies

Strategy

Description

Cost leadership

Cost leadership is about becoming a low-cost producer in the industry of the organisation. The goal is for low-cost producers to find all sources of cost-advantage over their competitors. The value they propose is a lower cost than their competitors. *PEP*, for example, focuses on low cost and not quality.

Differentiation

Differentiation refers to an organisation that is unique in its industry. Organisations following this strategy select attributes that most buyers within the industry find essential, and then they position themselves to meet those needs. Differentiation usually leads to products that would come at a premium price. Patagonia is a good example of a brand that focuses on differentiation and not cost. They target a market that can relate to their passion for nature, and they would rather spend more money on a product of high quality to be more sustainable.

Focus

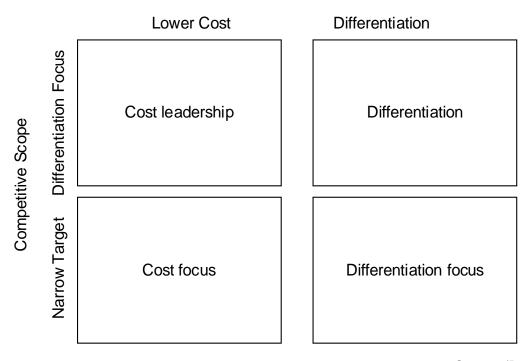
Focus can be split into cost focus and differentiation focus. Focus refers to the choice that organisations make between having a narrow or broad competitive scope in their industry: they either focus on a core segment or on a group of segments within the industry. A target segment refers to a segment within the industry with customers that have unique needs, or on the way the product or service is delivered that is different from the rest of the industry. The focus strategy has two variants within itself:

- Cost focus drives a firm to seek a cost advantage within its target segment(s).
- 2. Within focus differentiation, an organisation is looking for differentiation within its target segment(s).

Source:(Porter, 1985)

Porter created the following figure to display the relationship between the three generic strategies.

Competitive Advantage



Source: (Porter, 1985)

Figure 2.14: Porter's generic strategies

Apart from Porter's generic strategies, it is of great value for organisations to identify and exploit uncontested markets. This is called value innovation.

Business model and leveraging existing business models

According to Kylliäinen (2018), there are two approaches to innovation strategies: *Business Model Innovation* (BMI) *and leveraging existing business models*. These two approaches will be discussed in further detail in the section below.

Business model innovation

The objective of BMI is to generate new revenue sources by improving product value, or by changing how the product is delivered to the market. Business models vary from one organisation to another. Gassmann, Frankenberger & Csik (2019) conceptualised business models by dividing them into four dimensions: WHO, WHAT, HOW and WHY?

It is essential for an organisation to align their business model and innovation strategy with each other. Businesses should continuously re-evaluate their business model to ensure that they remain competitive in their market or in new markets. When evaluating the business model, the four dimensions named above are useful in discerning that all aspects of the business are included in the process (Gassmann *et al.*, 2019).

- WHO is the target market?
- WHAT is offered?
- HOW is the value proposition created?
- WHY is the model financially viable?

Leveraging existing business models

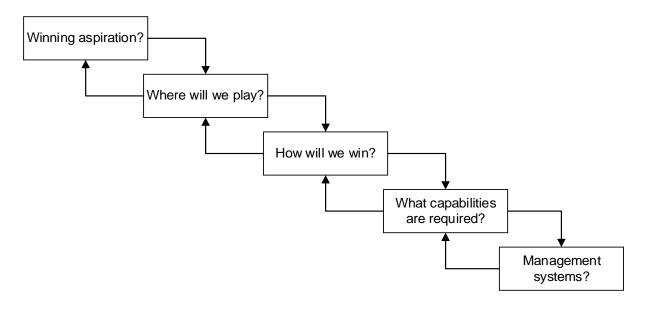
As opposed to the business model innovation approach, this approach focuses on smaller incremental improvements within the existing business model. The primary goal of this innovation strategy approach is to improve the core business.

2.5.3. Building an innovation strategy

The various innovation strategy approaches are useful to identify the areas and methods that organisations can target to become more innovative. However, constructing an innovation strategy that considers all areas within an organisation is of much importance.

Lafley & Martin (2013) wrote a book called "Playing to Win: How Strategy Really Works." They created a framework that can help companies build a strategy that will comply with their business goals.

Lafley & Martin (2013) state that strategies are about making the right choices. The framework they built is suitable for any business, part of a business, or even non-profit organisations. It is a framework that can help anyone, or anything develop a strategy to be better equipped to win in the area where they are competing. In this case, it can be used to develop an innovation strategy. Figure 2.15 shows the framework schematically.



Adapted from: (Lafley & Martin, 2013)

Figure 2.15: Strategy Cascade

Objectives and strategic approach to innovation (Winning Aspirations)

The first step is to understand why the organisation aspires to create value and competitive advantage. Without knowing *WHY* the organisation wants to succeed and what they want to achieve through innovation, it is difficult to find the intrinsic motivation that is necessary to drive innovation.

Defining the objectives should describe what the organisation wants to achieve with its innovation strategy. The objectives of the innovation strategy should help to achieve the business objectives, and vice versa. The following questions will help organisations to define their objectives more clearly:

- What are the organisation's vision and purpose?
- What does the organisation define as success/winning?
- When will the organisation know that they have been successful?
- What does win look like for their clients, employees and stakeholders?

Knowing the customers and competitors (Where to Play).

After establishing the WHY, the organisation must have a clear vision of their target market. The organisation does not only have to know what product they will sell or what service they will deliver, but also where they will 'play' geographically. This stage is crucial for developing a strategy for the marketing team.

Distanont and Khongmalai (2020) performed a literature review on competitive advantage and found that several studies show that customer feedback and relationship are crucial in gaining competitive advantage. When developing an innovation strategy, organisations must know what customers want and how they will deliver value to them. The following questions can assist organisations in defining where and with whom they want to 'play':

- What geographic scope should the organisation compete in?
- What product and services should the organisation offer?
- Where should the organisation invest their time, money, and resources to achieve its objectives?
- What similar or new territories should the organisation investigate?

In this phase of the cascade, the Red Ocean and Blue Ocean metaphor can also be considered to help the organisation decide where they want to focus their innovation strategies.

Red Oceans represent industries that are in existence today, or rather, the known market space (Kim & Mauborgne, 2004). The industry boundaries are defined and accepted by participants within

the market. Within the red ocean, companies try to gain a competitive advantage within the set boundaries.

As opposed to the red oceans metaphor, *blue oceans* refer to industries that are not currently in existence. In other words, the unknown market space that is untainted by competitors as of yet. The big difference between the *red oceans* and *blue oceans* is that with blue oceans demand is created rather than fought over (Kim & Mauborgne, 2004).

The *Blue Ocean* Strategy withdraws itself from the traditional model – which is competing within existing markets – and it is based on creating new markets or new value. In the study conducted by Kim & Mauborgne (2004), most *blue ocean* businesses were companies that were in existence prior to being classified as *blue* oceans, indicating that these companies 'survived', because they obtained and maintained a competitive advantage through pursuing uncontested markets.

Defining value proposition (How to win)

After establishing where and with whom the organisation wants to 'play', the organisation must define its value proposition. A value proposition will help organisations identify how they can 'win' within the market that they compete. Thus, this stage will help the organisation understand what they have or what they need in order to obtain a sustaining competitive advantage in their field. When defining a value proposition, organisations can ask themselves the following questions:

- · What is the landscape of the industry?
- Who are the competitors?
- What are the *current* core capabilities of the organisation?
- What is the organisation's strategic position from the customers' perspective?
- In what direction is the market moving?

The landscape of the industry can be mapped by knowing the number of competitors, the concentration of the market and the profit profile of the market. By knowing and understanding this, the organisation can pinpoint how they could win and what their value proposition is, or perhaps, what it should be.

Assessing and developing core capabilities.

During the fourth stage, organisations must investigate what capabilities they need in order to execute their innovation strategy successfully. To have a strategy, but not to be able to execute it, defeats the purpose of creating a strategy. Organisations can assess and develop core capabilities by asking the following questions:

What capabilities should the organisation have to 'win'?

- How can the organisation leverage their resources to obtain competitive advantage?
- How can the organisation improve their way of working? (Working processes)
- What tools does the organisation have or need in order to achieve their innovation strategy?

The first three stages of creating an innovation strategy mainly focus on the organisation's fundamental capabilities that are needed for them to win within their market space. Kylliäinen (2018) suggests that organisations need to consider the following aspects and find a connection between them to determine their core capabilities:

- Company culture
- Behaviours
- Knowledge
- Research and Development
- Values
- Skills

Louw *et al.* (2018) also define four supportive innovation capabilities in the Fugle innovation process model. Organisations can consider these capabilities when looking for ways to improve their innovation initiatives:

- Strategy
- People and Culture
- Information and Knowledge
- Organisational structures and Processes

Establishing innovation techniques and management systems.

The final stage in creating an innovation strategy is to establish what management systems need to be in place for the strategy to work. The systems should foster support measures for the innovation strategy and they are necessary to help with decision-making. It is important to establish these techniques and systems to ensure the execution of the innovation strategy in a scalable and integrated manner.

The organisation needs to define how it will measure the results of the innovation strategy. Measuring the inputs and the outputs of an innovation strategy is essential to ensure that the right decisions are made and that the organisation is on the path towards competitive advantage and growth. The following questions will help organisations establish innovation techniques and management systems:

How will the organisation measure their success?

- What should the organisational structure look like to assist the organisation in their innovation efforts?
- What role will incentives play in the organisation's drive for innovation?
- What training should employees partake in to help the organisation achieve its goals?

As part of the innovation strategy, organisations must consider the following elements: the role of the company within society; R&D; education and training; the structure of the company; production systems as well as marketing and finance systems. These elements need to be clearly defined for organisations to draw clear boundaries within their innovation system (Freeman, 1987).

2.6. Alertness

The subject of alertness and its influence on innovation is important in the innovation process. Employees and leaders need to be alert to new ventures and possibilities within both contested and uncontested markets (Tang, Kacmar & Busenitz, 2012). The way that new opportunities are seen by individuals, usually gets triggered by the their experiences, observation of their own environment, and to be in the right place at the right time (Tang, Kacmar & Busenitz, 2009).

Alertness is defined as the process and various perspectives that enable individuals to be more aware of the changes in the market, new opportunities that may arise, and the possibilities that are often overlooked by others (Tang *et al.*, 2009).

Foss & Klein, (2009) describe the alertness field of study to be more focused on the entrepreneurial opportunity than on the entrepreneur, company or new product. The slightest case of a person that is alert, could lead to new opportunities and the urging of new ideas or solutions.

Organisations should therefore ensure that their employees are aware of the need for the organisation to innovate, and of the implemented innovation process that they have. Employees should also be given the means to be alert to how the market is behaving. The alertness of the employees and leaders within an organisation could lead to an increase in innovative ideas, as it is more likely that new opportunities will be identified in the midst of both the red-ocean and blue-ocean markets.

2.7. Measuring innovation

Innovation metrics have gained a reputation for being complicated. They are different to typical business metrics because merely measuring the input and output will not necessarily show what the problem is, or what can be improved within the innovation system.

Albert Einstein once wrote:

"Not everything that can be counted counts, and not everything that counts can be counted."

Another famous quote from Peter Drucker says:

"You cannot manage what you do not measure".

This is very true for innovation management – if the process is not measured, it cannot be managed. This section will discuss what metrics can be used for the innovation process.

2.7.1. Importance of innovation metrics

In measuring innovation it is not only important to measure whether a specific innovation project is performing well, but also to measure whether the innovation strategy of the organisation is creating a competitive advantage. The impact of innovation cannot be measured on a short-term basis, but rather over a long period of time, as innovation metrics are put into place to track the impact of the innovation sufficiently. Innovation management is about creating a culture and organisational structure that supports innovation. It cannot simply happen by chance because the market might be receptive at the time. Innovation management allows organisations to be successful continually and to perform consistently.

Kaplan (2018) founder of *Innovation Point*, states in his online article that one in every three organisations on the Fortune 1000 list has formal innovation metrics. This is a low number and testifies to the fact that measuring innovation is not an easy feat. Kaplan also says that one of the mistakes that organisations make is using old metrics in a new environment. Some of the metrics used still add valuable insight, but they give a limited view of the organisation's innovation activities (Muller, Välikangas & Merlyn, 2005).

Roth, Aase, Swaminathan, *et al.* (2018) discussed the intricacies and importance of innovation metrics in an interview conducted in 2018. Erik Roth, one of the interviewees, argues that too many organisations consider upstream innovation metrics, and too few measure the actual impact and outcome of their innovation initiatives. They propose that organisations implement two metrics: (1) to measure their innovation performance relative to other companies within their industry, and (2) to measure whether they are achieving their performance objectives.

It becomes evident that having too many metrics to measure innovation activities can be detrimental to the innovation management process. Finding the right metrics are, as with finding an innovation strategy, not a 'one-size-fits-all' process. Organisations must tailor innovation metrics to their specific business and innovation strategy.

Muller *et al.* (2005) state that innovation metrics are essential for at least two reasons. The first is that the metrics help innovation managers make informed decisions based on quantitative and objective data, which is valuable because of the long-term nature and high risk that come with many innovation projects. Secondly, metrics affect the overall behaviour of organisations, since they help align goals and actions with what is best for the organisation.

The right metrics can help organisations combat strategy decay (Muller *et al.*, 2005). Strategies experience decay when they become less distinctive, the markets get saturated, or better strategies replace them. The most effective way to keep strategy decay from occurring, is to remain innovative. To have metrics in place for the sake of it, will add some value, but traditional metrics used by organisations only offer a limited view of the organisations' innovativeness (Kaplan, 2018).

2.7.2. Traditional metrics

The following traditional metrics stem from the early years of innovation as described by Kaplan (2018) and Muller *et al.* (2005):

- R&D budget as a percentage of annual sales;
- · number of patents filed in the past year;
- percentage of sales coming from new products in the past year;
- number of ideas submitted by employees; and
- the number of active projects.

A mistake many managers make is to add all the innovation metrics that they can find to the metrics portfolio – this is called a metrics overload. To have too many metrics, could lead to an excess in activities and possibly to conflicting behaviours (Kaplan, 2018).

2.7.3. Innovation metrics

To measure innovation activities and create innovation metrics, innovation needs to be structured (Källman, 2009). Källman (2009) summarised four innovation metric theories defined by Davila *et al.* (2006); Goffin & Mitchell (2005); Muller *et al.* (2005) & Regnell, Ritzén, Höst, *et al.* (2008). Källman (2009) also states that none of these authors mentioned, describe the different types of metrics in detail, and that their arguments simply lay a foundation for the specific areas of innovation that need to be measured.

In this research paper, only the theory by Muller et al. (2005) will be discussed. His theory suggests that organisations need to create a portfolio of metrics, and he gives three categories to consider for an innovation metrics portfolio:

- Return on Investments view
- Organisational Capability view
- Leadership view

Return on Investments.

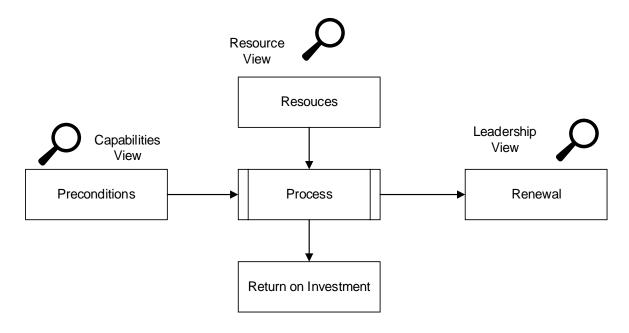
In the Return on Investments (ROI) view, organisations must weigh their investments in existing businesses versus new businesses. The investments are not necessarily only capital, but can also be labour and time. The ROI metrics are implemented to ensure that investments in new and old businesses are balanced, and to help organisations to justify the value of strategy investments, programs and overall investment in innovation.

Organisational capability

The capabilities view assesses the ability of an organisation's competencies, culture and conditions to support the creation and management of innovation. Kylliäinen (2018) suggests that if organisations can answer the question of which capabilities are required to innovate, they are more likely to choose the right metrics.

Leadership

Leadership metrics allows organisations to view how much the leadership of organisations support innovation projects. This is achieved by evaluating the involvement of leaders with innovation activities, establishing formal processes that promote innovation and the dissemination of innovation goals. Figure 2.16 shows the innovation framework created by Muller *et al.* (2005).



Source: (Muller et al., 2005)

Figure 2.16: Innovation framework.

2.7.4. Driving innovation metrics

Kaplan (2018) states that using metrics in an organisation is not a once-off exercise – it is an approach that involves planning, monitoring, and learning over a long period of time. Simple activities like these ensure that innovating metrics are used and referred to when making management decisions and re-evaluating the innovation strategy. A description for planning, monitoring, and learning as the three driving agents for innovation metrics is given in the table below.

Table 2.7: Approach for driving innovation metrics

Approach	Description
Planning	Involving key stakeholders in this phase will ensure that the correct
	assumptions are made about the sources of value and that the
	metrics align with the strategy of the organisation.
Monitoring	The metrics should have a specific goal(s). These goals should be
	tracked, and the results obtained from the metrics should be used
	to adjust innovation activities where necessary. The goal of
	monitoring the metrics is to ensure that the metrics remain relevant,
	or that the innovation strategy is working.
Learning	The whole idea of innovation metrics is to learn from their results.
	Involving the key stakeholders in the process is essential to identify
	new opportunities.
	0 (Karlar 2016

Source:(Kaplan, 2018)

2.8. Innovation portfolio management

It has become increasingly important for organisations to manage future and current innovation portfolios (Brasil & Eggers, 2019). Similar to managing financial portfolios, innovation portfolio management entails balancing risks, resource allocation, flexibility and adaptability (Brasil & Eggers, 2019). Innovation portfolio management can be defined as a dynamic decision-making process through which organisations evaluate and decide what innovation projects they will pursue (Brasil & Eggers, 2019; Stuart, 2009). It is about selecting the right projects for innovation and it comes down to the execution of the innovation strategy (Van den Ende, 2017).

In the Fugle model, the portfolio stage divides the funnel and the bugle and refers to the concepts that have already been developed. Within this stage of the innovation process, the organisation will prioritise their strategy, schedule projects, assign resources and funding, and release the concepts as projects into the deployment stage (Marais, 2010). The fugle model also contains a launch gate,

which is the decision point for the date that a chosen innovation project will be released (Louw et al., 2018).

The first phases of innovation portfolio management are to generate ideas and refine concepts. Then the decisions are made and finally the projects are launched. The first phase, idea generation and concept definitions, is relatively affordable regarding the resources required to implement the phase. The launch stage becomes increasingly expensive, and therefore to stop projects after it has been launched, is unfavourable. It is thus clear why the portfolio management phase is a fundamental part of the process.

2.8.1. Project selection types

There are two ways, according to Van den Ende (2017), for organisations to select projects during the portfolio management phase: reactive project selection and proactive project selection.

Reactive project selection is simple to implement, but the disadvantage of this method is that it leads to an over-representation of incremental projects. The reason therefore is that incremental ideas score higher in financial risk, and therefore appears better according to the scoring system used by Van den Ende (2017). The reactive project selection approach is described in Table 2.8.

Table 2.8: Reactive project selection.

Name	Description	Phase
Collecting proposals	Proposals for projects are collected for selection.	Idea generation and collection
Defining criteria	Criteria according to which ideas will be scored is defined.	Innovation Strategy
Scoring projects	Score the project according to the defined criteria.	Portfolio stage
Selecting projects	Select projects according to the scores.	Portfolio stage

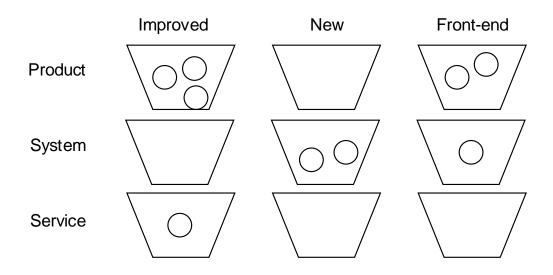
Adapted from (Van den Ende, 2017)

Proactive project selection is harder to implement, but it will result in a more balanced portfolio containing a variety of high- and low-risk projects. Van den Ende (2017) further describes the different activities in proactive portfolio management and provides tools for organisations to manage their innovation portfolios.

Table 2.9: Proactive project selection.

Name	Description	Phase
Budget for innovation	The organisation should decide on the amount of money that they want to make available for innovation projects.	Innovation strategy
Define buckets	Alternative opportunity areas should be defined. These different areas can be called buckets. Refer to Figure 2.17.	Innovation strategy
Define criteria per bucket	After the buckets have been defined, criteria for each bucket need to be defined. The criteria can include technical feasibility, market attractiveness, expected commercial value, strategic importance, and intellectual property protection.	Innovation strategy
Classify and choose projects	The projects that have been captured in the innovation process should be sorted into their respective buckets. These projects are then evaluated against the criteria defined for the bucket. The projects are the selected.	Portfolio stage

Adapted from (Chao & Kavadias, 2008; Van den Ende, 2017)



Source:(Van den Ende, 2017)

Figure 2.17: Philips Lighting buckets

2.8.2. Balance of innovation portfolio

Nagji & Tuff (2012) define three types of initiatives within an organisation: core, adjacent and transformational initiatives. They found that organisations that have a clear objective for their innovation activities, have the right balance between these three initiatives. These organisations implemented tools and developed their capabilities to help them manage their initiatives sufficiently. The definition of each initiative is as follows:

- Core initiatives refer to the incremental changes that have been made and they draw from the assets that the organisation already has. It refers to the core business of the organization.
- Adjacent innovations share characteristics of transformational and core initiatives and allow organisations to use existing capabilities to perform new activities.
- *Transformational* initiatives are completely new, radical and disruptive offerings where the organisation will require new capabilities to create these offerings.

In their research, Nagji & Tuff (2012) set out to find what the industry average was for the distribution of resources among the three initiatives. The industries that were included in the study are industrial, technology and consumer goods sectors. They found that organisations that outperformed their competitors, had a 70%, 20%, and 10% distribution among their core, adjacent and transformational initiatives. Interestingly, another ongoing research study that they conducted found that the financial returns that the organisations received on the different initiatives, are almost the inverse of the allocation distribution (Nagji & Tuff, 2012).

The allocation distribution will differ between different types of industries – how competitive the organisation is, and whether an organisation is catching up or is the leader in a market. A start-up company, for example, will most likely allocate a substantial proportion of their resources to transformation initiatives in comparison with organisations that are the leaders of that industry. This is likely due to having less resources available during the start-up phase. Organisations should thus choose a ratio that they believe will deliver the best results, while carefully considering the risks involved (Nagji & Tuff, 2012).

2.9. Creativity

Creativity is a crucial part of innovation, especially regarding the generation of new ideas and finding ways and methods to develop the idea so that it can become a successful innovation. Rhodes (1961) defines creativity as:

"a noun naming the phenomenon in which a person communicates a new concept."

Rhodes also argues that the word 'creativity' is often used out of context, and that it usually refers to only one part of the phenomenon. Creativity cannot be explained by a single component, but it is rather a sum of its parts (Rhodes, 1961). This section will discuss the four P's of creativity, the components of creative performance, and the relationship between creativity and innovation.

2.9.1. Four P's

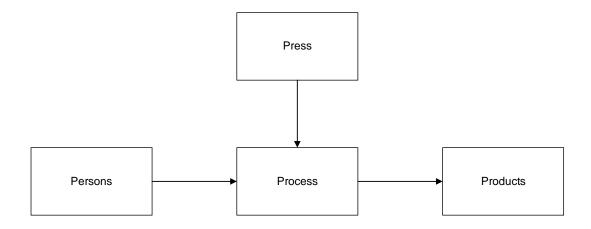
As part of Rhodes' analysis of creativity, four components have been defined to describe the phenomenon: persons, processes, press and products.

Persons refer to the human that is said to be creative. Within this component, the personality, intellectual ability, habits, behaviour and attitudes of the person are some of the indicators that can show whether this person could be creative (Rhodes, 1961).

Next, the mental *processes* refer to the motivation, perceptions, learning, thinking and communication of the person. Within this component of creativity, the organisation can gain insight into why some persons might look for a new and perhaps better way of doing things, while others remain satisfied with current methods and processes. It has also been found that the creative process is one that can be taught (Rhodes, 1961).

The environment in which the persons operate also influences the creative process. The relationship between the persons and the environment is represented by the *press* component. The impact of the external or internal environment of a person may be a catalyst to creative ideas. Innovative ideas form in a response to certain sensations, perceptions, or imagination that the person experiences.

The final component in the 4 P's of creativity is *products*. Ideas are the initial outcome of creativity, but once an idea becomes a product, it takes on a tangible form. Similar to inventions, products that originated from a creative idea, only become an innovation once it has been successfully deployed into the market or environment for which it was intended.



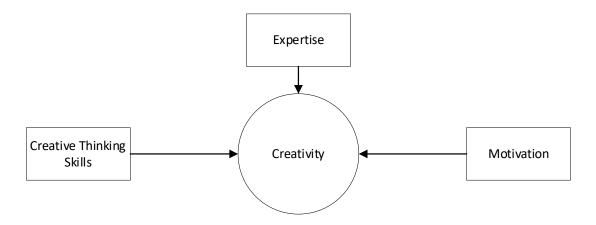
Source: (Langeveld & Stam, 2017)

Figure 2.18: Four P's of creativity

Figure 2.18 shows the relationship between the four components. The figure shows how *persons* with their own set of unique personal characteristics that influence their creativity are influenced by the *processes* and the *press* of the environment in which they operate. The outcome of these three components is essentially the product. Creativity therefore is not only the product or the person, but also the processes through which the person is creative and the influences that impact them that form part of the phenomenon called creativity.

2.9.2. Components of creative performance

Organisations should have an understanding of what makes people or teams creative to ensure that they position their resources in an optimal way. Amabile (1983) defined three requirements for persons or teams to be creative, otherwise known as the components of creative performance. These are *expertise*, *motivation*, and *creative thinking skills*.



Source: (Amabile, 1983)

Figure 2.19: Components of Creative performance

Motivation

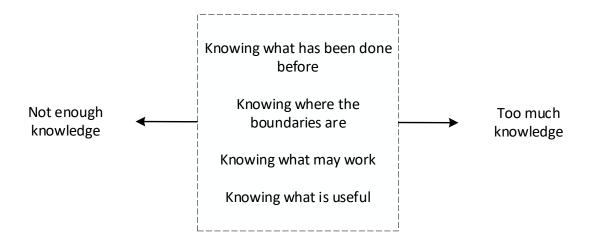
In this case, the motivation of a person is specific to the tasks or work that the person needs to do within the organisation. According to Amabile (1983) this motivation includes the attitudes of the person towards the task, and the person's motivation for performing the task.

Extrinsic motivation is when a person performs a certain task, not because of their love or passion for it, but because of external factors. Intrinsic motivation is when a person performs a task because they love and enjoy what they do, and not because of what they might get from performing the task (Bhaduri & Kumar, 2011). Being intrinsically motivated has many advantages that mean that a person could be more willing to overcome obstacles as they arise. Persons who are intrinsically motivated are also more prone to work hard and have a willingness to fail numerous times before they become successful in their tasks (Langeveld & Stam, 2017).

Intrinsic motivation is more desirable than extrinsic motivation, because it demands nothing from the organisation. Numerous theorists have proposed that the absence of external factors that put pressure on persons to be creative is crucial for creativity to flourish (Amabile, 1983).

Expertise

Expertise, or as Amabile (1983) defines it, domain-relevant skills, is the person's knowledge and skills of a specific domain of tasks. The person's skills can assist them in formulating new ideas as they have knowledge about a certain problem and understand how it is defined. By understanding the domain in which they are performing a task well, a person can also come up with numerous different and creative solutions.



Source: (Langeveld & Stam, 2017)

Figure 2.20: Too much vs not enough knowledge

Figure 2.20 depicts a sliding scale of having too much knowledge as opposed to having not enough knowledge. Both extremes have their advantages and disadvantages regarding creativity. But in general, it is generally better to have too much knowledge than not enough knowledge about creativity (Langeveld & Stam, 2017).

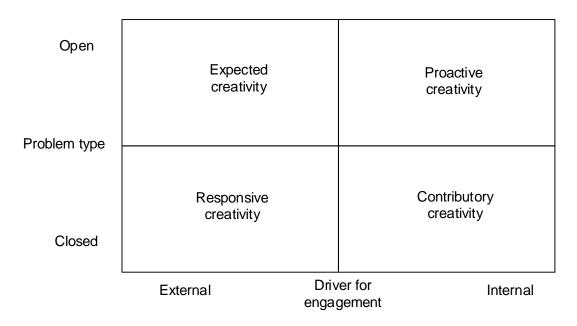
Creative Thinking Skills

Creative thinking skills is to be able to think flexibly and imaginatively. Amabile (1983) writes that a person that has a high level of domain relevant skills and is intrinsically motivated, but lacking creative thinking skills, will be incapable of delivering work that is considered creative.

People can get so used to doing things a certain way that there is no need or desire to look for other creative methods that might work better. Even if a certain method is not necessarily better, people should have the freedom and willingness to try new ideas and to be creative in the way that they think. It is necessary to think outside the box (Langeveld & Stam, 2017).

2.9.3. Types of creativity

Unsworth (2001) challenged the assumption that creativity is a unitary construct therefore developed a matrix of creativity types. The x-axis of the matrix represents the driving force for a person to be creative, while the y-axis represents the type of problem posed. The driving force is a spectrum of external to internal drivers. The problem type ranges from open to closed.



Source: (Unsworth, 2001)

Figure 2.21: Matrix of creativity types

Responsive creativity occurs when an externally-driven problem with specific requirements arises. In this category the individual has the least amount of control over the choices that need to be made to solve the problem.

Expected creativity also arises from an external driver, but the problem presented is open in that there are no requirements for how the problem should be solved.

Contributory creativity is when a problem is self-determined by the individual and it is well defined. An example of contributory creativity can be when an individual chooses to contribute to solving a problem that they are not directly a part of.

Proactive creativity occurs when an individual searches for problems to solve alone. The problems are not presented before the employees, but employees displaying proactive creativity will suggest new improvements or new products.

2.10. Innovation and knowledge

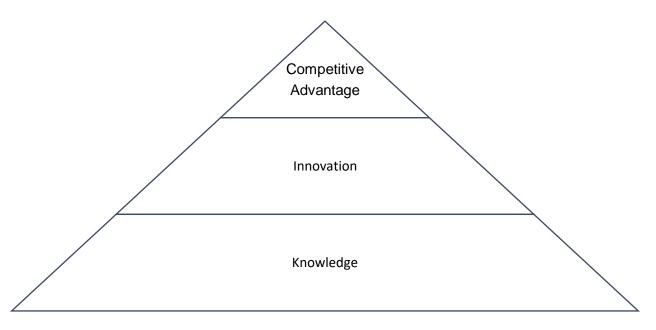
Knowledge is a critical aspect of innovation management (Du Preez & Louw, 2007). It is the foundation for innovation (Figure 2.22), where innovation is the building block towards competitive advantage (Du Preez *et al.*, 2015). The experience, insight and expertise in an organisation are known as the knowledge that organisations hold (Hoe, 2006).

Defining knowledge is not an easy feat. There are mainly two low-level knowledge types: individual and organisational knowledge. Individuals possess individual knowledge that they know how to use or implement. Organisational knowledge refers to knowledge that is distributed within the organisation; this knowledge can be formed through the routines, symbols, behavioural norms, and the values of the organisation (Leber, Buchmeister & Ivanisevic, 2015).

Knowledge is the most valuable asset that a company can obtain, followed by encompassing information and data. Knowledge informs better decision making, which could result in improved competitiveness. Information and data may with effort and skill, assist in acquiring more knowledge. (Grover & Davenport, 2001)

Du Preez & Louw (2008) state that information is a crucial catalyst for idea generation. They list different types of information that might be useful in driving innovation:

- Information about challenges or problems currently in the space that they compete in;
- Information about the organisation's competitors;
- Information about the market and the organisation's clients;
- Information about existing or newly developed technology; and
- Information about the strategy and goals of the organisation.



Sources: (Du Preez et al., 2015)

Figure 2.22: The impact of knowledge on Innovation

The knowledge management lifecycle consists of knowledge-creation, -storage and retrieval, - transfer and application (Du Preez & Louw, 2007). Knowledge management is thus the exchange of knowledge among all entities within and outside of the organisational domain and it is a common practice within strategic alliances (Briones-Peñalver, Andrés Bernal-Conesa, De, *et al.*, 2020).

Choi, Ahn, Jung, et al. (2020) found that people share knowledge easier and more effectively when they share common interests. This leads to better and more sustainable knowledge management activities. The researchers also found that knowledge management has a positive impact on the innovativeness of organisations. They state that the purpose of knowledge management is for organisations to increase their competitive advantage by increasing their efficiency and innovation, and therefore it is woven into the strategy of an organisation.

Leber *et al.* (2015) distinguish between two types of knowledge within an organisation. The individual knowledge and the organisational knowledge. Individual knowledge refers to the knowledge that individuals possess, and thus it is argued that knowledge is intrinsically linked to people. Organisational knowledge refers to the collective understanding within the organisation. Organisational knowledge is shaped by the organisational culture which is developed over a long period of time.

Grover & Davenport (2001) discuss six useful concepts of knowledge management. The concepts are described in Table 2.10.

Table 2.10: Six useful concepts for knowledge management.

Concept	Description
Tacit and explicit knowledge	Literature in the knowledge management field defines two types of knowledge. Tacit knowledge refers to knowledge that people have but cannot express easily. Explicit knowledge, on the other hand, refers to knowledge that can easily be translated or codified into materials.
Knowledge processes	The knowledge process can be categorised into three sub-processes: knowledge generation, knowledge codification, and knowledge transfer. Knowledge generation is the process of acquiring more knowledge. The codification of knowledge entails the conversion of tacit knowledge to a more accessible format. Knowledge transfer is the transfer of knowledge from its origin, which could be when it was generated from its codified form to the point where that knowledge is applied.
Codification vs personalisation	The distinction between these two concepts involves an organisation's primary method of knowledge transfer. Organisations implementing the codification approach mainly rely on knowledge repositories. On the other hand, organisations implementing the personalisation approach rely on the interaction between people.
Knowledge markets	Organisations are knowledge markets where knowledge is exchanged for something in return. Thus, some people would have an interest in keeping their knowledge to themselves, unless they receive some form of remuneration for it.
Communities of practice	This concept suggests that knowledge is best shared and transfers better between people from different departments within an organisation, but who still have the same work interest. Formulising such interactions is not necessarily a good option but should rather occur naturally.
Intangible assets	Intangible assets refer to knowledge as an asset that cannot be measured. Adapted from: (Grover & Davenport, 2001)

Adapted from: (Grover & Davenport, 2001)

Esterhuizen, Schutte & Du Toit (2012) designed a knowledge management framework that could assist organisations in improving their innovation capability maturity. Innovation capability refers to the ability that an organisation has to be innovative. Organisations should reassess their innovation capability continually to ensure that they are improving and progress in terms of their innovation efforts (Esterhuizen *et al.*, 2012; Du Preez *et al.*, 2009). The framework enables organisation to assess their knowledge management activities and processes to make sure that they are on the right trajectory to meet their innovation capability requirements. Their study ultimately suggests that knowledge management is an important driver for the innovation capability of an organisation.

2.11. Social networks and innovation

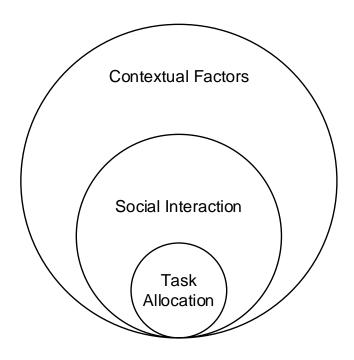
All organisations consist of different teams. Teams are coordinated groups of diverse people with different expertise, organisational functions, and with different cultures and backgrounds who have a common goal (Tasselli, 2017). Teams and teamwork can be an important determinant for innovations and good outcomes. Organisations also have social networks that describe the relation that members of the organisation have with one another. This section will discuss teams and social networks and how they influence the innovativeness of organisations.

2.11.1. Teams

Teams contribute to the innovativeness of an organisation by communicating and pursuing a common goal. Teams are usually designed formally or they naturally take a formal structure once they come together.

According to Tasselli (2017) team success is dependent on several key components:

- 1. Task Allocation the allocation of different tasks to different team members and the interaction of team members with one another.
- 2. Social Interaction how the members of the team interact and integrate their diverse expertise and knowledge to pursue a common goal.
- 3. Contextual Factors the rewards systems, human resource systems, information systems, and the availability of resources within the organization.



Source: (Tasselli, 2017)

Figure 2.23: Components necessary for team success

Diversity can affect innovation, since a diverse team could create multiple sources of ideas. Members with different backgrounds and expertise have multiple views of the work environment and the various challenges that the organisations and their customers face. The different perspectives and ideas that can emerge from diverse teams could lead to multiple concepts and solutions to a problem and in effect increase the chances of innovations that develop (Tasselli, 2017).

Diversity in teams can be split into two legs:

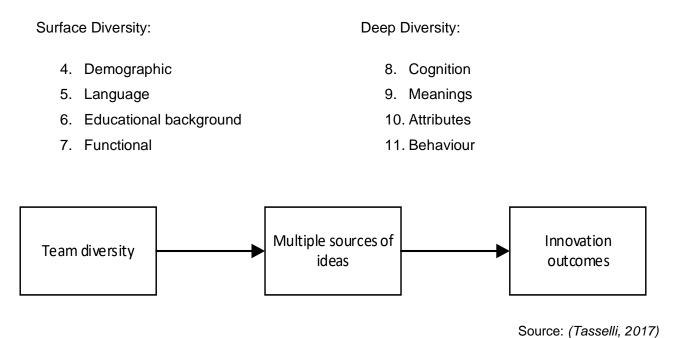
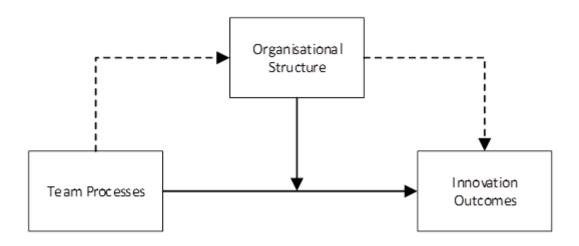


Figure 2.24: Effect of team diversity on innovation

Teams contribute to innovation by a process that is described in Figure 2.25. Team processes refer to the commitment of team members to the common goals set before them, the participation of all members, and task orientation which can affect the radicalness, magnitude, and effectiveness of innovations. The organisational structure and team processes influence each other, and then determine the outcomes of the organisation and innovation.



Source:(West & Anderson, 1996)

Figure 2.25: Contribution of teams to increase innovativeness

2.11.2. Social networks

Leenders & Dolfsma (2016) state that it is important for innovation to be a collaborative effort. During the collaboration process, existing knowledge and ideas among persons can merge to form new ideas and knowledge. This occurs when members of an organisation interact within their social networks. Kolleck (2013) found that social networks are of great importance for innovation diffusion, since they have the potential to influence learning processes, provide opportunities for problem solving, and to establish a platform for new ideas to originate from.

Social networks are important to understand, as the informal or formal communication between employees could be a vital catalyst for innovation (Leenders & Dolfsma, 2016). The networks give an understanding of how people within an organisation interact with one another. There is a clear difference between teams and social networks within organisations. Teams are usually assigned formally, and they are hierarchal in nature. Teams also tend to be more stable than social networks and have a clearly defined goal. On the other hand, social networks are informal, emergent, and dynamic. Social networks are not hierarchal in nature, and they can either be goal-orientated or unforeseen (Tasselli, 2017).

Sociograms are diagrams that display the interaction between all the actors in an organisation. Within social networks, social network analysis could help organisations identify weak links within

the organisation, that a department such as human resources can act on by hosting group activities or workshops to encourage interaction among their employees. Figure 2.26 shows an example of a sociogram. Imagine that each circle represents a person, and the direction of the arrow shows the interaction between the persons (Burt, Kilduff & Tasselli, 2013; Leenders & Dolfsma, 2016).

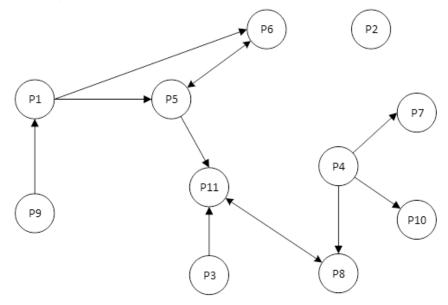


Figure 2.26: Sociogram Example

Burt *et al.*, (2013) & Tasselli (2017) state that there are four key features of social networks that need to be understood. The four features are density, reciprocity, activity and popularity. Density refers to the number of ties/connections between the nodes in a social network. The more connections the denser the network. A good social network will be dense and not fragmented. Thus, a network that is too dense can also hinder the productivity of an organisation or team.

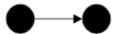


Figure 2.27: Density

Reciprocity refers to the tendency of members in the network to seek advice or interact with the reciprocating members. Thus, it means that the relation or information flow between the members goes in both directions.



Figure 2.28: Reciprocity

The activity shows the tendency of a member to seek interaction/advice from other members of the network. The more connections a person has with other nodes, the more active that person is.

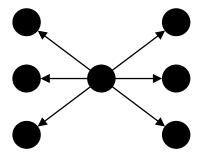


Figure 2.29: Activity

Finally, the popularity is used to describe a member of the network who is popular, since many other members approach them for advice or a connection. Typically, a leader will be popular in a social network. Being popular is not necessary a positive attribute, since having to manage too many interactions could decrease productivity, effectiveness, and less focus on generating new ideas.

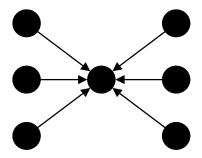


Figure 2.30: Popularity

Social network diagrams can be useful tools for organisations to understand how they can improve the social network within their organisation, to increase the number of ideas generated, and to improve knowledge sharing. New ideas will eventually become innovations which will increase the competitive advantage of the organisation.

2.12. Incentives and rewards

One of the issues regarding the motivation of employees to generate and share ideas is incentivising/rewarding them for their participation. One would think that it goes without saying that incentivising people for their contribution to their organisation's innovation programs would increase the innovativeness of the company, but it is not necessarily the case (Kanama & Nishikawa, 2017).

The literature shows that there are two types of rewards/incentives: extrinsic rewards and intrinsic rewards. Extrinsic rewards refer to rewards introduced by organisations to motivate their employees to be innovative – usually some sort of financial reward. Intrinsic rewards, on the other hand, refer to the rewards some employees might enjoy, as the action of innovation is inherently pleasurable for them.

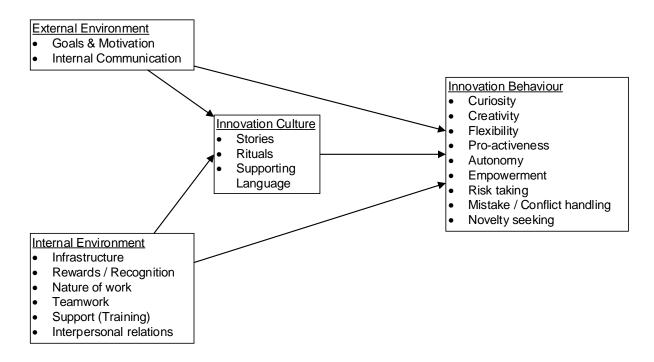
The results from different studies on rewards and incentives differ. Some studies find that extrinsic rewards are not effective while others argue that it is important for innovation (Kanama & Nishikawa, 2017; Marx, Reis Faleiros Soares & da Silva Barros, 2016). Some research in this field suggests that the introduction of extrinsic rewards would encourage employees to pursue smaller, low-risk, and incremental ideas to increase their chance of receiving the rewards (Marx *et al.*, 2016). Organisations should thus be careful what incentives they provide and whether they should provide extrinsic incentives at all.

Behrens & Patzelt (2018) state three reasons why extrinsic motivation might overpower the intrinsic motivation that some employees possess. Firstly, extrinsic rewards could decrease the speed at which a company innovates, if the rewards are perceived to be complex and difficult to obtain. Secondly, employees can become more fixated on getting rewarded than on coming up with breakthrough ideas. Thirdly, extrinsic incentives could impact a culture of collaboration negatively, since each member of an organisation will want to be remunerated for their own ideas and innovations. Behrens & Patzelt (2018) conclude that the introduction of extrinsic motivation could be unfavourable for innovation. Organisations can combat this negative effect by keeping the extrinsic incentives simple and by ensuring that it is not prominent. Having extrinsic benefits that are too prominent, could divert the attention from innovation to the rewards. Kanama & Nishikawa (2017) also concluded that the introduction of monetary (extrinsic) rewards harms the creation of new products and/or services.

An alternative to extrinsic rewards is the introduction of an evaluation system based on innovation performance (Kanama & Nishikawa, 2017). It was found that employees, especially in larger organisations, tend to become demotivated when there are monetary rewards available for innovative performance. The reason for this occurrence is that the employees feel like their chance of being rewarded is slim. However, they seem to become more motivated when evaluation systems are implemented. This might be because employees feel that they will be evaluated based on their performance and not against their co-workers.

2.13. Innovation Culture

The culture within an organisation is one of the core capabilities that drives innovation . Roffeei, Kamarulzaman & Yusop (2016) investigated the role of innovation culture within the higher education context. They proposed a framework for innovation culture that consists of four parts: external environment, internal environment, innovation culture and innovation behaviour. Figure 2.31 depicts the framework.



Adapted from (Roffeei et al., 2016)

Figure 2.31: Innovation culture framework in higher education

The framework suggests that a positive external environment will lead to a positive innovation culture and positive innovation behaviour within the organisation. Furthermore, a positive internal environment of the organisation which includes the infrastructure, rewards, teamwork etc., also leads to a positive innovation culture and positive innovation behaviour.

The innovation culture consists of stories, rituals, and supporting language. This research suggests that storytelling is a crucial part of motivating members of an organisation, since previous success stories (and sometime failures) or influential and significant events of the organisation's past are being told, which could inspire employees and enable them to learn from past successes and failures. Rituals in this case specifically refer to convocations and graduation ceremonies at higher education institutions, but business orientated organisations could also introduce rituals that will support an innovation behaviour. Supporting language is important in creating an environment where members of the organisation can learn from one another (Roffeei *et al.*, 2016).

Again, a positive innovation culture will lead to positive innovation behaviour within the organisation. The behaviour that supports innovation is not necessarily something that an organisation can implement, it is rather the result of positive external and internal environments and a positive innovation culture. The environments and the culture can be seen as the soil, and behaviour is the fruit that grows from it. Although the study by Roffeei *et al.* (2016) focuses on the higher education domain, it is certainly applicable to other types of organisations.

Dobni & Klassen (2018) have found that innovation becomes truly successful when leadership that supports an innovation culture is present within an organisation, and when a systemic approach that reinforces innovative behaviours is implemented. It has also been observed that most organisations are aware that they need something to become more innovative, but they are not quite sure what they need. The journey for these organisations can be frustrating and many times it amounts to nothing. Dobni & Klassen (2018) propose a framework that enhances innovation culture in their research.

Four categories have been defined that have an impact on the innovation culture of an organisation: knowledge management, process, leadership and resources and they are each defined by three innovation drivers given in the table below.

Table 2.11: Framework to enhance innovation culture in organisations

Dimension	Innovation Driver	Description
Knowledge Management	Knowledge generation	An environment where the generation of knowledge within the organisation can take place among all members.
	Knowledge transfer	An environment where the transfer of knowledge towards the right members takes place at the right time.
	Knowledge decision- making	The employees' ability to convert the knowledge obtained through knowledge generation and transfer into useful projects and solutions within their business.
Process	Employee engagement/ empowerment	The psychological empowerment of employees to undertake projects and problems that will contribute to the value creation of the organisation. It also refers to motivating employees and giving them confidence in their abilities.
	Idea management	The level at which members of the organisation can pursue opportunities that they would not necessarily have pursued within their roles. This involves new entrepreneurial and innovative opportunities within the organisation.

	Alignment	The alignment of the innovation strategy with the strategy of the organisation.
Leadership	Innovation goals or vision	The degree to which the organisation has defined their business model to include the active development and inclusion of activities to support innovation.
	Employee connectivity	This driver refers to how employees relate to one another in terms of their contributions and whether they feel appreciated. It also refers to whether the employees have a passion or can resonate with what the organisation does and with its vision.
	Strategic Model	This involves the strategy towards innovation. This strategy lays the foundation for the innovation activities and processes throughout the organisation.
Resources	Employee skills and creativity	The level of skills and creativity of employees to contribute to the innovativeness of the organisation. It also includes how much the environment in which the employees operate allows them to utilise their skills and creativity.
	Organisational learning	The implementation of learning and development programs to upskill employees. These programs should focus on instilling new behaviours as well as reinforcement programs afterwards.
	Technological and financial support	This is the amount of time, technologies, people, and other resources that the organisation supplies to support their innovation initiatives.

Source: (Dobni & Klassen, 2018)

The framework of Dobni & Klassen (2018) proposes that the twelve drivers for innovation can be used to measure the health of the innovation initiatives within the organisation. It is called the Innovation Health Index. This index is calculated by giving a score for each of the twelve innovation drivers and taking the average of all the scores. This index does not measure the actual innovation process, but rather the health of the environment in which the organisation will try to be innovative.

It can be concluded from this study that the innovation culture of an organisation is crucial for the success of the innovation programs.

The frameworks proposed by Dobni & Klassen (2018) and Roffeei *et al.* (2016) have a lot of similarities regarding the drivers of innovation culture and behaviours. The various factors that these studies mention, can be used as a starting point for organisations to find the areas to actively create an environment for innovation to succeed.

2.14. Innovation and failure

Innovation and failure are two words that organisations dislike when it is used close to each other: Innovation and failure often go hand in hand, and the task of innovation managers is to minimise the risks. A simple change of perspective can help organisations not only to see the value of failure, but to use failures as a vehicle for future success.

This view does not encourage reckless decision-making, but it rather fosters members of an organisation to explore unknown territories which could increase breakthrough solutions or technologies. There are several examples of breakthrough inventions that did not come from immaculate planning and structure, but from so-called 'mistakes'. Thomas Edison experimented with 800 different types of filaments before he found the one filament that changed the world (Hogarth & Schoemaker, 2005).

Townsend (2010) argues that organisations only look at static measures for innovation and how the innovations will add value directly to their organisation, whilst neglecting the possibility that innovations classified as failures could also add value to their firm in a secondary way. Townsend (2010) states that:

"The concept that unsuccessful innovations may generate organisational benefit is largely unexamined."

In the past, metrics only measured the monetary value attached to the innovation, such as profits, losses and R&D expenditure. But as time passed, it became evident that innovations add value to firms in numerous ways. It is not only organisations that measure innovation wrongly most of the time, but many studies also relate the performance of an organisation to the success of innovations.

Beers (2003) found that failed innovations are usually swept under the carpet, because the success or failure of innovations have a direct impact on the careers of individuals. When innovations are successful, people want all the praise, but when they fail, they tend to shift the blame or hide it.

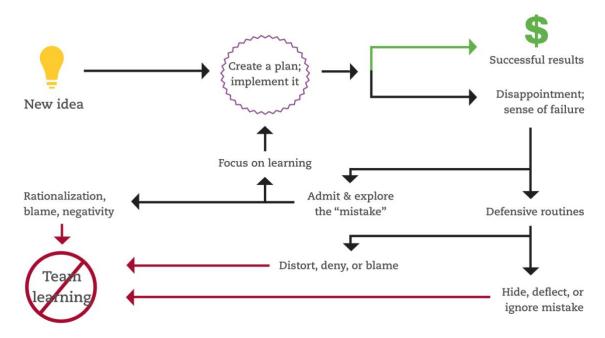
2.14.1. Learning from mistakes

Schoemaker, Heaton & Teece (2018) discuss the value that failed innovations can add to organisations. They believe that when people and firms try to forget their mistakes, it could lead to missed opportunities for innovation and creative problem-solving. Mistakes should be viewed as new opportunities, or as Schoemaker *et al.* (2018) call it, "portals to innovation". Mistakes must be investigated, not to determine whose fault it is, but to learn from the mistakes. Organisations should create a learning culture instead of a culture of excellence, according to Schoemaker. Thomas Watson, a former CEO of IBM, famously said:

"If you want to succeed faster, make more mistakes".

Learning from errors allows for new opportunities which will eventually compensate for the mistake. But this is not as simple as it sounds. Companies have to develop a strategy to incorporate a type of learning that will lead to improved performance. One way to ensure that mistakes are learned from, is to create opportunities and to discuss them.

Schoemaker also suggests that employees should investigate outside of what is reasonable or that fits within their usual assumptions (Hogarth & Schoemaker, 2005). Confirmation bias occurs when you have tunnel vision and you struggle to consider other options or possibilities as a solution to a problem based on past experiences. Allowing out-of-the-box thinking could open up a whole new list of opportunities.



Source: (Schoemaker, 2012)

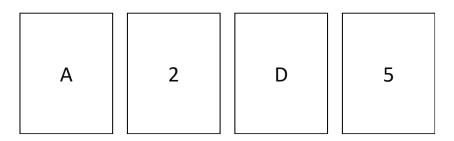
Figure 2.32: Good and bad learning loops

Figure 2.32 shows the Good and Bad learning loops that Schoemaker (2012) constructed. The figure explains what good learning vs bad learning looks like. It is argued that organisations should create a culture where people are allowed to make mistakes and to create opportunities where new knowledge can be created from what was learned from the mistakes. When mistakes are made, it should be acknowledged, but then focus should be put on learning from it, in order to create better products or services. To have this mentality, could give employees more confidence in sharing ideas without fear of failure.

2.14.2. Confirmation bias and innovation

The Wason experiment is used by Schoemaker (2012) to prove that people often fall into confirmation bias. The Wason experiment or the Wason Selection Task is performed to test logical reasoning in the experimental psychology field. Peter Wason designed this test to see if people applied logic that would disprove a hypothesis by falsifying it as well as confirming it (Dickey, 2021).

The experiment is as follows: The task for the reader is to investigate whether the cards have been sorted correctly. If the card has a vowel on one side, it should have an even number on the other side. Figure 2.33 shows four cards. Which of the four cards need to be turned over to determine if it does not conform to the rule? (Wason & Shapiro, 1971).



Adapted from: (Bye, 2012)

Figure 2.33: Confirmation bias

The correct answer is that the card with the letter A and the card with the number 5 should be turned around. Most people choose only the letter A, or they choose the letter D and number 2. The reason for the correct answer is that the rule states that any card with a vowel must have an even number on the back, but not the other way around. And it is important to know what is on the other side of the number 5, because if it is a vowel, the rule will be violated (Bye, 2012; Wason & Shapiro, 1971).

In the case of innovation, this simple experiment shows that people will only test the possibilities that fit their way of thinking. The trick of these tests is that one should also check the options that violate your guess. In the same way, organisations should encourage employees to investigate options that violate their preconceived ways of thinking. Just because one solution to a problem always works, does not mean there is not a better solution (Schoemaker, 2012).

2.15. Conclusion

The purpose of this chapter is for the researcher to gain knowledge and a better understanding of the innovation management field. It also serves as the foundation of the Conceptual Framework Analysis that will be performed in Chapter 3, which is the first two phases of the CFA. These phases are the mapping of sources and reading and categorisation of the different concepts.

This chapter provides an overview of the literature of innovation management and the related fields. It was found that innovation management has an impact on economic and business growth, and that organisations and countries should therefore have a strategy to enhance their innovativeness. This would ensure an increase in competitive advantage. It was also concluded that the growth of the economy and businesses do not only have financial benefits in store for large corporations, but also for the society (Abramovitz, 1956; Rosenberg, 2004).

Various concepts have been identified in the literature review that are important for managing innovation. All these concepts can be considered when creating an innovation strategy to ensure that all available sources and innovation drivers are utilised for the benefit of the organisation in its attempt to be more innovative. The seven rules of innovation that are defined by Davila *et al.* (2006), assisted in finding the areas and components that play a significant role in innovation management.

Knowledge is the basis on which and from which all processes, strategies and new ideas can be developed. Organisations should therefore ensure that they have the required knowledge to first develop a strategy and processes, and to then be able to address the problems that their customers have, or the spaces in the market that remain uncontested. Managing the information and knowledge becomes an important asset for organisations and they should manage it to ensure that they reap the benefits from it. Tacit knowledge is generally difficult to manage, but if an organisation can manage it, they will have an understanding of what they know, and it will enable them to better assign the right resources to the different innovation projects.

Two important categories have been identified: management components and driver components. Management components refer to the collective group of concepts that contributes to the management of innovation or are directly related to it. For example, innovation types, models, metrics, idea management, knowledge management and portfolio management are all concepts that can either assist in the management of innovations or are tools that can be used to improve the management process.

Driver components are the concepts that cannot be easily managed necessarily, but that impact innovations The main purpose of driver components is to drive new or existing ideas or innovation projects. Examples of such concepts are creativity, motivation, organisational culture, the market, employees and other role players.

The challenge for organisations would be to bring these two groups of concepts together in order to manage their innovations better. The researcher concludes that the innovation strategy is the concept that can be utilised to achieve this. The innovation strategy should create a culture and space within the organisation where all factors influencing innovation can be used to its full potential, in order to improve the innovativeness of the organisation.

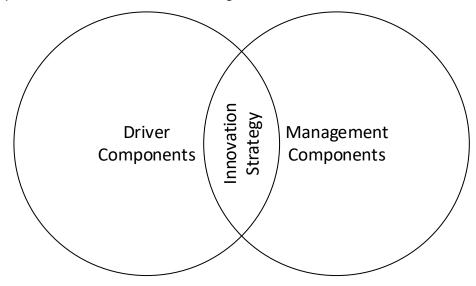


Figure 2.34: Main components of innovation management identified in literature

The researcher has found that it is not necessarily about the innovation management or idea management model that an organisation selects or designs, but rather the successful implementation and execution of the innovation process. People are the largest contributor to innovations and thus it is crucial for organisations to manage how their employees and potential ideators view the innovation programs, since they want their contributors to have a desire to participate.

The following chapter will discuss the conceptual framework analysis. This will entail the process followed to develop the conceptual framework and will discuss the framework that is developed before it is validated.

3. Conceptual framework analysis

Conceptual frameworks play an important role in academics and can be defined as the product of a researcher's reasoning or tentative conclusion. Frameworks can be used to show the relationships between concepts within a specific field. Jabareen (2009) defines a conceptual framework as a network of interlinked concepts that provides a comprehensive understanding of a phenomenon or phenomena. The concepts support one another, articulate their respective phenomena, and establish a framework specific philosophy. A conceptual framework is not merely a collection of concepts, but rather a construct in which each concept plays an integral part (Jabareen, 2009).

3.1. Methodology

The Conceptual Framework Analysis (CFA) methodology will be used to construct a conceptual framework for innovation management. Jabareen (2009) defines the CFA methodology as a tool that offers a procedure for theorisation in building a conceptual framework based on the grounded theory method. Grounded theory is a systematic methodology that is used mainly in qualitative research studies. The advantage of the CFA methodology is its flexibility, ability to be modified and its emphasis on understanding instead of predicting.

In the case if this thesis, the phenomenon is Innovation Management. Each concept that is identified in the analysis will have attributes, characteristics, assumptions, limitations, distinct perspectives and a function within the developed conceptual framework.

The data used for the analysis will come from the literature review in Chapter 2 of this paper as well as additional papers surrounding Innovation Management. The literature review will be constructed from many sources, such as academic articles, textbooks and online resources. The researcher will have to remain in the scope of the thesis when the literature review is constructed, as Innovation Management is a broad topic.

The development of the conceptual framework is an iterative process. Therefore, a continuous exchange between the analysis and data collection is required. The first two phases of the conceptual framework analysis are mapping the selected data sources, and extensive reading and categorising of the selected data. These two phases will be performed as part of the literature review chapter. From the third phase until the sixth phase will be discussed in this chapter: identifying and naming, deconstructing and categorising, as well as integrating the concepts, and synthesising the framework.

3.2. Identifying and naming the concepts

Concepts in the context of a conceptual framework refer to something that consist of different components. The components define the concept and what the concept is meant to represent or perform. According to Jabareen (2009), all concepts relate back to other concepts and should be understood in relation with its components, other concepts it relates to, and the problem it aims to solve.

The researcher identified various concepts throughout the literature review and chose concepts based on the impact they have on innovation and innovation management in the CFA. Each of these concepts are defined in the context of the conceptual framework. Appendix A contains the table with the identified concepts in the literature.

3.3. Deconstructing and categorising the concepts

After the different concepts have been identified, the researcher started to categorise the different concepts. The concepts' attributes, characteristics and roles are identified in order to categorise the concepts according to their features and ontological roles (Jabareen, 2009).

For example, incremental, radical, sustaining, and disruptive innovations are all concepts that are used to describe different types of innovations. There are many other concepts that describe innovations as well. All these concepts can be categorised as Innovation Types.

Another example is concepts that refer to the role players of innovation. The literature identifies several role-players in innovation, some of them being Academia, Governments, Industries, Coordinators and Leaders. These concepts can all be categorised as role players.

The process of categorisation will be performed on each concept by consulting the research papers and iteratively amending the concepts as new knowledge regarding the phenomenon is gained.

3.4. Integrating the concepts

The objective of the following phase is to integrate all the concepts in order to construct the conceptual framework. Concepts that have similarities or address the same issue can be integrated. This is done to reduce the number of concepts.

For example, radical and incremental innovations are both concepts used to describe the *Degree of Innovations*. The role of these concepts is to help organisations categorise their innovation projects so that they can balance their innovation portfolios more efficiently. Thus, they can manage their risks better.

Similarly, technology push and market pull are concepts used to describe how the innovation has been *triggered*. By identifying under which of these two concepts an innovation falls, an organisation will be able to understand what factors they need to consider when pursuing an innovation project. For example, when an idea originated from a new technology, it means that the trigger is technology

push, and therefore the organisation must take extra care when considering whether there is an actual need or latent need for the innovation. When the innovation stems from market pull, the organisation might need to spend more resources on developing new technologies to meet the need. By understanding what triggered the innovation, organisations gain more knowledge in how to manage the innovations.

The examples show that the radical and incremental innovation concepts can be integrated into the concept called *Degree of Innovation*. Technology-push and market-pull concepts can be integrated into the concept called *Trigger of Innovation*. The researcher will not explain how all the different concepts are integrated as this can be deducted from the conceptual framework.

3.5. Synthesising the concepts

After the concepts have been integrated, the next step is to combine the concepts into a coherent whole and to explain the relationships among them conceptually. This process is performed iteratively and repetitively. The researcher must be open, tolerant and flexible to allow for new theories that might emerge from the process.

The process of synthesising the concepts will be performed numerous times, as the researcher gains more understanding of the different concepts in the field of research. The developed Conceptual Framework for Innovation management can be seen in Figure 3.1.

3.6. Validation of the conceptual framework

The objective of this step is to validate the conceptual framework that has been constructed. This is necessary to ensure that the framework does not only make sense to the researcher, but also to other scholars and people in the industry. According to Jabareen (2009), the process of validation starts with the researcher (the insider) who seeks validation from outsiders.

The conceptual framework constructed in this thesis shows the different concepts of innovation management and their relationship with one another. By understanding the framework, organisations can come up with better strategies for innovation activities. A large part of the conceptual framework is the capturing of ideas and managing the innovation process. Thus, the researcher developed an idea management tool which allows outsiders to practically implement the conceptual framework.

The researcher will receive feedback from an organisation who has implemented the conceptual framework after developing their own innovation strategy and using the idea management tool. The organisation, Dynamo Analytics, is a fast-growing SME (small- to medium-sized enterprise) that has had a lot of success, due to their innovativeness. The organisation does not, however, have an innovation strategy or system in place and does not follow an innovation process framework when considering innovation activities and the generation and collection of ideas. Chapter 4 will describe

the reason why a case study was chosen to validate the framework from a research methodology perspective; and it will also describe the reason and methodology for the design and development of an idea management tool.

3.7. The Framework

The framework and its different components, concepts and relationships will now be discussed. The researcher will explain how the concepts interact with one another and what impact it could have on the innovation activities of organisations.

Figure 3.1 shows the developed conceptual framework. The researcher found that the literature expressed the importance of knowledge and an innovation strategy for the success of an innovation. Knowledge can come from inside or outside of the organisation's boundaries and it is an important driver for innovation. The innovation strategy gets developed from within the organisation's boundary, but during the development of the strategy both internal and external factors should be considered.

The rest of the framework can be split into three parts: the internal domain, the external domain, and the outcomes of the innovation process.

3.7.1. The Core

Knowledge

The foundation of innovation is knowledge (Du Preez *et al.*, 2015). Without knowledge an organisation will seize to exist. Organisations must have knowledge about the field in which they participate, their competitors, how to manage their resources, etc. Knowledge can be obtained internally or externally, and organisations should have formulised systems in place to capture both explicit and tacit knowledge. Knowledge can also be obtained by having an organisational culture that encourages people to learn from their mistakes (Innovation and failure).

Innovation strategy

The innovation strategy is the next important aspect organisations need in order to be successful in their innovation activities. Several frameworks can be used to develop an innovation strategy. A popular and effective framework to use is the Strategy Cascade Framework developed by Lafley & Martin (2013). When the innovation strategy is being constructed, the organisation should keep all the factors and concepts in the framework in mind that may influence the innovation activities and ensure that the innovation strategy and business strategy are aligned with each other. The innovation strategy will become the game plan of the organisation and can be amended as more knowledge about the innovation process and its effects on the innovativeness of the organisation is gathered over time.

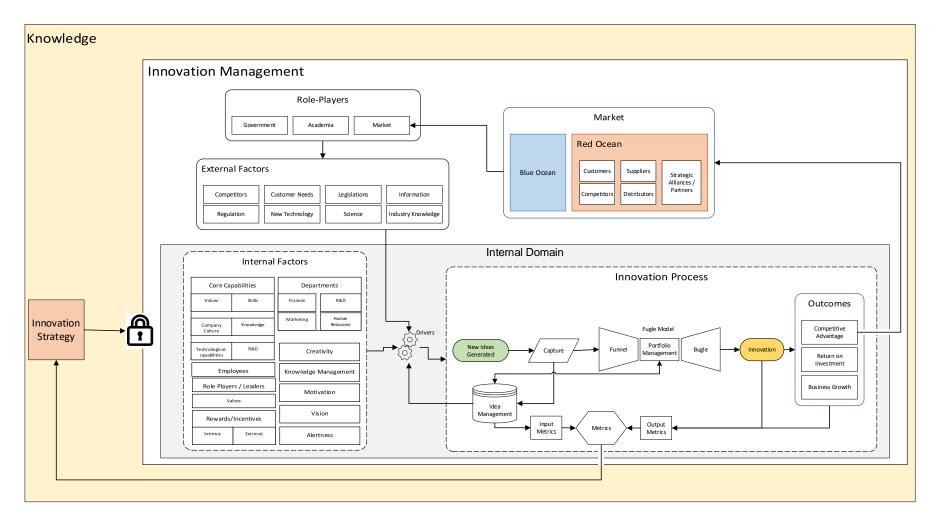


Figure 3.1: The Synthesised conceptual framework

3.7.2. External domain

The external domain refers to the components outside of the organisational boundary. Apart from the internal aspects influencing the innovativeness of organisations, the external domain also has an impact.

Three main categories have been identified in the conceptual framework analysis that influence innovation within organisations. Organisations should consider these categories when developing and maintaining their innovation strategies:

- 1. Markets
- 2. Role-Players
- 3. External Factors Driving Innovation

Markets

In the framework, the market is split into two categories, i.e. Red Ocean and Blue Ocean categories (Kim & Mauborgne, 2004). Red ocean refers to the known market space and represents the industries that are in existence today. Blue ocean refers to the unknown market space that has untapped potential for organisations to discover. As mentioned in the literature review, demand is created in blue oceans and not fought over as is the case with red oceans.

The framework distinguishes between the two types of markets to highlight the fact that the organisations should consider as part of developing an innovation strategy, whether they will contest (or continue contesting) in existing markets or create a new market.

Within the Red Ocean space, different components can have an impact on the innovativeness of an organisation. Organisations should keep these components in mind when developing their innovation strategies to ensure that they use all possible resources to increase their competitive advantage. The components and their respective descriptions in the context of the framework are tabulated in Table 3.1.

Table 3.1: Market components

Component	Description
Customers	Customers are one of the most important groups that influence the success
	of an innovation, since they are the group that will be using and paying for
	the innovations. The needs of customers drive new innovations, but their

acceptance of technology-push innovations is crucial for the innovations to succeed.

Competitors

Competitors also have a major impact on innovations as they are the group which the organisation needs to gain a competitive advantage over. The competitors thus create competition and the pressure to innovate, since the products or services provided by an organisation should have more benefits for the customers than for their competitors.

Suppliers

The products or services that suppliers deliver to organisations can either improve or inhibit the innovativeness of the organisation to which it is delivered. When suppliers are innovative, it could have a similar impact on their customers. For example, a new and stronger type of cement could make construction companies more innovative in their business.

Strategic Alliances

Organisations can collaborate with one another to combine their resources to develop new solutions to the demands of the market. Organisations should consider whether it will be in their interest to partner with other organisations, or to use existing partnerships as part of their quest to gain competitive advantage.

Distributors

Distributors refer to entities who will distribute the invention to the customers after the launch. Efficient and successful delivery of the product or service will have an impact on the acceptance of the invention by the market.

Role-players

The role players in the external domain include markets, academia and governments (Du Preez *et al.*, 2015). Each of the role players contributes to the environment in which an organisation can be innovative. In the framework (Figure 3.1), the role players are part of the external factors that drive innovations.

The role players in the external environment contributes to innovation on a national/international level. Table 3.2 shows the role players and their respective descriptions.

Table 3.2. National level role players

Role player	Description
Government	The government provides businesses and academia with the necessary resources and incentives to encourage innovation. The inputs they give could lead to a stronger economy and competitiveness for the country in the global sphere. Apart from these inputs, regulations and legislation introduced by governments could also require organisations to adapt products, services, or processes to ensure that they adhere to the rules. Adapting existing inventions could lead to innovations as well.
Academia	Universities and research institutions are important role players in driving innovations. Information and scientific evidence coming from these groups may lead to innovations. Academic research is not confined to the borders of every country – the internet and digital journals allow organisations to have access to research from around the globe to grow their knowledge and generate ideas based on it.
Market	New information that surfaces because of applied research, may come from industry participants and could be implemented by organisations to create new and improved products. Customer needs and new introduced technology stemming from the market, could also contribute to the generation of innovative products or services.

External factors influencing innovation

The national/international role players contribute to the external factors that places pressure on organisations to be innovative. Some of the factors do not necessarily introduce pressure, but they create opportunities for organisations to create innovative products or services. This section describes the concepts that have been identified as external drivers of innovation.

The different external factors with their respective descriptions that drive innovation, are tabulated in Table 3.3.

Table 3.3: External factors influencing innovation.

External Factor	Description
Competition	Competition usually stems from the market and pressurises organisations. The competitors could pose a threat to the completive advantage of an organisation. If an organisation is not innovative and does not actively pursue activities to help them gain competitive advantage over their competition, they could become irrelevant in the market.
Customer Needs	The needs of the consumer also come from the market component. Organisations with a business-to-customer focus will usually be pressurised from the customer – this is where the market-pull innovations are incubated. The customer's needs create the foundation for innovation to take place.
Legislation	Laws introduced by the government or associations can introduce pressure to innovate, because existing products may need to be adapted to adhere to these legislations.
Regulations	Like legislation, regulations could also induce pressure to innovate. It does not necessarily mean that products or services should be modified, but they could also make room for a whole new market.
Information	New information regarding the market, competitors, customers, etc. can trigger the generation of ideas that could lead to innovations. Information does not necessarily create pressure to innovate, but can certainly trigger innovations.
New Technology	A new technology creates opportunities for organisations to use the technology to their advantage in creating products and services that could not have been possible without it.
Science	Scientific evolvement or research can lead to new possibilities in the development of products or services.

Technological Change The improvements of existing technologies could induce pressure to organisations to adapt their products or services to allow for possible constraints that might have come from the changes. This could also allow for innovations that might not have been possible before.

All the concepts that form part of the external domain could contribute to driving innovations. These concepts will not necessarily play a role in each organisation, but organisations may find that they are beneficial to each of the components in mind. This could be done by maximizing the positive impact that these components may have and reducing the risks associated with them. Apart from the external domain, there are internal factors that drive innovation as well.

3.7.3. Internal domain

The internal domain refers to concepts inside organisational boundaries that could have an impact on the innovations of an organisation. It includes the internal factors that drive innovation and the innovation process of the organisation.

Internal factors driving innovation

There are many factors that can drive innovation, but the core capabilities of an organisation are those that have the largest impact on innovation. Understanding and improving the core capabilities of the organisation is important to drive innovations within the organisation and is part of the process to construct an innovation strategy. The core capabilities of an organisation identified in the innovation management literature, can be described by the six capabilities in Table 3.4.

Table 3.4: The core capabilities of an organisation

Capability	Description
Values	Organisational values have an indirect impact on the innovativeness of the organisation, therefore organisations should ensure that their values create an environment where new ideas are more likely to be generated and lead to successful innovations. Examples of values are integrity, respect for others, humility, honesty, and ethical behaviour.
Skills	The skills of the employees are a vital internal driver for innovations. Many ideas may be generated, but without the necessary skill to take it from ideas to successful innovations, those ideas will remain ideas. Organisations must have a clear understanding of the skills that they

have within their organisation, and they must empower their employees proactively by up-skilling them. However, when up-skilling employees, the organisation should ensure that the skills fit into their innovation strategy.

Company Culture

Company culture refers to the environment in which employees operate and the shared beliefs and behaviours among them. It is largely based on the values of the organisation and could be an indicator of whether these values are truly lived by – it can thus be seen as the practical implementation of the organisational values. The culture within the organisation could create a desirable environment for innovativeness.

Knowledge

The knowledge of an organisation can be divided into tacit and explicit knowledge. Knowledge and the successful management thereof is crucial for organisations to be innovative. Organisations should be strategic in obtaining more knowledge to ensure that the knowledge gained is in line with the objectives outlined in their innovation strategy. There should, however, be a culture where knowledge generation is encouraged. Apart from internal knowledge, knowledge in territories outside of the market that the organisation competes in could be valuable as well, and organisations should utilise it. Knowledge management can also give organisations a better understanding of their weaknesses and strengths in terms of what they know and what they do not know.

Technological Capabilities

Technological capability refers to an organisation's ability to transform its knowledge and skills into designs and workable solutions that perform according to the needs of the market (Hao & Yu, 2011; Salisu & Abu Bakar, 2019). Companies can align their technological capabilities with their strategic goals by generating knowledge and obtaining skills that suit their objectives to improve their innovativeness.

Research & Development

R&D are the activities within an organisation that focus on the development of new products/services or improvement thereof.

Organisations should also consider the various departments within their business when developing an innovation strategy. Each department can contribute to the innovativeness of the organisation, and by harnessing the departments to function as a whole, and to work towards a common goal. This could be a major driver of innovation within an organisation. Innovation leaders can be assigned to each department where the leader is responsible for managing and driving innovations within the department. Table 3.5 describes the four most common departments that would usually be present in organisations.

Table 3.5: Departments

Department	Description
Finance	The finance department has a significant role to play in the innovativeness of its organisation. Innovative solutions to fund R&D, save money, or create new sources of income, are some of the areas where this department can have an influence.
Marketing	The marketing department's participation is crucial in ensuring that products or services developed by the organisation are successfully exploited. This department is not only part of exploiting the products, but also in understanding the market and its needs. The innovation strategy should make provision to exploit the skills and knowledge of this department to lead to breakthrough products or services. At the same time, the innovation strategy should also make provision for the department to find innovative solutions to their own activities and processes.
Human Resources	HR is responsible for managing the most important resource of any organisation – the employees. Organisations should consider how the processes and decision-making of the HR department contribute to the innovation strategy. An example would be for HR to hold sessions where employees can develop their creative thinking skills, and the recruitment of people with the necessary skills that are required for the organisation to optimise its innovativeness.
Research & Development	The R&D department has always been the main source of innovations. Organisations can integrate this department's activities with those of other departments to ensure that all the departments contribute to the overall strategic objective.

Employees need to understand the goals and objectives of their organisation. Significant investments are spent on up-skilling employees and equipping them to ensure they contribute effectively. The organisation should create an environment for the employees where they feel their contribution is valuable and that the leadership value their ideas, knowledge and skills.

Creativity, rewards, and motivation impact the contributions employees make towards the innovativeness of their organisations. Organisations should strategize how they can increase the contribution of their employees by considering these aspects. Table 3.6 describes the roles of the above-mentioned concepts.

Table 3.6: Factors influencing employee contribution to innovation.

Factor Description

Creativity

Creativity leads to the production of novel and useful ideas. It is the start of innovation, as innovation is the successful implementation of a creative idea. Organisations should recruit creative people and/or introduce training that increases the overall creativity within the organisation. Creativity can be obtained by having different perspectives of problems, and therefore diversity in the workplace could be helpful to obtain it.

Rewards

Rewarding or incentivising employees could have an impact on their performance regarding their contributions towards creative ideas. Rewards do not necessarily mean extrinsic (monetary) rewards, but can also be in the form of recognition, etc. Organisations should consider how they will make rewards part of their innovation strategy. Some research shows that extrinsic rewards could be detrimental to innovativeness, but each organisation should go through the process to see what rewarding systems suit their organisation as well as the cultures of their employees.

Motivation

The motivation to be innovative and to contribute creative ideas is a crucial attribute that employees should have. The willingness of employees to overcome obstacles, to continue despite failure, and to work hard, will ensure a steady stream of ideas. Intrinsic motivation is preferable to extrinsic motivation, and organisations should therefore strive to align their innovation strategy by promoting intrinsic motivation.

Knowledge can be described as the glue that combines all the different components that influence innovation. Knowledge management is a crucial activity that an organisation should perform to

ensure that they utilise the knowledge they have, whether tacit or explicit, to generate ideas and develop innovations.

The Innovation processes

This part of the conceptual framework is where the actual process of innovation development starts. Idea generation and capturing, development and exploitation all take place in this part of the framework. Everything outside of the innovation process boundary forms part of the components that should be considered by innovation leaders to prepare and create an environment where ideas can be generated and become successful innovations.

The innovation process depicted in this framework (Figure 3.1) takes into consideration that an organisation would implement some form of idea management tool along with the Fugle Model (Du Preez & Louw, 2008a). The Fugle model follows the traditional stage-gate model and combines it with a funnel and a bugle. The funnel is where ideas are gathered and refined to concepts that can be developed. The bugle is where the concepts are exploited (Du Preez *et al.*, 2015) The stages and the gates can be designed by the organisation to ensure that they fit in with their current processes and they are aligned with their innovation strategy.

As ideas are generated during the innovation process, it is captured and stored in a database where the ideas can be managed. Ideas can be categorised using the known types of innovations, like radical or incremental; disruptive or sustaining; and technology-push or market-pull. The different categorisation methods can be determined once the innovation strategy is constructed. The advantage of having ideas sorted into different categories is that 'buckets' can be created that could help the organisation manage their innovation portfolios better. Organisations can then ensure that they have a balanced portfolio that contains high-risk and low-risk, short-term and long-term innovation projects.

With an idea management tool, organisations can track the status of ideas and add information regarding the decision-making process. This way organisations can use all related information/data to measure the performance of their innovation projects. When more information is captured, better and more informed choices can be made.

Table 3.7 contains descriptions of the different components of the innovation process that form part of the conceptual framework.

Table 3.7: Components of the innovation process

Component	Description
New Ideas	Ideas can be generated in several ways. Employees can generate ideas consistently, through brainstorming sessions, hackathons, steering discussions, etc. The innovation strategy can put policies in place to create an environment where ideas can be generated. Employees should be encouraged to submit ideas and to make mistakes.
Capture	Ideas must be captured. The ideas and the 'meta-data' related to them can be stored in a database. Storing ideas makes it easier for decision-making, tracking and measuring the innovation projects and portfolio.
Funnel	Typically, the funnel would contain stages and gates such as idea generation, idea filter, concept definition, concept filter, feasibility, funding gate, etc. The funnel is an important part of the innovation process as it is important to select the right ideas in order to move on to the portfolio phase. The phases within the funnel will differ for each organisation and they should be designed as part of the innovation strategy.
Portfolio management	The portfolio phase is where the feasible concepts that have been filtered are evaluated. The organisation should consider the risks, time-to-implementation and required resources during this phase. Portfolio management has several tools that can be utilised to assist the organisation in managing the risks associated with innovation.
Bugle	The bugle phase focuses on the development, implementation and exploitation of the innovation projects. Concepts that have been launched as projects after the portfolio management stage are developed into a useable product or service during this section of the innovation process. Every phase in the process is important for successful innovations, but the phases within the bugle are where organisations should exercise care and diligence, as the projects become more expensive to terminate as they progress through the process.
Idea Management	Idea management is the first part of the innovation process and is where ideas are captured and evaluated. As part of the innovation strategy, organisations should define how the process of idea management will be performed and what

tools will be used to capture the ideas. The strategy can also define whether ideas are only captured internally, or if other stakeholders, such as customers can also submit their ideas.

Metrics

Innovation metrics could be used by innovation managers as a tool to measure the organisation's innovation efforts and whether the objectives of the innovation strategy are achieved. Organisations should define innovation metrics that align with their innovation strategy.

Decision-Making The decisions that innovation leaders make during the innovation process should be based on the innovation strategy, but they should also be able and willing to take informed risks. Having too many incremental ideas will mean that the risks are low, but also that the competitive advantage gained might not be much. On the other hand, radical ideas inherently have more risks, but the competitive advantage gained from it might be much more. To have several persons taking part in the decision-making process, will help to get different perspectives and ensure that the best possible decisions are made for the organisation.

The innovation process is the execution phase of innovation management. As stated before, it is of great importance for organisations to develop an innovation strategy to ensure that an execution plan that is followed.

3.7.4. Outcomes

The outcomes of the innovation process are foremost innovations. From innovations come other advantages such as competitive advantage, return on investments, and ultimately, business growth. These outcomes are the objectives for many organisations, and thus the construction of an innovation strategy is oftentimes performed with the prospect of gaining these advantages.

The outcomes of the innovation process feed back into the external domain. The innovations and competitive advantage of the organisation impact the market and how the organisation interacts with it. As the competitive advantage increases and the organisation experiences business growth (Abramovitz, 1956), the organisation starts gaining a larger percentage of the market share.

The outcomes and all the information related to it can be used as output metrics. These metrics can assist organisations in adapting the internal environment and/or their innovation strategy according

to this information if required. It can also be utilised to adapt how the organisation interacts with the external domain. Some of the information that could be used are:

- 1. Total sales because of an innovation.
- 2. Number of successful innovations.
- 3. The date an innovation project started and has been deployed.

Organisations can use existing innovation metrics or define their own, depending on their needs and how they want to measure their innovation efforts.

3.8. Conclusion

This chapter discussed the methodology that was followed in constructing the innovation management conceptual framework, as well as the developed conceptual framework itself. The concepts and their definitions are defined in Appendix A and the conceptual framework can be seen in Figure 3.1. The validation of the framework will be detailed in Chapter 6.

The framework consists of six major components: knowledge, innovation strategy, external drivers, internal drivers, innovation process and the outcomes. The framework shows the relationship that these components and concepts have relative to one another.

Organisations should first pursue the action of developing a strong knowledge base and innovation strategy. The generation of ideas will not, however, only start once a solid strategy has been implemented. Employees will always have ideas, and therefore the capturing of these ideas can be done in parallel to the development of a strategy and the generation and management of knowledge.

The framework contains sections of the Fugle Innovation framework (Du Preez & Louw, 2008) as part of its innovation process component. The conceptual framework developed in this thesis has similarities to the Fugle model, since it also describes the impact of the external and internal environments on innovation. The Fugle model focuses more on the innovation process itself, whereas the researcher wanted to focus more on the whole process of innovation management and how the different concepts relate. Emphasis is also put on the importance of an innovation strategy and the management of ideas. The purpose of the developed conceptual framework is not to improve the existing models, but to display the researcher's understanding of the topic and to guide the design and development of an idea management software tool.

Next, the research methodology behind the validation process will be discussed.

4. Research methodology: Validation of the conceptual framework

Phase seven of the conceptual framework analysis research methodology describes the validation of the conceptual framework. Jabareen (2009) states that the reason for the validation of a framework is to determine whether the framework and the concepts within the framework make sense to not only the researcher, but other experts and practitioners as well. He further states that the validation process starts with the researcher who seeks validation from persons outside of the research.

For the purposes of validation and verification, the framework was separated into three logical sub-components. The development of a strategy as well as internal factors that impact innovation were validated using strategy meetings and direct feedback via an interview (Chapter 6). The idea management process is better suited to an automated tool, since approaching this process manually may be manipulated by role-players and would be labour-intensive. In contrast, the development of an innovation strategy is a more organic and emergent activity that is well suited to people discussing ideas and then formulation a shared vision and strategy. This chapter also explains why the researcher chose to develop an idea management tool, the methodology used to develop the tool and finally the methodologies chosen to validate the logical sub-components of the conceptual framework.

4.1. Case study as a method to validate a conceptual framework

The successful implementation of innovation management is important for any organisation in any industry since the survival and growth of an organisation depends on their ability to innovate. The framework seeks to address the issue of how organisations could implement innovation management successfully to advance their competitive advantage.

4.1.1. A summary of the case study research method

A case study was selected as the method of validation for the conceptual framework. A case study refers to the detailed and intensive analysis of a case or cases that a researcher wants to observe and study and is a common methodology used in business research. A case can be a single organisation, location or event (Bryman, Bell, Hirschsohn, *et al.*, 2014).

According to McCombes (2019), a case study research involves mainly qualitative methods, but can also make use of quantitative methods to assist the research. McCombes (2019) also states that case studies are a good methodology to describe, compare, evaluate and to gain a better understanding of different aspects within a research problem.

In the context of this research, innovation management entails numerous different concepts; these concepts were synthesised to produce a conceptual framework. It would therefore be useful to validate the framework using a case study approach. The case study will be performed at a single organisation that is constantly seeking to be innovative in order to increase their competitive advantage.

4.1.2. Research using case studies as methods to validate conceptual frameworks

Steyn (2013) developed a conceptual framework to evaluate the tax burden on individuals in South Africa as part of a PhD thesis in economics at the University of Pretoria. Steyn used a case study to evaluate the theoretical framework that was developed. He wrote that a case study would be an applicable technique to the research by applying the framework to a real-life context since it is important to understand specific cases to achieve a more holistic approach to the research. Similarly, the researcher wants to apply the developed conceptual framework of this research to a real-life context in order gain real-life experience of the challenge of implementing innovation management at a company.

Otto (2019) also developed a conceptual framework for his PhD thesis. The topic of the research is Framework to manage change complexity when introducing high voltage technology to automotive production lines. To validate the framework, he conducted a case study by implementing the framework at an automotive factory.

These two examples show that it is a valid approach for the researcher to select as the process for validating the conceptual framework developed in this study.

4.2. Why a software idea management tool

The conceptual framework describes the different concepts found in the literature of innovation management. A part of innovation management is managing the ideas and projects that come from the concepts that drive innovation. Once ideas have been generated, they need to be captured and managed throughout the innovation process

For the case study that will be conducted to validate the conceptual framework, an idea management software tool will be developed that could assist with the implementation of the innovation process component of the conceptual framework. The innovation process component of the developed conceptual framework is depicted in *Figure* 4.1.

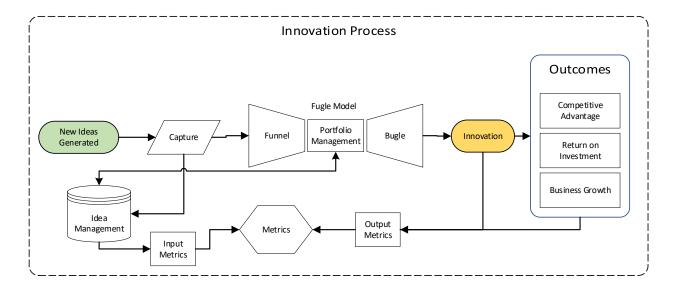


Figure 4.1: Innovation process component of the conceptual framework

The reason for a software solution is to reduce the effort and time taken during the validation process to capture, process and manage ideas - which would have been tedious if a paper process had been followed. The organisation where the case study will be performed is an international company where - due to the Covid-19 pandemic - many employees work from home. A software tool that is connected to the internet would therefore give all the employees of the company the ability to participate. The use of a software tool also prevents the outright manipulation or stealing of ideas by supervisors or managers and may enforce fair attribution of ideas.

4.3. Design Science methodology to develop the idea management tool

From a research perspective, the Design Science research methodology will be used in the design and development of the idea management software tool. The purpose of the methodology is to design an artifact, using the available knowledge, that can address a problem within a certain context (Wieringa, 2014). In this case, the artifact is the idea management tool and the problem that is being addressed is the successful capturing and management of ideas in the case study. The data that flows from the idea management tool may then be used to assist in the validation of the conceptual framework that addresses innovation management at an organisation.

The design problem is thus as follow:

To improve the implementation of a theoretical conceptual framework at an organisation during a case study by developing an idea management software tool. This will be done so that the innovation management process component of the framework can be facilitated to ensure better results from the validation process.

The requirements for the tool were gained from the literature review and is discussed in section 5.2. The literature guided the development of the tool and showed what is needed for an idea management tool for it to help capture and manage ideas effectively. Having such a tool during the validation process could improve the validation experience for the organisation and assist them with understanding the framework. Furthermore, it helped them see the impact of an innovation strategy and process on their innovation management initiatives. This allowed participants in the case study to be in a better position to respond to the questions the researcher asked them after the implementation period.

The development life cycle that was used to develop the idea management tool is discussed in the next chapter.

4.4. Conclusion

This chapter discussed the research methodology regarding the validation of the conceptual framework and the design and development of an idea management tool. The case study research methodology was selected for the research as it gave the researcher the ability to validate the conceptual framework at an organisation that is actively involved with innovation and where the leaders of the company have industry experience.

The reason for the design and development of an idea management tool was also discussed. The tool was developed to assist with the practical implementation of the conceptual framework. The research methodology that was used to design and develop the idea management tool is Design Science methodology.

The next chapter discusses the design and development of an idea management software tool that can assist organisations with the management of their innovations and ideas.

5. Design and development of an idea management tool

Subsequent to the literature review and in parallel with the development of the conceptual framework, the next step is to take the knowledge gained in the research to design and develop a tool that can be used to assist with the case study. This chapter will discuss the design and development of a digital application that can be used as an idea management tool. More detailed background on the requirements and development process followed are in appendix B and C.

5.1. Software development life cycle methodologies

Part of the goal of this thesis is to design and build a software tool that will help organisations manage their innovation projects. The Software Development Life Cycle (SDLC) is the methodology that is followed in the development of software. SDLC is used to improve the design, product management, and project management of software projects.

Any SDLC has six generic stages that they follow:

- 1. Planning
- 2. Analysis
- 3. Design

- 4. Development & Implementation
- 5. Testing
- 6. Maintenance

There are several SDLC methodologies. How the SDLC is chosen and implemented within organisations, depends on the organisational structure, size and culture. These methodologies can be:

- Agile
- Lean
- Waterfall
- Iterative
- Spiral

- DevOps
- V-model
- Big Bang Model
- RAD model

Some of the methodologies mentioned are explained in Appendix B. For the purpose of this software development project, the agile software development methodology will be followed. In this approach, there are incremental changes from the previous release of the software, which means that there are ongoing release cycles. The agile approach allows software developers to identify minor issues early on in the development process before these issues become more significant as the project grows. This method is found to be the best of the different methodologies mentioned for this project, since the researcher will be the sole developer, and incremental deployments of code will be

released inevitably. After each release, the functionality will be tested to ensure that the code added performs according to its purpose and it works for all given scenarios.

The agile software methodology is not restricted to a specific set of phases, and the methodology can come in different shapes and sizes. It does however follow the same core principles. The agile approach followed for this research consist of the following phases depicted in Figure 5.1.

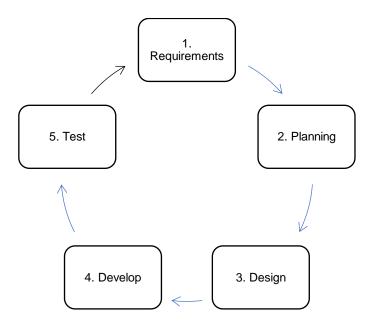


Figure 5.1: Agile development cycle for this research

5.2. Requirements

The requirements analysis are crucial parts of the SDLC. This stage is the first stage of the Agile methodology (Figure 5.1). Without this stage, the process of developing the software cannot commence. Because the Agile SDLC is used, the requirements will be amended as the development of the tool progresses and as the developer's/researcher's knowledge of the subject of innovation management expands.

The literature review and the conceptual framework will serve as the sources from which the requirements of the software will be constructed. The following sections will discuss the requirements for the idea management tool, what type of software application it will be, and how the application should be deployed and secured.

5.2.1. Functionality requirements

The goal of the application is to provide originations with a tool that they can use to manage their innovation processes. Innovation management has an underlying foundation, but how each

organisation manages or should manage their innovation, is dependent on their organisational structure, culture and line of business. The tool should, therefore, have an underlying framework that relies on literature, but also on the customisability to allow organisations to implement their own processes. The researcher identified these data types that should be included in the process of idea capturing:

- Title for the idea
- A description of the idea
- Department in which the idea has been generated
- Category of the idea

- Type of idea
- · Required Skills
- Conditions under which the idea was generated

Some of these data types will have to be pre-configured by the organisation and are dependent on the innovation strategy as well as where in the organisation the innovation activities will take place. These data types are described in Table 5.1.

Table 5.1: Preconfigured data types

Data	Description
Departments	Departments in an organisation usually include Human Resources, Research & Development, Finance and Marketing. When ideas are generated, the department in which it originated can be identified. This will help the innovation managers pinpoint what departments in their organisation are the most or least innovative. By having this information, they can adapt their strategy to improve the organisation's overall contribution to innovation.
Categories	Categories refer to whether the idea will become a product, service or process innovation. The organisation can define their own categories according to their business and the type of offerings they deliver, or the type of innovation projects that they wish to pursue.
Skills	For each innovation project resources will be required. The organisation should understand what resources they have access to and which resources they need that they do not currently have. By knowing what skills are required as part of an

innovation project, the organisation can assign resources and upskill their employees accordingly.

Types of Ideas

This refers to whether an idea is radical or incremental, technology-push or market-pull, etc. The innovation leaders should configure the idea types according to their strategy and how they wish to manage the different ideas.

Apart from these data types, the progress and statuses of ideas should be monitored on the tool. For this to be possible, the process that the organisation uses as well as the possible outcomes should be captured when the app is being configured for the organisation.

Most management activities require that past data is made available for managers to use as a guideline in making decisions and therefore, the app should capture the history of ideas as well. All this data can then be used to calculate innovation metrics that could assist organisations in improving their innovation management efforts. Thus, the app should be able to capture ideas as well as the history of how each idea moves through the innovation process.

A vital catalyst for innovation is knowledge sharing. This is mainly managed by the organisation through internal or public events that they organise to harness the knowledge of their employees, whether it is tacit or explicit knowledge. Innovation networks can be used to create value. The app will contribute to innovation networks by having a central knowledge base of ideas. More specifically, users should be allowed to share their comments on certain ideas to help build more robust concepts that can eventually be launched as an innovation project. By knowing who commented or contributed to certain innovation projects, the organisation will be able to determine how the employees interact with one another and where the information-flow is weak within the organisation.

There are several project management software solutions that have been developed. Most organisations already have tools to manage their projects with tasks that are assigned to the members of their projects. The app will not focus on project management, but on innovation management. The app should be able to link with the tools that are used by the organisations, irrespective of what those tools are.

The app should also have a user interface that makes the process of submitting, reviewing, and managing ideas as easy as possible. Users should not spend time trying to figure out how the tool works; a built-in help section should assist users with uncertainties and in how the app works.

5.2.2. Idea management tool security

The software should only be accessible to the organisation that will use it. The ideas that will be captured are considered to be intellectual property and should therefore not be available to the public. The software should be safe and secure to avoid information leakage.

5.2.3. User management

Users must sign in to use the app so that they can be authenticated and authorised. The passwords that users use should not be stored in the database in its pure form, but they should rather be encrypted so that no one can decrypt the password and use it to log in to another user's account. Not all users should have access to all the resources of the app. Therefore, there should be different access levels assigned to each user to ensure that access is restricted for lower-level users.

5.2.4. Idea submission

With regard to the authenticity of who submitted the idea, ideators should receive some sort of proof that they submitted that idea. This proof should be verifiable and auditable to avoid employees stealing one another's ideas.

5.2.5. Software framework

There is not a specific requirement to what programming language or framework should be used. The criteria are that the language should give the developer the ability to build the app in as short a time as possible, so that it can go through the iterations and testing that are required to deliver a viable solution.

The database, back-end and front-end should interact with one another. There are several frameworks that can be used to achieve this. The software should therefore be built on a framework that enables the interaction between these components to be seamless and secure.

5.2.6. Database

The purpose of the database is to store all the information that is required for the app to function. The database should store the information that has been specified in the app requirements and this will be mainly unstructured data. It should thus be big enough to store all the information required for the app to run, as well as to store new information that are written for the database. Depending on the size of the organisation and how regularly the app will be used, the database should be able to handle all the requests for it. Organisations, especially ones that are innovative, will grow, and therefore the database should be scalable to handle the increase in requests as well as in the amount of data written for it.

5.2.7. Deployment of the tool

The app should be deployed so that all employees in an organisation can access it. They should have access to either a mobile phone or computer that will allow them to participate in the innovation activities of the organisation. It should be easy to scale the application for the scenarios where the size of the organisation increases, or when an organisational brainstorm event was held causing an increase in ideas submitted to the app.

5.3. Planning

The planning phase is the second part of the Agile software methodology (Figure 5.1). The web application will be developed in incremental parts. First, all high-level functionalities will be implemented. As the development process continues, functionalities that are directed at innovation management will be added. The advantage of using this agile approach is that the researcher can easily add new functionalities as the development process continues; this gives room to new ideas that will be generated as the web application progresses. The disadvantage is that adding new functionalities could become stringent, because space needs to be created for the app to function well in conjunction with the rest of the code.

The following plan for the development process will be followed:

- 1. Determine which requirements are high- or low-level requirements.
- 2. The high-level functions (Table 5.2) will be developed and implemented first.
- 3. The low-level functionalities (Table 5.3) will be implemented when the high-level functions are working as expected.
- 4. Any code-based problems that are encountered during the process will be solved through the help of online communities, e.g., Stack Overflow. By consulting these platforms, the researcher will save time and use best practices instead of solving the problem by himself.
- 5. The code will be written in such a way that it can be reused throughout the application. Thus, the code must be as modular as possible.
- 6. All iterations of the code will be pushed to a GitHub repository. This will be implemented for version control, and to ensure that the code is stored securely in the cloud where it can always be accessed by the researcher from any device.

Table 5.2: High-level functions

Function	Description
Idea submission	The main purpose of the app is to capture the ideas of the employees. The development of this functionality will include the database design, form and functions required to make this possible.
User management	The app's goal is also to ensure that the person submitting an idea gets the recognition for being the ideator. This means that users will have to sign on to the app using their credentials and passwords. Apart from managing the users, it also allows the monitoring of who gets access to the information/intellectual property of the organisation.
Innovation process configuration	Not all organisations use the same innovation process. Therefore, the app should be developed with that in mind to allow for customisability of the innovation process. The database design should thus include a table where this information can be stored. The development should also include a page and form where this information can be captured.
Innovation Process Management	Innovation leaders must have the ability to manage the innovation process. The management of the process should allow them to move ideas from one stage to the next, edit the meta-data of the idea, edit the outcome, and manage the resources of the idea. The app should generate reports that will assist the management of the organisations to make decisions with regard to their innovation activities.

Table 5.3: Low-level functions

Function	Description
Comments	Users of the app should be able to leave comments on the other employees' ideas. By having this function, ideas can be conceptualised better when more people give their input. There should be clear guidelines as to what comments user may make to ensure that negative comments do not cause employees to log less ideas.
Employee Information	Employees using the app should be able to capture information such as their job title, what skills they have and the department in which they work.
Integrate app with other software	The app should be able to integrate with other software tools the organisation uses to manage their business processes.
Help page	A help page where the users can go to assist them with any questions, they might have with regards to the use of the tool.
ldea filter	A component where users can filter the ideas by ideator, innovation types, department etc.
Send emails	The tool should be able to send emails where users can receive confirmation of account creation, idea submission and any other changes or messages related to their account on the app.

5.3.1. Framework & deployment

The software will have three components on which it will depend: the front-end, back-end and the database. The front-end, also known as the User-Interface (UI), is the component that the user interacts with; this is where the user can view information as well as add new information. The back-end component is responsible to handle requests from the user. The database is where all the information is stored and which is required for the software program to function.

Within each component there are different options for what programming language can be used. For the front-end, it depends on what type of software application will be developed. The language is also dependant on the preferences, knowledge and skills of the developer. The software can either be a web app or desktop app (mobile apps will not be considered for this project). Some languages that can be used to build desktop and web apps include:

Desktop Apps

- C# and VB.NET (.NET Framework)
- Python (Tkinter, PyQT)
- C and C++
- Java

Web Apps

- PHP
- Python (Django Framework)
- Ruby (Ruby on Rails)
- JavaScript
- Java
- C# (.Net Core Framework)

Choosing what language and framework to use is dependent on what type of application will be built. Consequently, it should first be determined whether the idea management tool should be a web application or desktop application.

5.3.2. Web app or desktop app

The app should be accessible to all the employees of an organisation. In the case where the app will be used by more than one employee, an organisation should have its own instance of the application, to ensure that intellectual property of different organisations is not shared on one platform. Thus, each organisation will have their own database as well. But, for the purpose of this research, it can be assumed that only one organisation will use the application, but it should be designed as 'future proof'. This should be considered when choosing between web and desktop applications. Both web apps and desktop apps have advantages and disadvantages, as can be seen in Table 5.4.

Table 5.4: Desktop versus web applications

Desktop Application Advantages	Web Application Advantages
Offers offline capabilities.	It only needs to get installed once.
More secure than web apps because the user can work offline.	Web apps can be accessed from any computer with any operating system.

The app's performance relies on the user's Better choice for multiple users. computer speed.

Desktop apps are cheaper over a longer period (from the customer perspective, but also depends on the licensing agreement).

Desktop apps are cheaper over a longer period Users get the latest updates essentially for free.

Resolves question of ownership.

Ensures all users use the latest version of the application.

Desktop apps do not force users into upgrades (This could be a disadvantage as well).

Source: (Bychkov, 2013; Makhija, n.d.)

Accessibility adds a lot of value to an idea management app. Organisations should ensure that everyone in the organisation can access the application, so that they can participate in the innovation activities. The more users, the more ideas will be generated and shared. Sometimes one new idea is required to trigger a train of thought for someone else. In this case, the web app will be more accessible from early in the development process.

Since many users will be using the same database, it will be best to have all users use the same version of the application. When someone is using an out-of-date application, it could hinder the dataflow and cause issues in the database. Web apps are the best option for this scenario, because they can be updated easily.

With the idea management app, it is also beneficial for everyone to have the latest data shared across devices. It is not preferable to have an app that is functional offline and that enables users to leave comments or submit ideas when not connected to the internet. This can be a disadvantage, but since generating ideas is not the main line of business for almost every company, it is not priority for a user to have access to the application when they are not online. They can write their idea down or make a mental note and then submit it to the application once connected to the internet again.

The application should be accessible to all users of the organisation from any device, since the goal is to encourage employees to share their ideas on the application. Web applications will therefore be a better choice, because users will be able to access it from any device if it is in line with their company's data security policy.

The tool should be secure, as it will have access to a database that contains the intellectual property of the organisation that uses it. The tool should be accessible through the internet. Therefore, all

possible steps should be taken to ensure that the app is secure and can only be accessed by the users who are authorised to access it.

From the above considerations it has been concluded that the best app for this project will be a web app. Deploying a web application and making it accessible to all employees will be easier and more efficient and it will work well with the agile development methodology, because updates can be performed much faster.

5.3.3. Web framework and language

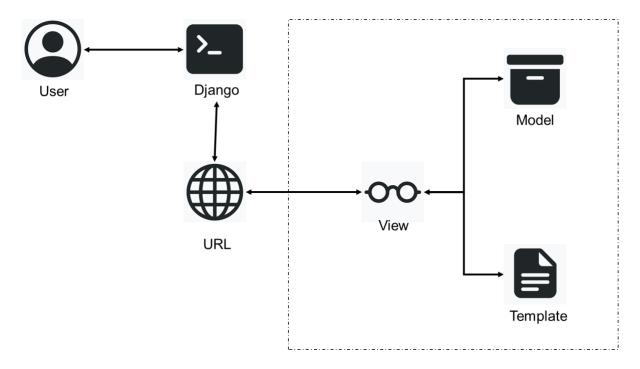
Web frameworks, as described by *GeeksforGeeks*, "is a software framework that is designed to support the development of web applications including web services, web resources and web API's (Application Programming Interface)" (Intelegain, 2019).

Django is an open-source Python-based web framework that will be used to build the web app. Django has a Model-View-Controller (MVT) architectural pattern and is a prevalent web framework that is widely implemented by companies such as Instagram, Pinterest, YouTube, and more.

The framework allows developers to go from concept to completion in a short time. The available documentation, security, ease of use, and scalability are some of the advantages of the Django framework. Figure 5.2 describes the MVT. The model leg of the MVT pattern acts as the interface between the application (View) and the data, and the view leg represents the interface that the user will communicate with. In the Django framework, the View can be developed using HTML, CSS and JavaScript. The Template leg consists of the static components of the application. The View handles the data and parses it into static files to create the interface that the user will see. During the development process, the web app will be tested on a local server. After it has been tested, the software can be released to a web server, where it will be hosted.

Hosting the application on a web server will allow the organisation to connect to the app from any device with internet access. Heroku is a platform as a service (PaaS) that allows developers and organisations to deploy server-side applications. The Heroku website states that it allows for quick scaling of applications; the platform handles the security, runtime, configuration, and everything else required for successful deployment of applications.

Heroku is based on a managed container system. The containers allow for fast deployment of software and scalability. They manage the hardware so that the developers can focus on building applications without distraction. The platform has an integrated data management service and provides options of different types of databases like Heroku-Postgres, Redis, and Apache Kafka. The platform also provided tools related to database management, such as the ability to create backups of databases.



Source: ("Django MVT", 2019)

Figure 5.2: Model View Template

5.3.4. The software tool

The application will have four main components: front-end, back-end, framework and database. The application will then be deployed to a web server where it will be hosted. The framework is necessary to link the back-end, front-end and database with one another.

The back-end of the application will be written in Python. Python was chosen as the programming language for this project, because the researcher has the most experience with this programming language. Other languages could also have been an option, but the time constraint on the project does not allow for the researcher to gain knowledge of another language. The Python programming language is a general-purpose language that focuses on code readability.

The front-end or user interface of the web application will be built with HTML, CSS and JavaScript. The researcher also has skills in web development, which is why this markup-language will be used. HTML is a Hypertext Markup language used to develop web pages. Cascading Style Sheets (CSS) and JavaScript can be used in conjunction with HTML. CSS is used to style the layout of the application, and JavaScript (JS) is used to make webpages more dynamic.

Lately, organisations have become more prone to choose Software as a Service (SaaS) solutions. Thus, developing the app as a web platform, allows for any organisation to easily deploy and access the app if they wish to implement it for managing their innovation processes. SaaS is generally

cheaper than implementing the software on-premises, as the organisation does not have to buy and manage servers.

5.3.5. Database

Structured Query Language (SQL) is the programming language that will be implemented for the management of the data that will be submitted through the application. SQL is designed for managing data that is stored in relational data management systems. The use of a relational database will be beneficial in the context of this application, and because each idea will have relationships with data in different tables of data, it is essential to keep the data organised and easily accessible.

A Postgres database will be used with the web application. Postgres is a free relational database management system. The reason for selecting Postgres as the database management system is, because of its seamless integration with the Django framework and the Heroku platform. The database will store all the data required for the application to function according to the requirements.

5.4. Design architecture

The design phase is the third phase of agile software development lifecycle (Figure 5.1). The objective is to take the requirements of the current cycle, to take the plan and design accordingly for the implementation thereof.

5.4.1. Database design

The design of a database is part of building an application. Planning the database design allows for fewer complications further down the development process and it is therefore essential. For the database of the idea management web app the requirements are checked to get an idea of what needs to be stored in the database. Since numerous characteristics can belong to a single idea, it is beneficial to use the relational database system.

Requirements for the database

The starting point for the design of the database is to allow for idea capturing. This would require that data is either directly related to the idea or that data could be shared among ideas. For example, data directly related to an idea would be the title, description and ideator name. Data that could be shared or reused are idea types, idea categories and skills.

Innovation management has many aspects that can help organisations manage their innovation portfolios. An idea can be a specific type – radical, incremental, sustaining, or disruptive innovation. The innovation process consists of several phases, and an idea could be within a specific phase during its lifetime. Ideas could also have outcomes, which include being reviewed, rejected, in progress, failed or successful. Every innovation project requires a set of skills to take it from

conception to implementation, which is why it can be of significant value for organisations to capture the skills related to the project in a database.

Some of the potential benefits that could come from capturing skills linked to a project in a database are:

- Organisations can observe whether they will be able to pursue the project by comparing the required skills to their possessed skills.
- 2. By gaining this insight, they could either hire new employees or upskill current ones.
- 3. They can quickly and efficiently assign the best people for a project if they also have a database of the current employees and their skills.

Below are the different types of actions that the database should be able to handle. The application should store the data related to innovation management, but also the information required for the app to function, i.e. user login information.

Idea submission

An idea will have different information attached to it: the idea ID, title, department, ideator, joint ideators (if the idea originated from more than one person), and the priority of the idea. The ID is used to identify ideas from one another and can be used to link ideas to other tables in the database as a primary key. Primary keys can be used in either many-to-many tables, or as foreign keys in other tables within the database to refer to the idea. Figure 5.3 explains the many-to-many relationships.

The ideator is the person who submits the idea to the application. Each idea must have an ideator assigned to it. The ideator will receive an email upon submission, confirming that he/she is the original ideator. An option to select 'joint ideators' to an idea will also be available. Having this option will make provision for cases where an idea has originated from a group discussion or brainstorming session.

The title of an idea is a unique name given to the idea by the ideator. Ideas captured in the same database cannot have the same names. The title should be as descriptive and concise as possible so that other users of the application will be able to have some understanding of what an idea is about before opening it.

A description is essential when an idea is submitted to the application. The ideators should give as much detail about the idea as they can. The description is the part of the information that assists the managers most in understanding what the ideator has in mind. Being clear and touching the detail, is what is required in the description box of the submission form. If the ideator did not give enough

information in the description, the managers would be able to request more information from the ideator after the idea has been submitted.

Departments can also be linked to an idea. Having this information related to an idea, may help managers to observe which departments are responsible for the innovativeness of the organisation. To have this data could help the organisation to spread their resources regarding innovation strategies and focus their attention to specific lines of business more effectively.

When the database contains several different ideas and innovation projects, it becomes challenging to know which ideas have a higher priority than others. The application should allow for the priority of an idea or project to be set by the managers when they review the idea. The priority can be determined by different metrics. Each organisation will have its own way of deciding what ideas are better than others, by using the portfolio management process.

Finally, when the idea is submitted, the ideator can select the type of idea. The type can either be Incremental, Radical, Disruptive, Sustaining, etc. These typologies are derived from literature and are the four main types of innovations. Members of the organisation can receive basic training to understand these basic concepts of innovation management. If ideators have already identified the type of innovation at conception, much time could be saved and may even lead to a shorter time from idea submission to the acceptance or rejection of ideas. Ideators should carefully select the type of idea, or rather leave it open if they are unsure about the category that their idea falls under. Idea types are not fixed, and the organisation can define what type of ideas they wish to use as part of their innovation management process.

Outcome status

Once the idea has been submitted, the process of managing the innovation starts. There are five types of innovation outcomes: *Being Reviewed, In Progress, Rejected, Failed* or *Success*.

When an innovative idea is submitted, the default outcome will be *Being Reviewed*. The innovation manager can then review the idea and add it to one of the other categories. Every time an idea is moved to another category, it should be logged in the database by the person that made the change. The manager should also be able to give a reason for moving the idea to another outcome status. For transparency and management purposes, a history log table will be added to the database. This table will keep a record of the changes made to an idea. The data that will be captured includes the idea that was changed, a timestamp, the person who made the change, a reason, and the outcome that the idea moved to. This data can also be used for metrics to understand the performance of the organisation's innovation and management efforts.

Phases

All innovation processes have phases that depend on the organisation's innovation process. Thus, the application should allow for an organisation to add their innovation process to it. Some organisations might use the stage-gate model and others may not. The flexibility of the app should thus make it suitable to use for any process.

When an organisation adds its innovation process to the application, it should create a table in the database that contains their innovation process. The table will contain the name of the phase, order number of the phase relative to the other phases in the process, and a phase ID.

Similar to the outcome status, the change in phases should also be logged. A phase history table will be created to capture the data related to the changes that were made to an idea's phase. If an idea moves from the conception stage to the design phase, the reason for change and time of change should be captured, along with the person who made the change. This feature allows the organisation to see which phases take longer, and if there are any trends with regard to projects getting stuck in particular phases.

The data that will be captured in the phase history table includes:

- The idea that is changed
- Timestamps
- To which phase it is changed

- By whom the change is made
- A reason for the change

Departments

Having a table that contains the different departments in an organisation, could assist in managing the innovation process more effectively. For example, when an idea gets linked to a department, the organisation can base its decision on whether the return on investment for a particular project would be good enough to continue with the project. The department data can help identify which departments lack innovativeness. If this is the case, innovation workshops, competitions, or any activity can be implemented that would increase the specific department's innovativeness.

User profiles

Users of the tool will have to be logged onto the tool so that they can use it. They will have a user profile containing their details; this is for management purposes and also to give credit to ideators. Each idea submitted will have one or more ideator. This data can be used to track employees' performances. The user profile database will contain the following information:

Username

First name and last name

- Email address
- User access level (superuser or standard user)
- · Encrypted password
- · Last Login date
- Position of the user in the organisation

- Department the user belongs to
- Whether the user has agreed to the informed consent form of the idea management tool (Ethical Clearance)

Many-to-many relationship database tables

Linked with the user profile will be data captured in other tables. In relational database design, these tables are called many-to-many relationship tables. The tables contain two columns – each column contains the unique identifier of the items that are related to one another. Skills, contributions, and joint ideator are the many-to-many relationships that the profile table has. The many-to-many relationship table, therefore, should have a column for the skill ID and a column for the ID of the user profile. Skill IDs get obtained from the Skills table which contains a list of all the skills within an organisation. When users set up their profiles, they should be able to select what skills they have. If they have a skill that is not on the list, they can add the skill to the Skills database and then add it to their list of skills. When users contribute to a project, they become a contributor thereof. These functionalities might be more helpful in larger organisations than in smaller organisations.

Many-to-many relationship tables should have a column for the idea identifier and a column for the user profile identifier. To have this data, could be valuable information for an organisation and can, for example, be used to create a network diagram of how employees within the organisation interact with one another.

Some ideas will have more than one ideator. In this case, there will have to be a many-to-many relationship between a user profile and an idea. Figure 5.3 shows how the many-to-many relationship table functions. The first row of the table shows that a relationship between the profile identifier of John and the idea 'New Feature' exists. But since Susan is also an ideator, her User ID is also linked with the same idea.

Many-to-many relationships help to make a database much more efficient in terms of storage. If the same data had to be stored in a database without many-to-many tables, a large amount of unnecessary data would be duplicated. For example, it would mean that in the idea table, there would have been multiple tables for the same idea, for it to be stored as both John and Susan as

ideators. Thus, data such as the idea title, description, and time of submission would have been duplicated. This is inefficient and why many-to many relationships exist. The database diagram for the idea management tool can be found in Appendix C.

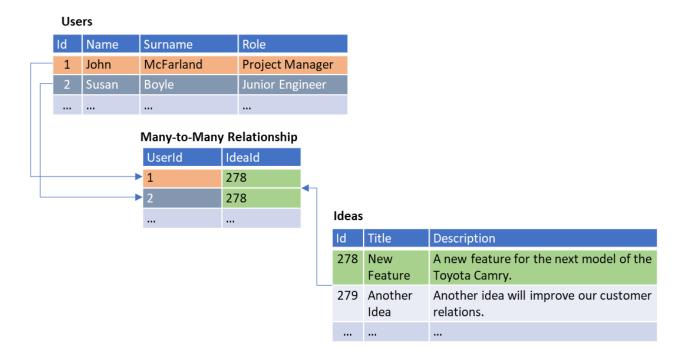


Figure 5.3: Many-to-many relationships

5.4.2. Idea management software tool

The tool will be built from the front-end to the back end. The different pages and functionalities will be determined and designed and then the back end will be developed to handle the requests made by the users.

The styling of the application and components used will be developed using Bootstrap, which is an open-source framework using CSS.

Table 5.5: Summary of pages

Page Name	Description
User Management	The user management pages are the sign-up, login and password reset pages.
Home	The home page contains a summary of the application's functionality and buttons that will direct the user to the summary of ideas, idea submission or help page.

Idea submission This page is where the ideas will be submitted by the ideators. Innovation Process The organisation will set up the innovation process and other data fields Setup that should be pre-configured according to the developed innovation strategy. Departments, idea types, skills, idea categories, and innovation process phases will be captured on this page. User Profile Page The user profile page contains a user's details and gives a summary of the ideas the user submitted. Users will also be able to update their details like their names, department, position and add skills to their profile. All Ideas This page will contain a table of all the ideas that have been submitted. There will also be a panel where the user can filter the ideas according to the different data related to the ideas. Idea Information This page will contain all the detail related to the idea, like the ideator name, description, etc. It will also display in what phase of the innovation process the idea is, as well as comments from other users. Idea Management Only authorised users should have access to this page. On this page, ideas can be moved from one phase to the next, and the data related to the idea can be updated. Data that cannot be updated after the idea has been submitted, is the ideator, description, title and date of submission. As part of idea management, there will also be a page where managers can request more information if the description of the idea is inadequate. Reports A reports page will be available to the innovation managers to view a summary of the data captured on the application. Help Page A help page will be available to explain the main functionalities of the application.

5.5. Building and development

The fourth phase of the Agile software development cycle (Figure 5.1) is the development of the functionality for that phase. The software tool will be built using an open-source Python integrated development environment. After each functionality has been developed, it will be tested (Phase 5) and then the code will be published to GitHub to enforce version control.

Because the development of the tool will be performed in parallel with the development of the conceptual framework, new minor features may be added. If any issues arise during the testing and validation of the tool, the issues will be addressed immediately.

Appendix D shows figures of the different pages on the idea management tool, called CoLab.

5.6. Verification and validation

During the development process, each functionality will be tested (Phase 5) before it is released to GitHub. It will be tested on both a local and a development environment before it will be released to the production environment.

The validation of the tool will be performed alongside the validation of the conceptual framework developed in Chapter 3. The validation will take place in an organisation that will implement the tool in order to improve their innovation process. The testing and validation process of both the idea management tool and conceptual framework will be discussed in Chapter 6.

5.7. Conclusion

In this chapter the software development life cycle was selected for this project, the requirements for an idea management tool were defined, planning for the development was done, and the conceptual design for the tool was discussed.

The development of the tool was performed in parallel to the development of the conceptual framework. The database diagram for the tool can be found in Appendix C and shows the relationship between all the different tables. The database is built on a Postgres database. The tool is a web application and is built on the Django framework using Python as the back-end, HTML and CSS as the front-end. The web application will be hosted on Heroku.

The validity and usefulness of the tool will be determined in the next chapter where the validation of the application by a fast-growing SME will be discussed by implementing innovation management concepts from the conceptual framework and the idea management tool.

The key learning point taken from the development process is that it is not preferable to attempt designing and developing a customisable idea management tool. Instead, each organisation should

develop a unique tool that suits their own needs. Each organisation is unique not only in their offering, but also in how they do business, their company culture, etc. Their innovation strategies will also look vastly different. Every organisation will have different needs and requirements regarding idea management software solutions. This conclusion is drawn from the researcher's industry experience gained the case study performed in Chapter 6.

6. Case study: Validation of the conceptual framework

The validation of the framework will be performed in various steps, where the final step would be to refine the framework further with the knowledge gained throughout the validation process which will be in the form a case study. The main question that this case study seeks to answer is whether the conceptual framework, as Jabareen (2009) states, makes sense to other scholars and practitioners. The case study will be performed at an organisation that is highly innovative and the leadership are therefore the practitioners from whom the researcher will seek validation for the conceptual framework.

6.1. Background of the organisation

The organisation, Dynamo Analytics, is predominantly working in the insurance industry as consultants and provide actuarial software solutions to their customers. Though they are relatively young, they are already leaders within their competitive space and continue to grow in all aspects.

Dynamo Analytics was founded in 2012 and is headquartered in London (UK). They also have offices in South Africa, Nordics, Australia, and France. Since they started, they have heavily invested in developing their software called Psicle - an advanced software solution that allows the building and industrialisation of actuarial, statistical, and technical processes and models. Dynamo Analytics is led by a highly innovative team and leadership, and it is because of this that they have been approached to participate in the case study to validate the conceptual framework.

6.2. The case study approach

McCombes (2019) defines the case study process in four steps. These steps are similar to the steps followed by Steyn (2013) in his research and are as follow:

1. Select a case

The case refers to the research problem that the case study should address. According to McCombes (2019), a good case study should have the ability to provide insight into a specific subject, challenge existing theories, propose practical courses of action, and open future research prospects.

Innovation management and the successful implementation of innovation management processes and systems is the case for this research. More specifically, the objective of this case study is to validate the conceptual framework.

2. Building a theoretical framework

McCombes (2019) stated that a case study should have a connection to a theory in the field that is being investigated. By having this connection, the study is integrated with existing knowledge, and is consequently not only a stand-alone description. The theoretical framework for this study is the conceptual framework describing innovation management and the relevant concepts that influence the innovativeness of an organisation.

3. Collect data

Case studies usually focus on qualitative methods to gather data, such as interviews, observations and the analysis of both primary and secondary sources (McCombes, 2019). The objective of collecting data is to obtain a greater understanding of the case and the context in which the case finds itself.

In this case study, data will be collected via observations, semi-structured interviews, discussions of the framework, and feedback captured through the idea management tool. The framework was split into three logical components i.e. the innovation strategy, the idea management tool, and the remaining factors/concepts influencing the innovativeness of an organisation. These three components are incorporated into the validation process discussed in the next section.

4. Describe and analyse the data

Finally, the case study and the data collected throughout the process should be discussed.

6.3. Validation process

The conceptual framework could help organisations understand the different innovation management concepts and their relationship with one another in the innovation management field. The validation process that will be followed is depicted in Figure 6.1.

The *first phase* is to discuss the conceptual framework with the organisation where the case study will be performed. This discussion will establish a platform where the researcher can explain the framework and the organisation can ask questions and make comments about the proposed framework. Once this has been done and amendments have been made to the framework based on the discussions, the next phase will commence. This phase is not the complete validation of the framework, but merely the start of the validation process. The phase will give the stakeholders a better understanding of the framework around which the case study is performed.

The second phase is to develop the innovation strategy for the organisation along with the gatekeeper. The strategy will be developed using the Strategy Cascade Framework (Figure 2.15) constructed by Lafley & Martin (2013) in their book "Playing to Win". The outcome of the strategy

cascade will establish the context for the innovation strategy and the strategy a blueprint for how the organisation's innovation management process will be implemented and managed alongside the idea management tool.

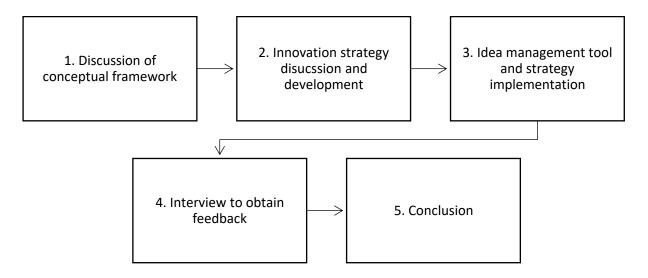


Figure 6.1: Validation process

The *third phase* will be the implementation of the idea management tool. This will include the set-up of the application in adherence to the security policies of the organisation, and the set-up of the innovation process of the organisation by uploading the process to the application. The application will then be used as a part of the innovation management process where members of the organisation will submit their ideas and where the ideas will be managed. The idea management tool will merely be a tool to facilitate the process and not the overarching system used to manage the innovation process. The tool will be used to support the innovation strategy that will be developed in the second phase. This phase includes sessions where the innovation managers/leaders will filter the ideas on the application. These sessions can be a valuable catalyst for the innovation leaders to give more thought to innovation and the management thereof. By using the idea management tool and going through the process of capturing and managing the ideas, the organisation can also get a better feeling for the innovation strategy and how the different concepts within the framework manifest in practice.

The *fourth phase* is where the researcher will conduct an interview with the members of the organisation who participated as managers in the validation process. These members will be part of the initial discussions and decision-making process for the conceptual framework and innovation strategy. Other members of the organisation will be able to leave feedback on the application itself. The purpose of the interviews is to gain an understanding of whether the proposed framework and IM application is a viable solution for the organisation to better manage their innovation efforts.

The *fifth phase* will be the refinement of the framework and the researcher will summarise all the knowledge and industry experience gained throughout the case study.

6.4. Profile of participants of the case study

Throughout the different stages of the validation process numerous employees of Dynamo Analytics participated in the case study. This section will discuss the profiles of the participants in each of the different phases.

Throughout the case study there was one constant participant who acted as the gatekeeper between the researcher and the rest of the organisation to ensure that the researcher adhered to the ethical implications of the research. The gatekeeper is the leader of a software development team within the organisation and has practical experience in managing people and in ensuring that the product Dynamo Analytics deliver improves continually and that it gives them a competitive advantage.

6.4.1. Discussion of the conceptual framework

The conceptual framework discussion took place via a Microsoft Teams meeting with two participants, the first being the gatekeeper and second being one of the leaders (Leader A) of the organisation. Leader A is a director at Dynamo and was previously a chief actuary at a prominent insurance organisation, which has given him practical experience in leading and managing teams as well as managing a fast-growing business.

6.4.2. Innovation strategy development

The innovation strategy was developed by the gatekeeper with the assistance of the researcher. The gatekeeper is well-placed to create an innovation strategy using the conceptual framework given his knowledge of Dynamo Analytics' working processes, objectives, and goals.

Leader B is also a director and has extensive experience in the actuarial and product development industry and has co-lead Dynamo since its inception. Leader B also gave insights and contributions to the innovation strategy after it was developed.

6.4.3. Idea management tool and strategy implementation

For this phase of the case study, the gatekeeper launched the idea management tool to the rest of the organisation. During this phase the idea management tool was used by 9 users, sessions were held with stakeholders to manage the ideas, and as part of the strategy a company-wide innovation discussion was held where ideators could present their ideas.

The employees that participated as users of the idea management tool ranged from actuarial consultants to operation managers and developers. The consultants work with the clients and software daily and thus have a clear understanding of what the product should offer and where it

can be improved. The operation engineers work closely with the different stakeholders of the application and ensure that the product is handed over smoothly. The developers are the ones building the software, they have a clear understanding of the technology used and have the expertise to make the required improvements and add new features. All the users work in a professional environment with a clear understanding of the market, client needs, and the product and service they deliver.

During the three months that the idea management tool was used by the 9 users, the researcher, gatekeeper, Leader B and the product leader met to manage the ideas. During these sessions they would discuss the ideas submitted by the employees and decide whether it would move to the next phase of the innovation process or not. The participants of these sessions have a clear understanding of what is required to gain more advantage over their competitors.

At the end of the three-month period, an innovation management session was held internal to the company. During this session, three ideas submitted to the idea management tool were selected. The ideators were asked to present their ideas and afterwards their colleagues could ask questions. This gave them opportunities to conceptualise the ideas better, which will consequently help the innovation leaders make more informed decisions on whether the ideas should move on to the portfolio management stage of the innovation process.

6.4.4. Interview

The interview was conducted with Leader B and the gatekeeper. Both these participants were active throughout the case study and have the relevant business and industry knowledge required to validate the conceptual framework as practitioners.

6.5. Discussion of the conceptual framework

The conceptual framework was discussed with some of the stakeholders within Dynamo Analytics to give them an overview of the framework and to allow them to ask questions. The discussion was fruitful and led to a more practical view of what the conceptual framework could represent.

It has been found that the framework could be helpful in the process of developing an innovation strategy. The framework depicts the components of the innovation environment that could be considered when developing an innovation strategy. For example, the organisation can strategize how they will motivate their employees to be innovative or share their ideas. Similarly, they can consider the different components that consist of different parts of their innovation strategy.

6.6. Innovation strategy development

During the research and validation process it has become evident that the innovation strategy is a crucial aspect and essentially the key to innovation management. The organisation could have the

best management software, ideas in their offices or communication channels, but there should be a strategy that will direct the way in which the ideas can be best harnessed so that they can be converted into competitive advantage. As seen in the conceptual framework depicted in Figure 3.1, the innovation strategy is the starting point of the innovation management process. It is essential for an organisation to understand and have a clear vision of what they want to achieve with their innovation management initiatives.

The innovation strategy was developed using the Strategy Cascade framework (Lafley & Martin, 2013) and the gatekeeper of the company worked alongside the researcher to define the strategy. The five categories of the cascade were 'fleshed' out by considering the different concepts of the conceptual framework. The company came up with the following outline as they considered each question of the Strategy Cascade (Figure 2.15). The strategy described below is generic in order to preserve information that is owned by the organisation.

Winning aspirations

The vision of the organisation is the starting point in identifying what the goal of the organisation is and what drives their ambition to be innovative. It is closely related to the business strategy. The understanding of what the winning aspirations are, is a necessary starting point to broaden the innovation strategy. Dynamo Analytics used their vision to describe their winning aspiration. The vision consists of the overall organisational vision, but also the vision for the product and service they provide for their customers. The vision of Dynamo Analytics is to be recognised for their modern, innovative, high quality software platform that they provide for their clients.

Where to play

The *where to play* questions of the strategy cascade focuses on the areas where an organisation needs to do business in order to achieve their objectives. The areas can be divided into three groups, namely the target market, geographies, and the new territories.

The target market refers to which market the organisation should predominantly focus their attention on. This includes the current market, but also new markets that they are not 'playing' in. Dynamo Analytics mainly 'plays' in the insurance industry, but the products or services they deliver is also of interest to chief actuaries and companies searching for process automation.

Dynamo Analytics has clients all around the globe and is looking to expand even more. The geographies they choose to play in focus specifically on the countries where they have many potential clients. By choosing in which geographies to play, the company can better strategize on what capabilities they need to have in place to make this expansion possible.

New territories refer to areas that the company does not currently compete in. The company has identified areas that they can start playing in as well.

How to win

How an organisation will win, depends on their value proposition. It is necessary to understand what will be delivered in the market that they compete in, to achieve their objectives.

The company will list their competitors and what value propositions they have, respectively. This will help them to understand their shortcomings and in what areas they can improve. Along with the list of competitors and their value proposition, they have their own value proposition that gives them a competitive advantage over their competitors. These propositions can specify what their strengths are and where they can improve to ensure they are a cut above their competitors.

Next, the needs of the customers can give a better understanding of the direction in which the product or service should move. The needs of the customers are ever-evolving, and thus the organisation should define a clear strategy of how they will capture these needs and act on them. This strategy will be defined in the final stage of the Strategy Cascade.

Innovation projects, especially radical, disruptive and technology push innovations, require more resources. The time employees spend on projects is directly proportional to the costs of a project. As part of the innovation strategy, organisations should know how their innovation projects will be financed.

Most organisations have suppliers or service providers who play a role in the successes of the companies. The product or service that the suppliers or service providers provide an organisation with, will have an impact on the product or service that the organisation delivers. In some cases, the supplier could drive innovations by providing products that would support new technologies or solutions to problems. Organisations can actively learn more about what their suppliers or alternative suppliers have to offer in order to get the most out of their partnership.

Being able to win, requires the right people. As part of their innovation strategy, an organisation can have a recruitment strategy that might assist them in finding the right people for the innovation initiatives. Finding the right people will go hand in hand with the company culture: first, the culture must be beneficial for innovation, and secondly the people appointed should complement or add to the culture.

The innovation strategy should also include a strategy for the marketing department to ensure that new innovations are well received by the customers or potential customers. The company will create such a strategy to make sure that they do not only execute the development of their innovation projects well, but that the full potential of an innovative offering is exploited.

Capabilities required

Dynamo Analytics has not only relied on ideas and solutions originating from inside its organisational boundaries, but also on the ideas and requirements of key market experts. These experts are people who understand the offering and what it should deliver, and therefore they are able to give valuable inputs that might lead to new innovations. The organisation will thus have to put in place a platform where the inputs of key market experts could be captured and further developed.

Marketing capabilities are needed to ensure that adequate market research is performed and that potential clients are aware of the offerings the company has to offer. This will assist the organisation in achieving their goals.

Another capability that will be required to become more innovative is to motivate employees to take part in the organisation's innovation activities. By motivating the employees, they will also become more alert to have an entrepreneurial outlook on day-to-day work activities.

Creativity is one of the major drivers for innovation and therefore it is consequently required as a capability for the company to achieve the objectives within their innovation strategy. The company will be looking at activities that might increase the individual and group creativity within their organisation.

The organisation will also require more skills that are specifically focused on their key business. The research performed in the literature review has shown that information and knowledge are important for the generation of new ideas and solutions. Having skilled people with knowledge of the key business environment, could be beneficial for the innovativeness of the organisation and can assist them in executing their innovation strategy.

Although the company has been innovative and continues to deliver new solutions to the market, a dedicated and holistic innovation process has not been implemented. The capabilities to manage the process are therefore required to ensure that the strategy is executed and the objectives are reached.

Management techniques and systems

Some of the management techniques that have been identified during the development of the innovation strategy are discussed below. These are the concepts that will be investigated to ensure that the innovation process is effective and that the strategy is executed.

Rewarding employees for contributing to the innovation process is one of the management techniques that can be implemented to ensure an increase in innovations. There are arguments for and against the use of extrinsic motivation in literature, but the company also has experience with

rewarding systems. They found that the use of extrinsic rewards created confusion, and therefore they do not have a rewards system towards innovation currently.

Innovation leaders have to be appointed to drive the innovation management process. The company will also have to create a team of innovative employees who are passionate about innovation and about managing the innovation process. The leaders could be responsible for making other employees alert to the need for innovation, filtering ideas prior to the portfolio stage, leading discussion groups and taking ownership of the innovation activities.

An innovation process has been developed that functions similarly to the Fugle model developed by Du Preez, Louw & Essmann (2010). The process will consist of five stages and 4 stage gates. The five stages are idea generation & identification, concept definition & feasibility, portfolio management, deployment & refinement, and finally the exploitation phase. The stage gates include filtering ideas, the concept filter, launch gate, and the exploitation gate. The process was developed based on the current working processes of the company and introduces structure to a process that is generally difficult to manage. It can therefore assist the organisation in managing their ideas and innovations.

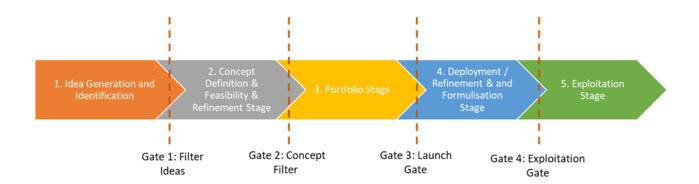


Figure 6.2: Validation innovation process

The management of ideas and innovation projects will be done through the implementation of the application that has been developed as part of this project. The purpose of the application is to assist with the management of ideas and the innovation process. The application will allow the organisation to capture ideas and then take them through the process until viable ideas become innovation projects.

Innovation metrics will be used to give the company insight into their innovation efforts, which will be useful information to have at hand when the innovation strategy needs to be revised. One of the benefits of having a software solution for idea and innovation management is that the captured data can be used to create metrics, which the company can develop as their strategy evolves. The application has some metrics built in that will be used as part of the validation process.

Organisational structure and culture are both crucial aspects that drive the success of an organisation's innovations. The culture at Dynamo Analytics is already good and creates an environment for innovation to flourish. The organisation will continue to assess their culture to ensure that it continues to be a culture where employees help one another, share knowledge, tell stories and learn. The Company will also introduce monthly sessions where ideas will be discussed among everyone, which might introduce an alertness among employees to generate more ideas and be innovative. Ideas focused on new business opportunities that are submitted to the application will be selected for these sessions. Such discussion sessions could also assist in determining the feasibility of ideas and ensure that all relevant questions are asked before moving an idea further along the innovation process.

Training and development are also one of the techniques that will be used to ensure that there are steady knowledge generation and skill development processes in place that will support innovation.

6.7. Idea management tool and strategy implementation

The process from the development of the application to the implementation thereof is depicted in Figure 6.3. First, research was conducted which led to the development of the conceptual framework and the idea management tool. The implementation phase then commenced by developing an innovation strategy and launching the application within the organisation. Together all these phases finally form an innovation management process.

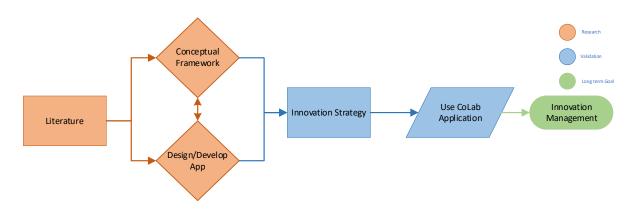


Figure 6.3: From development to implementation

The researcher worked with the gatekeeper at Dynamo Analytics to develop the innovation strategy, to implement the tool and to manage the ideas that was submitted to it.

The gatekeeper acted as the lead innovation manager and was therefore the one who set up the application with the assistance of the researcher, by defining and capturing the different departments, types of innovation that could be captured, the process, innovation categories, and the skills within the company.

Recommendations prior to the launch

Before the application was launched within the company, the gatekeeper made some suggestions that came from discussions during the set-up phase. These suggestions entailed changes to the application that would improve it from a management point of view, its usability, and to improve the general knowledge of the application users of the innovation management field and the process implemented.

The recommendation was to add descriptions to the different phases of the innovation process for users to understand what each phase entails. An extra page was then added to the application to list the different phases, give a description for each phase, and add a link that shows the number of ideas per phase – clicking on it will direct the user to those ideas. Figure D.10 in Appendix D shows this page. Other minor recommendations were also made to improve the usability and to fix software bugs that were discovered.

Observations

When the application was launched internally, the initial response from the employees was positive. The launch was in the form of a message from the gatekeeper that notified employees of the application, what it can be used for, and how to access it. During the implementation and use of the application, the researcher made the following observations.

The response to the launch of the idea management tool was promising. Eleven new ideas were logged within the first two weeks of the launch – most of them were incremental. The frequency at which ideas were logged thereafter decreased. Innovation leaders were not appointed at the time and thus employees either forgot about the application or they were not that aware of the fact the company is looking for new innovative ideas that could lead to new revenue streams.

As part of the strategy to increase their innovativeness, the company decided to host monthly discussions where some of the ideas that were submitted that complied with the given requirements, would be discussed. The discussions focus on radical and disruptive ideas that will create new revenue streams or improve their current offering significantly. The ideators of the selected ideas will be given a chance to explain the idea and how it can be beneficial to the organisation. It was observed that as soon as a discussion was announced to the employees, the number of ideas that were logged, increased significantly. This shows that it is important to promote the innovation initiative of the organisation and to communicate the need for new ideas, whether they are disruptive or sustaining to the employees and other possible ideators. Employees must be alert and aware of the need for innovation and of the processes in place in order to take part. The importance of the alertness was also found in Section 2.6 (Alertness) of the literature review.

The researcher observed during the case study that not all types of ideas are required to go through all the phases during the innovation process. Because of the company's business, most incremental ideas could either be implemented within a very short time without many risks, or in some cases employees would not necessarily capture their incremental ideas, because they form part of their day-to-day work. Sometimes some ideas are merely good or bad ideas and can simply be accepted or rejected. If the system does not allow these ideas to 'skip' the innovation process, it might inhibit the ideas and eventually kill them. Thus, it might be beneficial for innovation leaders to exempt certain ideas from the whole innovation process. This will have to be handled with caution, and innovation leaders should ensure not to put ideas that do require more research into that category.

Finally, the company has a need for ideas to be captured in different buckets to create an extra level at which ideas can be sorted. For example, there could be a bucket for ideas directed at improving the existing business and offerings of the organisation, and another bucket for new business ideas. This will help the organisation to know exactly what type of idea they are working with. In the case of Dynamo Analytics and other organisations with a similar structure and culture, it might be beneficial to capture certain ideas in separate buckets. Thus, a new submission page can be created for every type of 'bucket' the organisation defines in their strategy.

During the validation period of three months, 9 employees joined the application and a total of 33 ideas were submitted.

6.8. Feedback

The researcher obtained feedback through an interview and via the tool. This section will outline the feedback that was received from the different channels.

6.8.1. Feedback submitted by the application users

Feedback from application users was not required, as the main feedback was expected to come from the interview. Users submitted their feedback on the application to make suggestions and to comment on their experience of having a dedicated platform where they could submit their ideas. The submissions that were made to the application can be seen in Table 6.1.

Table 6.1: Feedback from employees submitted on the application

Nr.	Type of feedback	Feedback
1	Feature	Really enjoying using the app – It would be great if users were able to upload images and videos to illustrate their ideas.

2 Suggestion

Radical ideas and incremental ideas are typically treated very differently in a business sense. Both ideas are important, therefore it would be great if there was a natural split between radical ideas as opposed to incremental ideas. Therefore, different buckets would be appropriate for this.

3 Suggestion

I think it was good to have the department and type of ideas in the submission form to guide the ideator to narrate the idea to appeal to decision makers. Though I think the type of ideas could be subjective, it is perhaps best categorised by just one person or a committee. Similarly, perhaps the ideators may not know the skills required for the ideas to be implemented, this may again be better decided by a committee after we have decided the ideas should go ahead

4 Suggestion

I really like the ability to view all the ideas and be able to identify the ones I have yet to view.

I think the submission form is good for ideas that are well defined and thought out, so that it can be explained in words. However, there may be some ideas that are still at their infancy which require some collaborative brainstorming. The ability to 'reply' to an idea would encourage all ideas to be captured.

5 Feature

Fit for purpose: The CoLab app is very user friendly and inviting to use. I especially liked the pdf certificates which it sent to you via email. I also enjoy looking at the stats ie. Idea success rate etc, and the ability to click on each of the items, which then takes you to the original idea logged. It was a very nice experience to use overall and can definitely see the use for the app for logging and tracking work requests.

6 Feature

Improvements: The ability to add comments to a request would be great for cases where you'd like to add extra info or make changes to the original.

7 Suggestion

Management input: More input from manager/team would be great, especially an indication of the expected time a certain request will take, and by when it will be implemented. In cases where it won't be implemented, a short description saying why not would also be nice.

This can all happen in the comments section (noted in improvement section). This would make the app more personal, knowing that there is a person behind the app, looking at the request, and not just automated

Suggestion 2 is similar to the observation made by the researcher in the previous section, which reinstates the fact that there is a need for applying a different process to different types of ideas.

It is assumed that the user who made Suggestion 3 was a normal user who did not have access to the innovation manager settings on the application. The fact that the user recommended this, shows that this ability included by the researcher is useful.

In Suggestion 4 the user mentions the ability to view other ideas. This feature allows the users to see other employees' ideas, and this could lead to additions or trigger new ideas. The user further suggests that once an idea has been submitted, the ideator should be able to append more information to the description as some ideas might still be incomplete or in its 'infancy'.

In Suggestion 7 the user mentions that management should give more feedback in order to ensure that the user experience is more personal. Thus, from a management perspective organisation should focus on providing prompt feedback to employees.

6.8.2. Interview

The interview was performed at the end of the validation period and was conducted between the researcher, Leader B and gatekeeper. Both participants were active throughout the case study. The interview was unstructured and allowed discussions regarding the implementation — what worked, and what improvements can be made to the framework. The semi-structured interview was designed to answer the three following questions regarding the three logical components of the conceptual framework:

- 1. Was the idea management tool useful and did it contribute to the implementation of the innovation strategy and conceptual framework?
- 2. Was the development of the innovation strategy while considering the conceptual framework intuitive and would such a strategy add value to the organisation?
- 3. Finally, and most importantly, does the conceptual framework make sense and do the concepts identified show an accurate representation of the different factors influencing innovation?

Below follows a summary of the interview and the conclusions that can be drawn from it.

Interview contributions to the idea management tool

The MD and gatekeeper could see the potential and usefulness of having an application as an idea management tool. Having a central place where ideas could be captured, was found to be very useful, since it serves as a repository for ideas and solves the problem of losing ideas. It also allows the organisation to revisit captured ideas in the future. They also like it that the ideas are not 'anonymous' anymore – the ideas are now available for everyone in the organisation to see and to contribute to them by voting for them, or by giving suggestions. It can also be evaluated by others who consistently follow the innovation strategy to manage the ideas that are submitted.

The interviewees also mentioned that, depending on the company culture, ideas should be available for everyone to see, to vote for, and to add comments to. Dynamo Analytics has the culture where this can work, but for some organisations it might be better to keep the ideas anonymous. Having more people see an idea, will help to identify the good and the bad aspects of the ideas and thus they can assist with the feasibility and concept definition phase. Although the team that selects the ideas for the portfolio stage remains consistent, it will help that other people could contribute to the concept of the idea. This will ensure that the portfolio management team does not overlook anything with regard to the idea.

It was also mentioned in the interview that ideas that require less effort to implement would not necessarily go through the same innovation process as more high-risk ideas that require significantly more resources. To manage small and incremental ideas the same way as radical ideas that could create new revenue streams, could inhibit the implementation thereof.

On the other hand, some ideas might need to be divided into a number of smaller ideas, and others need to be linked together as one project. Therefore, they suggested that the idea management tool would need to make provision for cases such as these. A ticketing system has been proposed where ideas are logged as tickets, and as the idea evolves the ticket is amended. As the process moves on, the ticket is promoted to the next phases. A ticket will only be closed when the project has been completed, paused or has failed.

This led to the point that certain ideas that lead to different outcomes might require different innovation processes. This makes innovation management increasingly complex and will also complicate the design of a software tool. This proves, once again, that there are no quick nor easy solutions to the challenge.

It was mentioned that since the phase of the portfolio management stage becomes project management, it is not required to manage ideas/projects further on the application. The application's role would then essentially be to capture ideas, to ensure that adequate concepts are defined, and that the right ideas are selected and filtered through to the portfolio management stage. This will

make the design and development of an idea management software tool simpler and more applicable, as its sole purpose would be to ensure that the best concepts are provided to the portfolio stage. The application should not be an all-rounder, but good at the funnel stage. What happens after that is up to the project managers of the launched innovation projects.

It was observed that some of the ideas that were captured on the application were unclear. The ideas were often good concepts but would not necessarily be practical. Other ideas did not provide a solution, but only stated a problem. This makes it difficult for innovation managers to filter ideas, as the idea is not clearly defined. It was then proposed that the submission of ideas should be more structured since ideators have to define the problem, the solution and what it would practically look like to implement the idea. This will help employees to think through their idea, and it would likely improve the speed at which ideas can be filtered.

The usefulness of innovation metrics have not been disputed, but it was mentioned that the metrics provided by the application are not necessarily useful. It would be more desirable to see the number rather than the percentages of incremental and radical ideas. The reason why the innovation management metrics are seen as useful, is because it could help the management team to make certain decisions. The example given in the interview was quite interesting, especially for the type of ideas that were being captured. Management could define their risk and innovation appetite for a given period and the fact that they could compare their defined appetite with the type of ideas that were captured, was regarded as highly valuable. This could help management adapt to the appetite of the company according to the current teams and business structure of the organisation. If many ideas are disruptive, for example have radical ideas, it might indicate that employees have big ideas and are currently looking for adventurous projects to pursue. The organisation will then have to make space for more adventurous projects, lest the employees take their ideas and start their own businesses or leave for more disruptive companies. On the other hand, if a large number of incremental ideas are submitted by employees, it might indicate that the organisation should focus on refining their current offerings.

In general, it was advised that the layout of the idea submission page should have a better flow than it currently has (Figure D.2). It was suggested that the page should have links to resources that explain the terminology and purpose of the different fields to educate users on the types of innovations, etc. The innovation types should change from a dropdown list to separate sliding scales, i.e. a sliding scale from 0–10 for radical versus incremental, disruptive against sustaining, and market-pull against technology push. The sliding scales will help the organisation to plot a more accurate matrix of where their innovation projects are located. Figure 6.4 shows an example of what the matrix could look like.

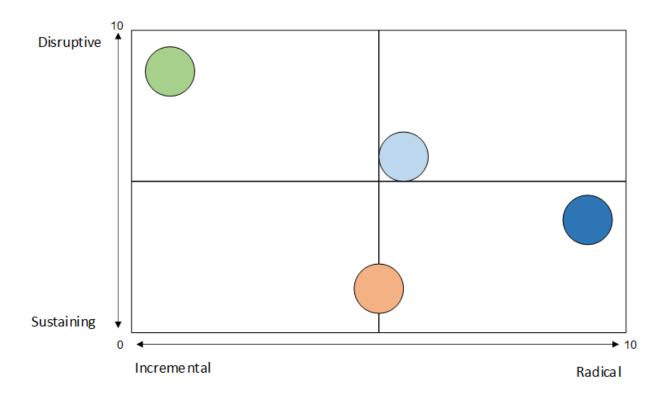


Figure 6.4: Mapping innovation types onto a matrix

The organisation would like to integrate the application with current software tools and working processes. This would mean that the application should, for example, notify people when ideas are submitted by publishing the idea on general communication channels, or sending emails to innovation leaders when new ideas have been captured.

Finally, it would be useful to have a dashboard of ideas that have not been selected and to be able to view them easily when the company has a better appetite for them. The application should thus have a better way of displaying and filtering ideas according to their category, type, etc.

Interview contributions to the Innovation strategy

The use of the strategy cascade was useful, as it gave structure to the process of developing the innovation strategy. The framework assisted in codifying and improving an innovation strategy that was tacit knowledge before. Therefore, taking loose ideas and putting them together. The gatekeeper also mentioned that it makes sense to have metrics defined in the strategy and to use them to make amendments to the innovation strategy in their scenario annually.

The importance of communicating the innovation process to line managers and management has been highlighted to ensures that these stakeholders are aware of the processes followed. It is also believed that the implementation of the process and a system will and has communicated to employees that action will come from ideas that are submitted, whether it is just feedback, or that the idea progresses to be an innovation project.

The addition of the monthly innovation discussions was added to the success of the application being used. It was found that, though it is useful to capture ideas, to have other activities focused on idea generation and sharing, help employees to be alert and aware of the systems that are in place, and thus encourages employees to start using them. This was seen in the report on the application: once the monthly innovation discussion was introduced, the number of ideas submitted, increased as well.

Interview contributions to the conceptual framework

When asked whether more value was attached to the framework than to the application, the response was that the conceptual framework is the more important one, but that it is equally important to have an effective implementation of the framework. If the application is successful in helping with the implementation of the framework, it can be considered as important, but it is not a requisite for a company in implementing the framework.

After applying the changes and possible improvements discussed in the previous section of the interview, the application could be useful in helping with the successful implementation of a conceptual framework. Some companies, however, have different company cultures and skills, and will therefore require different methods or tools to manage their innovation process. Dynamo Analytics have the culture and the technological capabilities to have a software tool as a solution to assist with the implementation of the framework. Other organisations might be relational and will therefore generate ideas by having group discussions and brainstorming sessions. There is no one-size-fits-all solution.

Furthermore, the implementation of the framework along with the innovation strategy and application, highlighted the benefits that could stem from having an innovation management framework/process in place. When asked whether the developed conceptual framework makes sense in the business sphere, the response was that the framework makes a lot of sense in the business context and that it is a very practical tool to implement. It will, however, be necessary to communicate and explain it properly to all managers and leaders within a business to ensure they understand it as well.

The time that was available was not enough to implement the innovation strategy and process completely. The company could thus not get a very good feel for the application. But as mentioned before, the implementation of the application, strategy and framework, made them aware of the importance of having a defined innovation process.

6.9. Refinement of the conceptual framework and application

The feedback from the company shows that the framework is useful and helpful in managing an organisation's innovations, it makes sense to implement it, and it is helpful in managing their

innovations. Recommendations have been made regarding the application and the discussions also led to refinements of the conceptual framework.

Feedback and validation indicated that a software solution for innovation management will be difficult to design and develop as a one-size-fits-all solution for a wide range of organisations. A single solution for several organisations could work, but it would be better to design and develop an application that is suited for the company culture and the requirements that they have.

The conceptual framework will mostly remain as it is, but small amendments will be made, like indicating which components of the innovation process component can be included in the idea management software solution. As mentioned in the interview, the application would only be required to manage ideas up until the portfolio management stage, therefore the Bugle phase of the innovation process will fall outside of the application domain.

Figure 6.5 shows the refined innovation process component of the conceptual framework, where the concepts within the application domain called Idea Management Software Solution, are the concepts that could contribute to such a solution. The concepts outside of the application domain are still part of the innovation process, but they will not be required to form part of the solution.

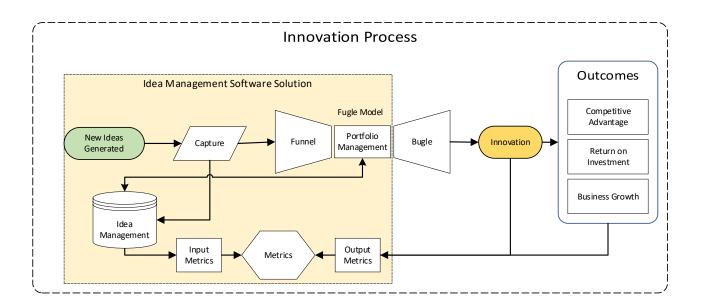


Figure 6.5: Refined innovation process component

The literature review indicated that the innovation strategy is an important aspect of the innovation management process. The effectiveness of innovation strategies can be measured by using innovation metrics, where the innovation strategy can then be adapted accordingly. Innovation strategies should not be updated too often.

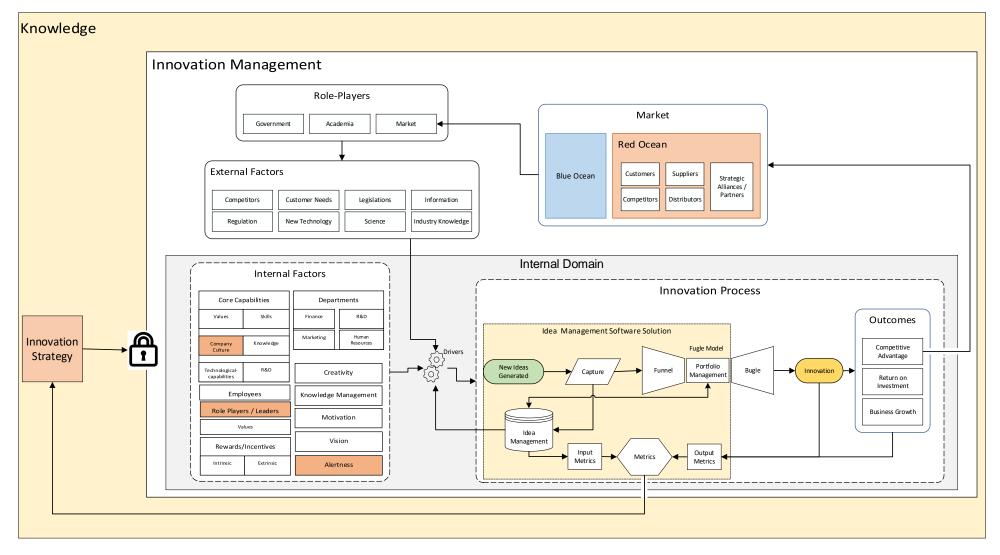


Figure 6.6: Refined Conceptual framework

It was also found that company culture plays a significant role in how the innovation process is managed and what a software solution could look like. When there is a culture of knowledge-sharing, helping one another, and support and motivation within the company, the organisation will more likely be able to make ideas within the organisation public. This will completely change the way in which they will manage their ideas as opposed to companies that do not have a similar culture. Culture establishes the foundation on which knowledge sharing, reward systems, values and leadership are built, and should therefore be managed and established according to what the organisation aims to achieve.

Another concept that stood out from the validation process is the alertness of the employees towards the innovation process, as well as the need to share their innovative ideas among one another on the dedicated platform. It was observed that when the employees became more aware of the innovation initiatives of the organisation, the number of captured ideas increased. It is therefore important that the innovation leaders are actively promoting the system.

Finally, it was found that the role players are important drivers of innovations. The innovation leaders and management teams are the ones who will set the example and motivate employees to contribute to the system. Without the leaders driving the innovation process by filtering ideas and providing feedback, the employees will lose motivation to contribute, as they might feel that nothing comes from sharing ideas.

6.10. Conclusion

This chapter discussed the case study that was performed to validate the conceptual framework developed by the researcher. The objective was to implement an innovation strategy and the idea management tool in order to assist with the validation of the conceptual framework.

First, the researcher gave a brief overview of the first discussion between himself and some of the stakeholders regarding the conceptual framework. Next, the innovation strategy development process was explained and executed by the gatekeeper and the researcher. The idea management tool and innovation strategy were then implemented, and the observations made by the researcher during the implementation phase were discussed. After the implementation, the researcher conducted an interview with some of the stakeholders to determine the usefulness and validity of the conceptual framework, the strategy, and the idea management tool. All these steps led to the validated conceptual framework.

The conclusion drawn from the data gathered in case study is that the conceptual framework is very practical and makes sense in the practical business environment. The concepts that have been highlighted throughout the validation process are the company culture, alertness and innovation leaders. The validation also led to the refinement of the framework as depicted in Figure 6.5.

Activities that are important for the innovation management process include the regular filtering of ideas, giving feedback for submitted ideas, and having group discussions where ideas are shared among the employees.

The researcher also concludes from observations and experience gained through the case study that an idea management tool will look different for each organisation, and therefore it would be more beneficial to design and develop a software solution according to the requirements of each unique organisation. Therefore, the researcher proposes the process depicted in Figure 6.7 for the design and implementation of an innovation management process. Instead of developing an idea management tool solely based on literature and the conceptual framework as opposed to Figure 6.3, the tool should be designed and developed after identifying the unique requirements and environment of the organisation in question. The figure shows that the literature review and conceptual framework should be completed first before an app and strategy are developed for an organisation. The requirements for the tool will come from both the innovation strategy and the conceptual framework. Then the strategy and the tool can be implemented to eventually lead to a successful innovation management operation.

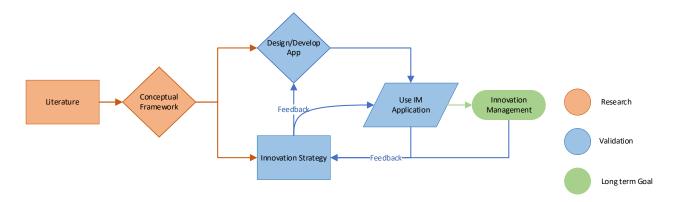


Figure 6.7: Proposed process for the development and implementation

7. Conclusion

7.1. Summary of work

Organisations that wish to survive in today's world are required to be innovative, otherwise they will be left behind. Large organisations have been disrupted in the market too many times, and the only way to ensure that this does not occur, is to constantly pursue an increase in competitive advantage. In order to do so, it is important that organisations actively manage their innovations by creating an innovation strategy and following an innovation process.

Numerous innovation framework models have been developed in the past, but how it is implemented and used, remains a challenge for many. Others are simply oblivious to the fact that they need to innovate. The researcher therefore aimed to study innovation literature in order to develop a conceptual framework that will describe the relationship between the different concepts of innovation management. The design and development of an idea management software tool were part of the intended outcome for a practical solution that can be implemented, instead of a theoretical model that might be difficult to validate.

This research was performed by the researcher to gain knowledge about the innovation management sphere and what it would practically look like in an organisation. The researcher set out to perform a literature review in order to identify the different concepts related to innovation management. These concepts were then used to create a conceptual framework using the Conceptual Framework Analysis methodology, developed by Jabareen, (2009). The literature review and the conceptual framework served as the source where the researcher gathered requirements for a software solution that companies might use to assist them with the implementation of an innovation strategy and process. The design and development of the idea management tool took place in parallel to the conceptual framework analysis and followed the design science methodology and agile development cycle. Finally, the conceptual framework, along with the tool, was validated at an innovative company that is looking to define a clearer innovation process in order to gain more competitive advantage. The following research questions were posed in the introduction and answered by completing the objectives of the research:

- 1. What is innovation management?
- 2. What are the main drivers that increase the innovativeness of organisations?
- 3. What components are present in the innovation management process?
- 4. How do the different components relate to one another?
- 5. What innovation process models have been developed and how can they be implemented?
- 6. What would an idea management tool entail?
- 7. What is the role of an innovation strategy in an innovation management process?

8. What will a system look like that benefits both employees and their organisation?

It was found in the literature that innovation is important as it is a significant driver of business and economic growth. For organisations to succeed, they have to actively pursue to be innovative, which requires risk-taking, resources, knowledge, company culture, creativity and numerous other concepts that have been identified in the literature review.

The definition for innovation as defined by Baregheh *et al.* (2009) is the multi-stage process by which an organisation converts ideas into new products, services, or processes in order to gain a competitive advantage over their competitors. Innovation management is the action of managing the innovation process, but as literature suggests, it is much more complex than it seems.

In the literature, many different concepts that contribute to either innovation or the management thereof were identified. These concepts were categorised and then synthesised to form the conceptual framework. The conceptual framework aims to describe the relationship among all the different concepts.

The framework (Figure 6.6) consists of the following different components which are: knowledge, innovation strategy, external and internal factors influencing innovation, the innovation process, and outcomes. Within each of these components are a number of concepts that contribute to it.

It was found in the literature that knowledge sets the foundation for innovation management, as knowledge of current processes, customer needs, problems, and the innovation process, etc, are crucial catalysts for new ideas and the successful implementation of the innovation process. The second most important concept is the innovation strategy, which is necessary, since an organisation needs a plan of how they will implement an innovation process and how it will be managed.

Within the component that represents the internal drivers, there are concepts such as creativity, employees, rewards/incentives, knowledge management, company culture, alertness of employees to innovate, etc. These concepts all influence the innovation activities of the organisation and the ideas that might be generated. Organisations could evaluate each of them to determine how they can utilise them in order to improve their innovativeness.

The external factors that might drive innovation are the market, external role players such as academia and the government, customer needs, competitors, etc. Organisations will have to manage the pressure that these external forces put on them and ensure that they convert the information and pressure into new ideas and offerings.

The innovation process component represents the stage of innovation management where the action happens. All the other components are very difficult to manage as there are no concrete processes

or methods to manage them. But within the innovation process, the organisation will have to manage the ideas that are generated by using a process defined in their innovation strategy. There are several innovation frameworks models that can be used, but each organisation will have to adapt the model to align with their own business processes. For the innovation process component, the Fugle model (Du Preez & Louw, 2008) has been included as the proposed innovation framework to use.

Also included in the innovation process component are idea management, innovation metrics, and other concepts that could be implemented in the form of a software solution for innovation management. The researcher proposed a software solution, as it can bring some structure to the management process.

Finally, the outcomes of innovation are the concepts identified as the end goal of innovation management, which include creating competitive advantage, obtaining return on the investments made, and inducing business growth. The outcomes of innovation also have an impact on the market and could contribute to the innovation metrics.

An important part of the conceptual framework is that the insights gained from the innovation metrics should be used to adapt the innovation strategy accordingly.

The literature review and conceptual framework feed into the design and development of the idea management software tool (Appendix D). The researcher considered the different concepts when extracting requirements for such a tool. The tool was developed using the agile software development methodology and is a web application.

The purpose of the tool is to assist organisations with the implementation of an innovation process. The tool allows organisations to set up their own innovation process, capture and manage ideas, and manage the idea through the innovation process. Some of the advantages for having such a tool are that the captured data can be used to create innovation metrics, and ideas are captured in a central place where everyone can comment and contribute to the idea to ensure that the concept definitions are adequate.

The next phase of the research was to validate both the conceptual framework and the idea management tool. The validation was performed at Dynamo Analytics. The company is innovative, but they are looking for a more structured approach to manage their innovation activities, and they agreed to validate the conceptual framework by participating in the case study. The company did not expect any benefits in return, except what they might learn during the process.

As part of the case study, an innovation strategy was developed using the strategy cascade framework (Lafley & Martin, 2013). It was developed by the gatekeeper of the organisation while the

researcher assisted. The conceptual framework was found to be helpful in developing the strategy, because it ensured that all the concepts that might influence innovation management were considered.

The idea management tool was used over a period of three months where nine users created accounts on the platform. The total number of ideas that have been submitted to the application is 33. It was very useful to have an application as part of the validation process, as it made the implementation thereof more practical and tangible for both employees and managers.

7.2. Concluding remarks

The researcher can confirm from the research that innovation management is not an easy topic or process to implement. It remains a continual learning process throughout the implementation of the innovation process. Literature does provide useful concepts for innovation management, but at the end of the day, each organisation will have to take these concepts and determine what works within their industry and for their company culture.

The validation of the conceptual framework has been successful. The feedback obtained by interviews during the case study as discussed in Section 6.8 showed that the conceptual framework is useful within the business context. Also in Chapter 6, the interviewees believe that the conceptual framework is of greater importance than the idea management tool, but if the tool could enhance the successful implementation of the framework, it would also be considered as important.

During the case study discussions, some of the concepts in the conceptual framework stood out from the rest. These were the innovation strategy, company culture, alertness of the employees, the role players, and the innovation process.

The innovation strategy is an important component of the conceptual framework. It is crucial for organisations to have a clear plan of how they will be innovative and how they will manage their innovation process. During the development of the innovation strategy, the organisation should also design their own innovation process to follow. The Fugle model is an excellent innovation model to use as a starting point for developing an innovation process.

During the interviews discussed in Section 6.8, the interviewees mentioned the importance of company culture several times. They stated that the way in which ideas are shared within the organisation would be highly dependent on the company culture. Also, introducing a culture of sharing, helping and teamwork will be beneficial for the innovation process, as people will be more likely to help one another to solve problems or to define concepts more clearly.

It was observed that after the initial launch of the idea management tool, several ideas were submitted to the system, but that thereafter the ideas that were submitted decreased. The

organisation decided to schedule monthly innovation discussions. Each month the best ideas that are directed at new business cases or revenue streams and are submitted on the idea management tool will be selected. The employees who submitted the idea will then have the opportunity to present the ideas to others. After the innovation discussions were introduced to the company, the number of ideas increased significantly. From this observation it can be concluded that it is important to ensure that the employees are alert to be innovative and that they are aware of the systems and processes that are put in place to manage the innovations.

For the employees to be aware, alert and motivated, innovation leaders are important role players. This has been observed in both the literature review and the validation period. Innovation leaders should also oversee the management of ideas, especially in the funnel phase of the innovation process. During the funnel phase ideas must be filtered and feedback must be given to employees. The data from the case study confirms the literature that states that when the time between the submission of ideas and receiving feedback is too long, it might demotivate employees to continue participating.

The innovation process is also one of the crucial components of the conceptual framework. Without a clearly defined process, it would be difficult to manage innovations. During the case study it was found that it would not be necessary for smaller incremental ideas to follow the same process as ideas that will require significantly more resources. Thus, a system that is used to manage ideas and innovations should allow organisations to exempt certain ideas from the full innovation process.

It was found during the case study that it is not necessary for the idea management tool to manage the Bugle phase – the launch of the innovative product or service. The idea management tool should rather focus on idea capturing and filtering, defining the concepts and ensuring that the selected ideas are feasible. This is to ensure that the right ideas progress to the portfolio management stage where the portfolio managers will make the final decision and assign resources to the ideas so that they can be launched as innovation projects. Project managers should then be responsible for the management of the projects. Figure 6.5 shows how the framework can be refined to show what part of the innovation process can be implemented by a software solution for idea management.

An effective innovation management system would be one that allows both the employer and the employee to benefit from it as much as possible. The innovation management system should create an environment where it is more beneficial for the employee to share and develop their ideas within the organisation than to take it somewhere elsewhere. From the insights obtained in the research, it is believed that a company culture that is favourable towards innovation and creates the space for employees to try and to fail without consequences, would create a foundation for an innovation management system that is beneficial for both the employer and employee.

It can be concluded that the conceptual framework developed in this research could serve as a tool to help organisations identify factors within the business environment that influence their innovation capabilities. Understanding and being aware of these factors could further help the organisation to develop a more holistic innovation strategy as these factors are taken into consideration.

The researcher believes that innovation management systems can often be overcomplicated. Organisations should obtain knowledge about innovation management, develop an innovation strategy, and execute the strategy as well as possible. The metrics should also be easy to use and keeping track of these metrics should direct the organisation to adapt their strategy where necessary.

Furthermore, each organisation will require a unique innovation strategy and innovation process that aligns with their company culture and objective. As Du Preez & Louw (2008) state, "There are just too many variables impacting the innovation and design processes for one framework to provide a 'one-size-fits-all' solution."

7.3. Future work

The conceptual framework has only been validated within one organisation, and it would be beneficial to perform similar implementations within other organisations. This might not be an easy task, as implementing an innovation process and finding a strategy, management techniques and systems, as well as the impact that they have on organisations, might take years to come into full effect.

Only some of the concepts within the conceptual framework were highlighted during the validation period, and it will be useful to gain more insight into the roles of each concept, its importance and its relevance in the framework across the different industries.

It would therefore be recommended that for future work, the framework along with an innovation strategy, and the design and development of an idea management tool, should be implemented in a number of different organisations within different industries.

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Appendix A: Concepts

Table A.1: Concepts of innovation management

	Concept Name	Description	Category	Reference
1	Academia	Academia is responsible for the knowledge society has on the different fields of expertise. This knowledge is a major driver for innovations in different industries.	National Role Players	(Du Preez et al., 2015)
2	Acceptable Risk	The policy on risk outlines the risks that a company deems as acceptable. This policy will have an influence on how the innovation leaders and stakeholders decide on the innovation projects that should be pursued or not.	Structure / Strategy / Internal Factor	(Brasil & Eggers, 2019)
3	Alertness	The alertness of employees of the organisation to new entrepreneurial opportunities that might become available.	Internal Driver	(Tang, Kacmar & Busenitz, 2009)
4	Architectural Changes	These are innovations that induce changes to the architecture of an offering. It is a change in the configuration of the entire system of an organisation and of how its different components interact with one another.	Innovation Type	(Magnusson, Lindström & Berggren, 2003)
5	Behaviours	The behaviours of the employees and leaders could impact the innovativeness of the organisation.	Innovation strategy / Corecapability	(Kylliäinen 2018)
6	Brand	An innovation that improves the image and representation of an organisation's offerings and overall business.	Innovation Type	(Keeley et al., 2013)
7	Business Growth	Business growth is one of the advantages organisations might enjoy from being innovative.	Innovation Outcome	(Abramovitz, 1956)
8	Business Model	Refers to how the organisation plans to generate a profit. The business model is important for the organisation to understand how they want to gain competitive advantage.	Structure / Strategy	(Van Zyl, du Preez & Schutte, 2007)
9	Business Strategy	The business strategy will determine how the innovation strategy looks and what innovation projects the organisation will pursue. The strategy sets the criteria to a large extent as to what and where the organisation can innovate.	Internal Driver	(Lafley & Martin, 2013)
10	Channel	An innovation that improves the way in which an offering is delivered to customers.	Innovation Type	(Keeley et al., 2013)

11	Close Innovation	Close innovation is the exact opposite of open innovation. It refers to the methodology followed by organisations when they do not make use of external sources in bringing forth new ideas. It focuses on ownership and control.	Innovation Type (Source of innovation)	(Marais, 2010)
12	Commercialisation	The phase in an innovation process where a product or service is commercialised.	Innovation process phase	(Louw et al., 2018; Cooper, 1990)
13	Company Culture	A capability of organisations to create an environment for employees to be creative, innovative and helpful. Company culture can set the tone for people to share ideas and to be proactive.	Internal Driver (Capability)	(Kylliäinen 2018; Louw et al., 2018)
14	Competitive Advantage	Competitive advantage is one of the outcomes of innovation. It refers to the advantage a company has over their competitors because of their offerings.	Innovation outcome	(Tidd and Bessant, 2018)
15	Competitiveness	Competitiveness in an industry or market drives innovation between different organisations.	Innovation Outcome / Driver	(Gerlach & Brem, 2017; Rossela, 2015)
16	Competitors	The other companies in the same market against which the organisation competes. Competitors could create pressure for an organisation to be innovative. Organisations should try to stay ahead of their competitors to avoid a loss of market share or to gain a larger share in the market.	External Driver / Market	(Du Preez & Louw, 2007)
17	Concept Definition/Develop ment	This is a phase in an innovation process where an idea is taken and a concept definition of the idea in greater detail. A clear concept definition is necessary for the portfolio stage to ensure that the right ideas are selected to be launched as innovation projects.	Innovation process phase	(Louw et al., 2018)
18	Concept Feasibility	The phase of an innovation process where the feasibility of a defined concept is being analysed to ensure that it is a workable solution or idea.	Innovation process phase	(Louw et al., 2018)
19	Configuration	Refers to the internal workings of an organisation i.e. the profit model, network, structure, and processes of the organisation. All these aspects of an organisation can be innovated.	Innovation Type	(Keeley et al., 2013)
20	Coordinator	Organisational coordinator that measures the coordinators of the organisational process.	Organisational Role Players	(Du Preez et al., 2015)

21	Cost	By lowering the cost of offerings, an organisation would also need to lower the cost of developing the product or service to ensure that they have an adequate return on investments. This can be a major challenge for organisations, but it can push them to solve these problems creatively.	Internal Driver (Pressure to Innovate)	(Du Preez & Louw, 2007)
22	Creative thinking skills	The ability of a person on group to think creatively and imaginatively.	Internal Factor	Amabile (1983)
23	Creativity	Creativity is a noun that names the phenomenon where a person describes a new concept. Creativity is a crucial and integral part of successful innovation. There are different types of creativity from which ideas can come. Organisations should encourage creativity and find ways to increase the creativity of individuals and groups.	Internal Driver (Capability)	Rhodes (1961)
24	Customer Engagement	An innovation that improves the interactions between the organisation and its customers.	Innovation Type	(Keeley et al., 2013)
25	Customers	Without customers there will not be a need to innovate. The success of innovations are also highly dependent on the acceptance of the offering by the customers.	Market	(Keeley et al., 2013)
26	Degree / Novelty of innovation	The degree or novelty of an innovation can be divided into either radical or incremental innovations.	Innovation Type Category	(McDermott & O'Connor, 2002)
27	Discovery / Idea generation	This is a generic innovation process phase. It is usually the first phase of the process and refers to the discovery or generation of ideas for possible innovations.	Innovation process phase	(Louw et al., 2018)
28	Distributors	In certain industries the distributors of the innovations can impact the success of an innovation. Swift and well managed distribution can contribute to the success of an innovation.	Market	
29	Economic Growth	One of the outcomes of innovations are economic growth of the country in which the innovative organisation resides.	Innovation Outcome	(Abramovitz, 1956)
30	Education & Training	Organisations should strategize as to how they will incorporate education and training into their business to create more knowledge. New ideas can originate from employees who are being trained in the areas in which the organisation competes.	Innovation strategy / Knowledge management	(Lafley & Martin, 2013)
31	Employees	Employees are one of the internal factors required for organisations to get new ideas, be creative, manage the innovation process, and make the ideas a reality. Employees are therefore one the important factors for driving innovation.	Internal Factor / Resource / Internal Driver	al

32	Experience	Some innovations might impact the experience customers have while engaging with an organisation. Service, channel, brand, and customer engagement are areas where innovations can impact customer experiences.	Innovation Type	(Keeley et al., 2013)
33	Expertise	The expertise that the employees and leaders of the organisation possess is an important driver for innovation, as it sets the foundation from where an idea can originate.	Internal Factor	(Amabile, 1983)
34	Explicit Knowledge	Explicit knowledge refers to knowledge that can easily be translated or codified into materials.	Knowledge Management / Internal Driver	(Grover & Davenport, 2001)
35	External Environment	The external environment refers to all the factors or concepts outside of the organisational domain that could influence the innovativeness of an organisation.	Overarching category	N/A
36	Extrinsic Motivation	Extrinsic motivation refers to when a person performs a certain task, not because of their love or passion for it, but because of external factors.	Internal Driver / Factor	(Bhaduri and Kumar, 2011)
37	Feasibility	Each idea and concept must be feasible for it to be selected as an innovation project.	Innovation management phase / concept	(Du Preez et al., 2015; Tidd & Bessant, 2018)
38	Finance	The finance department has a significant role to play in the innovativeness of its organisation. Innovative solutions to fund R&D, save money or create new sources of income are some of the areas where this department can have an influence. The financial system influences innovation as an internal factor because the organisation needs to fund their innovation projects. The financial system should be setup to support innovation and not inhibit it.	Organisational Department	(Kylliäinen, 2018)
39	Funding Gate	A gate in the stage-gate innovation process where the selected concepts are funded to become innovation projects.	Innovation Gate	(Louw et al., 2018)
40	Funnel	The funnel is a concept in innovation management that refers to the part of the innovation process where a larger number of ideas becomes less as time passes.	Innovation / Idea management phenomenon	(Du Preez et al., 2015).
41	Goals / Objectives	It is important for an organisation to have clear objectives as to what they want to achieve in order to create an innovation strategy.	Innovation strategy	(Lafley & Martin, 2013)

42	Government	Governments are major drivers of innovations as they fund and provide incentives for research and initiatives that could lead to an increase in innovation in the country. On the other hand, they can also impose laws and regulations that could cause organisations to adapt their offerings to adhere to it.	National Role Players	(Du Preez et al., 2015)
43	Human Resources	The HR department has a role to play in the innovation management process. The organisation should strategize on how they can employ people who can increase their innovativeness. The HR department can also generate innovative solutions that will address issues within their scope.	Organisational Department	(Tasselli, 2017)
44	Idea Management	The activity of capturing, evaluating and managing ideas.	Innovation process	(Brem and Voigt, 2007)
45	Impact on Core Design	This category refers to the modular and architectural changes that can be made to a product or service due to innovation.	Innovation Type Category	(Magnusson, Lindström & Berggren, 2003)
46	Impact on Market	This category can be divided into two sub-categories, i.e. sustaining innovations and disruptive innovations.	Innovation Type Category	(Christensen, 1997)
47	Incentives	Incentives can be either intrinsic or extrinsic. Organisations can incentivise employees who share a lot of ideas or takes the most risks to motivate them to be more innovative. However, some researchers found that extrinsic rewards will not necessarily have the impact that organisations desire. Thus, organisations should strategize well when it comes to the incentives that form part of their innovation management program.	Motivation / Strategy / Internal Driver / Factor	(Kanama & Nishikawa, 2017; Marx, Reis Faleiros Soares & da Silva Barros, 2016)
48	Incremental	Involves continuous improvements to existing products, services, or processes. It is an extension to current product offerings.	Innovation Type	(McDermott & O'Connor 2002)
49	Industry	The industry within which an organisation finds itself is one of the role players that can influence how innovative the organisation will be. Highly competitive industries can force organisations to be more innovative in order to gain a larger market share.	National Role Players	(Du Preez et al., 2015)
50	Information	Information in the context of innovation management refers to information regarding ideas, the problems at hand, requirements, customer needs etc. Information is a driver that helps employees develop innovative solutions and products.	Internal Driver	(Grover & Davenport, 2001; Du Preez & Louw, 2008)
51	Infrastructure	The infrastructure of an organisation has an impact on whether ideas can be converted into successful innovations or not.	Structure / Internal Factor	(Roffeei et al., 2016)

52	Innovation Framework / Models	An innovation framework creates a structure within organisations to manage their innovations more effectively. Innovation models refer to the different innovation process models that have been developed by academics and organisations. Some innovation models include stage-gate, Fugle, coupling, technology push and interactive innovation models.	Innovation management tool	(Cooper, 1990; Trott, 2017; Louw et al., 2018)
53	Innovation leaders / managers	The innovation leaders are responsible for managing the project managers. They are the contact point between the customers and the rest of the innovation network.	Internal Role-players	(Louw et al., 2018)
54	Innovation Process	An innovation process refers to a set of stages defined by an organisation to describe how they would manage their innovations.	Overarching category	(Ven, 2016; Van Zyl, du Preez & Schutte, 2007)
55	Innovation Strategy	A strategy developed by an organisation specially directed at the innovation initiatives of the organisation. The innovation strategy should be aligned with the overall business strategy of the organisation.	Strategy / Innovation management	(Ferreira, Fernandes, Alves, et al., 2015; Lafley & Martin, 2013)
56	Innovation Types	Innovation types refer to the different categorisations of innovations. Each innovation type has different characteristics and should therefore be categorised correctly so that organisations can use this information to understand the risks associated with the innovation and what process it should follow.	Overarching category	(Zapfl, 2018; Śledzik, 2013; Du Preez, Essman, Louw, et al. 2015; Keeley, 2013; Oerlemans, Knoben & Pretorius, 2013)
57	Internal Environment	The internal environment contains all internal workings of an organisation. It refers to all the internal factors that could influence the innovativeness of an organisation.	Overarching category	N/A
58	Internal Factors of Firm	The internal factors consist of concepts such as the departments, creativity, motivation, network within the organisation, the core capabilities, knowledge management etc. All these concepts are internal factors that influence the innovation initiatives of an organisation. An organisation should address these concepts and structure it in such a way to best assist the innovation management prospects.	Overarching category	N/A
59	Intrinsic Motivation	Intrinsic motivation is when a person performs a task because they love and enjoy what they do, and not because of what they might get from performing the task.	Internal Driver / Factor	(Bhaduri and Kumar, 2011)
60	Known Market Space / Red Oceans	Some organisations might pursue business in the known market space by differentiating themselves from their competitors. Another name for the known market space is Red Ocean.	Innovation strategy / Market	(Kim & Mauborgne, 2004)

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1983)

72	New Ideas	Ideas are the main drivers of innovation. The customer requirements can be identified, but how these requirements are converted into viable and profitable ideas is the key component that drives an organisation to be innovative.	Internal / External Driver	(Abramovitz, 1956)
73	New Technology / Technological change	Novel technology could create a space for downstream innovations in different industries. The introduction of a stronger and lighter material for example, may lead to innovative designs in the cycling industry.	External / Internal Driver	(Du Preez & Louw, 2007)
74	Object of Innovation	The area in a business where the innovation is taking place.	Innovation Type Category	(Keeley et al., 2013)
75	Offering	Some innovations impact the offerings of an organisation. The offering innovation type can be divided into product performance and product system innovation types.	Innovation Type	(Keeley et al., 2013)
76	Open Innovation	A type of innovation that refers to the source of innovative ideas. Some organisations might search for innovation sources outside of their organisational borders and thus, create a larger net to capture new ideas.	Innovation Type (Source of innovation)	(Marais, 2010)
77	Organisational Structure	Organisational structure is how the company arranges members and work to achieve their goals. The structure of an organisation plays an important role in how employees and their leaders interact and is thus crucial for ideas to be heard and for space to be created where ideas can be discussed and further developed.	Internal factor	(Du Preez & Louw, 2008)
78	Organisational Values	The attributes, behaviour and values that an organisation upholds and pursues could be a beneficial driver of innovation. For example, the value of helping one another could lead to employees assisting one another in solving problems and coming up with new ideas.	Internal Driver (Capability)	(Kylliäinen, 2018)
79	Portfolio Management	A phase in the innovation process where the concepts/ideas that have advanced to this phase are being selected according to different factors like the risk analysis, the appetite of the organisation, return on investment approximations etc.	Innovation process phase	(Brasil & Eggers, 2019; Stuart, 2009)
80	Process	An innovation that changes the processes of an organisation.	Innovation Type	(Keeley et al., 2013)
81	Product Performance	An innovation that changes the performance of a product offering.	Innovation Type	(Keeley et al., 2013)
82	Product System	An innovation that is complements an existing product.	Innovation Type	(Keeley et al., 2013)

83	Profit Model	An innovation that changes the profit model of an organisation.	Innovation Type	(Keeley et al., 2013)
84	Quality	The pressure of delivering higher quality products has numerous advantages for all stakeholders.	Internal Driver (Pressure to Innovate)	(Du Preez & Louw, 2007)
85	Radical	An innovation that involves a significant change to a product, service, or process. Radical innovations usually have higher risks associated with it.	Innovation Type	(Zapfl, 2018)
86	Regulations	Countries, industries, and organisations could have regulations. These regulations create a boundary in which innovations must stay. New regulations could also require organisations to adapt their current offerings and consequently introduce the need for innovative solutions that ensure that the aspects of the offering that makes it attractive to customers are not inhibited.	External Driver	(Du Preez & Louw, 2007)
87	Research and Development	The R&D department has always been the main source of innovations. Organisations can integrate this department's activities with those of other departments to ensure that all the departments contribute to the overall strategic objective.	Organisational Department	(Kylliäinen, 2018)
88	Resources	The available resources is an internal factor that could influence whether innovative ideas could become a reality. Resources could include employees, capital and assets. Resources should be assigned to different innovation projects during the portfolio management phase of the innovation process.	Internal Factor	(Marais, 2010; Brasil & Eggers, 2019)
89	Return on Investment	Return on investments refers to the reward that an organisation and the stakeholders might get from the innovations. Successful innovations would lead to satisfactory return on investments.	Innovation outcome / Metrics	(Muller et al., 2005)
90	Revenue	A major driver for organisations to be more competitive in the market in which they operate and to pursue new uncontested markets.	Internal Driver (Pressure to Innovate)	(Du Preez & Louw, 2007)
91	Science	New scientific findings could lead to new and improved materials or technology, which could in turn introduce innovative products or services.	External Drivers	(Taalbi, 2017)
92	Service	An innovation that improves the service an organisation offers.	Innovation Type	(Keeley et al., 2013)
93	Skills	The skills that a company or its employees possess is a crucial driver for the exploitation of innovative ideas or concepts.	Internal Driver (Capability)	(Tidd and Bessant 2018)

94	Stakeholders	The stakeholders might influence how decisions regarding innovation are made within the organisation. When pursuing innovative solutions, the organisation should also consider the impact it might have on its stakeholders	Internal / external driver	(Katz 2007)
95	Strategic Alliances/Partners	Organisations can collaborate with one another to combine their resources in developing new solutions to the demands of the market. Organisations should consider whether it will be within their interests to partner with other organisations or to use existing partnerships as part of their quest to gain competitive advantage.	Market	(Briones-Peñalver et al., 2020)
96	Structure	An innovation that changes the structure of an organisation.	Innovation Type	(Keeley et al., 2013)
97	Suppliers	The products or solutions that an organisation's suppliers have to offer will influence the level of innovativeness the organisation can achieve. Organisations should understand what their suppliers have to offer in comparison to the offerings of other suppliers so that they can put themselves in a position where they can deliver the best possible innovations.	Market	
98	Tacit Knowledge	Tacit knowledge refers to knowledge that people have but cannot express easily.	Knowledge Management / Internal Driver	(Grover & Davenport, 2001)
99	Technological Capability	The ability of an organisation to transform its knowledge and skills into workable and innovative solutions.	Internal Driver (Capability)	(Hao & Yu, 2011; Salisu & Abu Bakar, 2019)
100	Technology Push	When an idea or innovation originates from the introduction of new technology.	Type of Innovation	(Gabler, 2008)
101	Time	Time is a factor that induces pressure to innovate on an organisation.	Internal Driver (Pressure to Innovate)	(Du Preez & Louw, 2007)
102	Trigger of Innovation	This category consists of either technology push or market pull and refers to how an innovation is triggered. Knowing how an innovation is triggered could also assist organisations in understanding what risks are associated with the ideas.	Innovation Type Category	(Dixon, 2001; Lubik, Lim, Platts, et al., 2013; Ameka, 2013)
103	Unknown Market / Blue Oceans	Blue ocean is a name given to describe the unknown market space. This refers to opportunities that have not been pursued by any organisation yet.	Innovation strategy / Market	(Kim & Mauborgne, 2004)
104	Value Innovation	Value innovation is a strategy that organisations can adopt. This strategy has the objective of pursuing new opportunities in uncontested markets.	Innovation strategy	(Porter, 1985)

105	Value Proposition	As part of the innovation strategy, the organisation must understand the value that	Innovation strategy	(Lafley & Martin, 2013)
		they add through their offerings. This will help them to know what areas they should		
		pursue and will also help them identify the ideas that comply with their objectives.		

Appendix B: Software Development Lifecycles

Agile

Fast failure is considered positive in the agile methodology. In this approach, there are incremental changes from the previous release of the software, which means that there are ongoing release cycles. The agile approach allows software developers to identify minor issues early in the development process before these issues become more significant as the project grows. It also allows the developers to engage with stakeholders throughout the process.

The agile model, like many other SDLC models, is iterative. The agile model could follow these six stages:

- 1. Concept
- 2. Inception
- 3. Iteration/Construction

- 4. Release
- 5. Production
- 6. Retirement

Table B.1: Agile Advantages and Disadvantages

Advantage	Disadvantage
The model is flexible.	This model is not suitable for complex projects.
Ease of communication throughout the process.	Heavily dependent on accurate customer feedback and interaction.
Enables concurrent development and delivery.	Lack of documentation makes it hard to keep track of the project.
Suitable for small organisations.	Testing must be performed continuously.
Easy to manage.	It is hard to determine the resources that are required for a project.
Minimal resource requirements.	

Source: (Kumar, 2018)

Lean

The lean methodology stems from the lean manufacturing model. The lean model consists of seven principles: eliminate waste, amplify learning, decide as late as possible and deliver as fast as possible, empower the team, build integrity in, and see the whole.

The main goal for this method is to only work on what must be worked on at the time. The focus of these principles is to reduce wasted time and to increase value for the customer and the organisation. The seven principles are:

The term 'waste' within the lean model refers to any activity or aspect of a project that does not add value. Product development teams working with the lean model should focus on learning. Another aspect of this model mentioned by the author is that teams should decide as late as possible what features to include in their program. This will likely decrease the chance of having to make changes to the program.

Table B.2: Lean Methodology Advantages and Disadvantages

Advantages	Disadvantages
Elimination of waste.	Dependant on a team with a high skill set.
Quick turn-around time.	Many subgroups (because of teams) can lead to less focus.
Regular communication with the customer.	A high number of documentations.
	Source: (Singh, 2020)

Waterfall

The waterfall model originated from other engineering principles that were well-defined Crookshanks (2014). This methodology is based on a sequential process. Within this process, each phase only starts once its predecessor has been signed-off by the management team. The disadvantage of this methodology is that a large number of documentations is required throughout the life cycle of the project. Gantt charts are typically used to manage waterfall projects, and each phase has dedicated teams, e.g. the development phase, the testing phase, and validation phase. There are different teams responsible for the tasks in these phases. The phases do not overlap.

Table B.3: Waterfall Methodology Advantages and Disadvantages

Advantages	Disadvantages
The rigid model makes it easier to manage.	Working software only becomes available late in the development life cycle.
Excellent for smaller projects.	A lot of uncertainty and risks.
Enforces documentation of the whole process and results.	Not suitable for large projects extending over a long period.
	Difficult to manage.
	Change in requirements is not well received.
	Source: (Christian, 2021; Singh, 2020)

Iterative

This model does not depend on fully known requirements for the project to commence. The project team implements a smaller set of requirements and then tests and evaluates the software. After the evaluation, a new set of requirements are produced; this process evolves until the final product is developed. The requirements change throughout the development life cycle. According to this source, the iterative model has five cycles:

- 1. Planning and Requirements
- 2. Analysis and Design
- 3. Implementation
- 4. Testing
- 5. Evaluation

These cycles are repeated until the project is completed.

Table B.4: Iterative Methodology Advantages and Disadvantages

Advantages	Disadvantages
Easier to manage each milestone.	The iteration phases do not overlap with one another.
A working version of the product is available early in the project.	By not gathering all the requirements early in the project, issues with the architecture of the software may arise.
It is easier to implement changes in iterations.	The repetitive process can dry up resources faster than other models.
More straightforward to manage high-risk segments of the development process.	
The model does not require significant investments to make changes to the requirements.	

Source: (Singh, 2020)

Spiral

This method is one of the more flexible SDLC methodologies. Like the iterative model, it goes through several iterations before it is completed. The spiral model has the following four phases and passes through each phase in a spiral fashion:

- 1. Planning
- 2. Risk analysis
- 3. Engineering
- 4. Evaluation

Table B.5: Spiral Methodology Advantages and Disadvantages

Advantages	Disadvantages
Suitable for large products.	Rigorous management of the project.
Enables developer teams to build highly customisable products.	Having an indefinite loop of iterations can contain risks.
Beneficial for risk management.	The model is not typically used by SMEs.
Allows for change of requirements.	Much documentation required.
Customers can see the product early on.	
	Source: (Singh, 2020)

DevOps

The DevOps methodology is a mutation of the agile and lean models. The approach is a collaboration between development and operation staff members throughout the SDLC. These two teams work together to accelerate the innovation and deployment of products with higher quality. It is stated that DevOps is not only an approach to software development, but also a philosophy that requires a cultural change for it to be adopted.

Table B.6: DevOps Methodology Advantages and Disadvantages

Advantages	Disadvantages
Problems that arise are less complex to repair.	A large organisational change is required to be able to implement DevOps, which makes it challenging to integrate this method.
Time to fix problems are short.	Hard to find talented members to fulfil the roles.
Shorter time to market.	Automated testing is required.

Team efficiency.	To implement this model requires a significant initial investment of both time and money.
A continuous software delivery cycle.	
New features are delivered quickly.	
More stable operating environments.	
There is more time available to add value.	
Organisational risk is reduced.	
	Source: (Singh, 2020)

Appendix C: Database Diagram

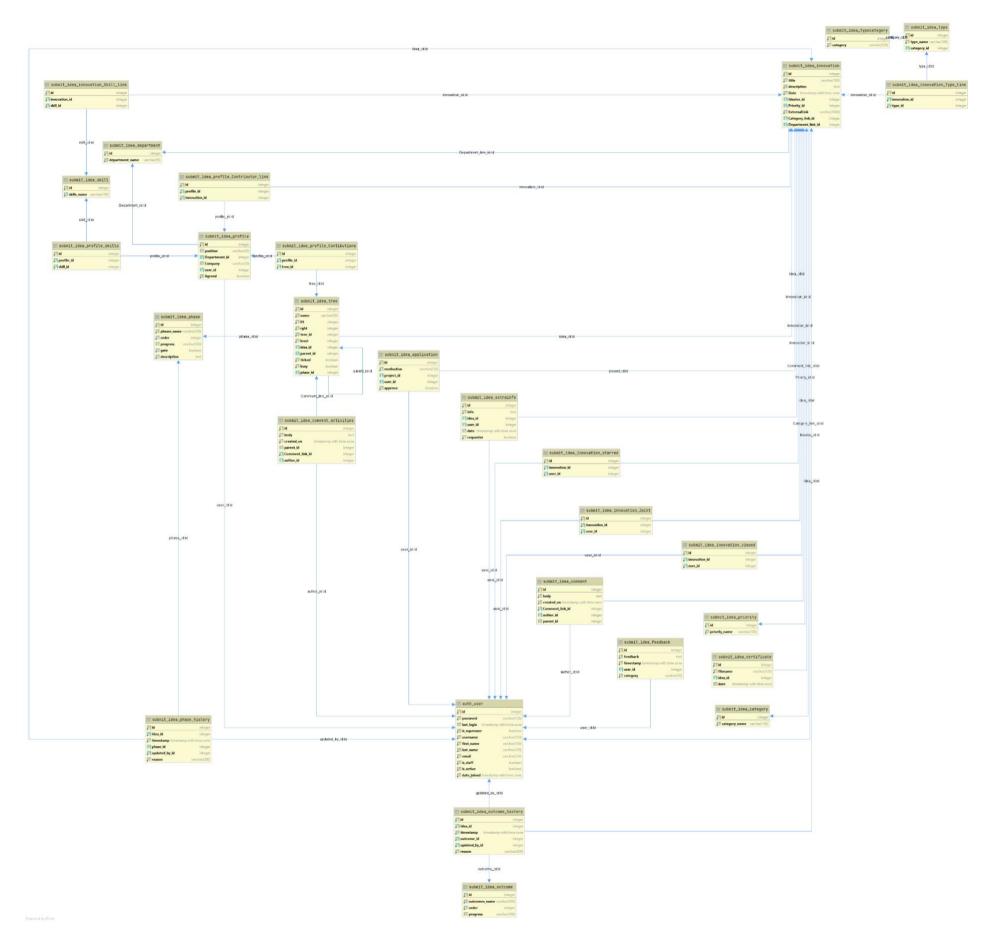


Figure C.1: Database diagram for the idea management tool

Appendix D: Idea management tool

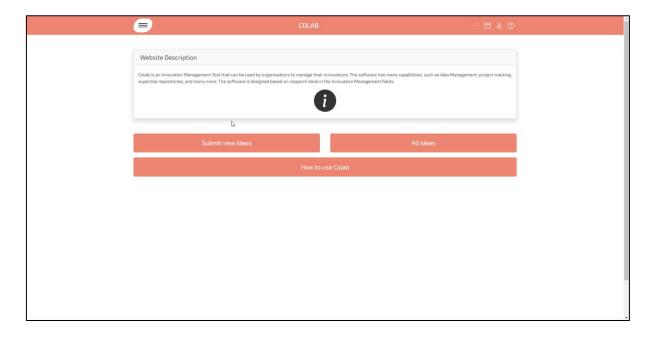


Figure D.1: Home Page

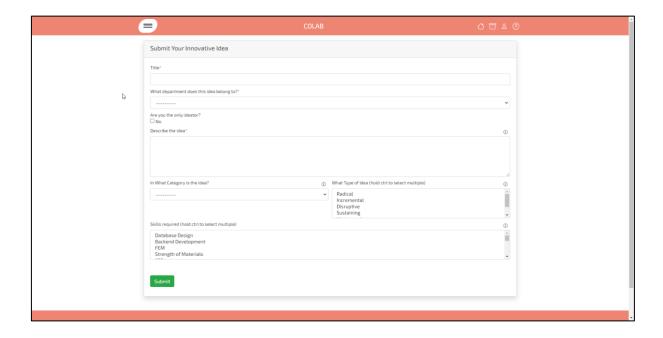


Figure D.2: Idea submission page

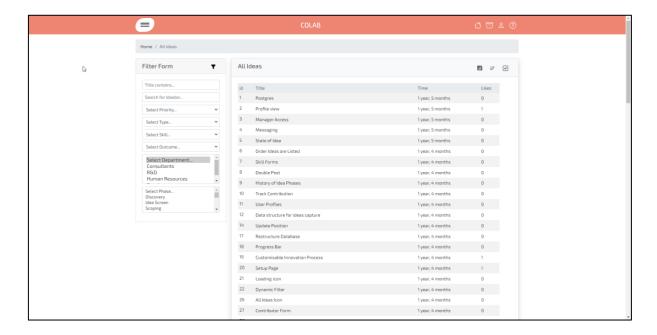


Figure D.3: All ideas page

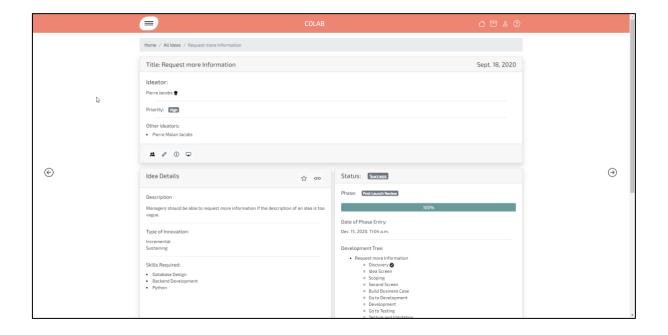


Figure D.4: Idea view as seen by an innovation manager

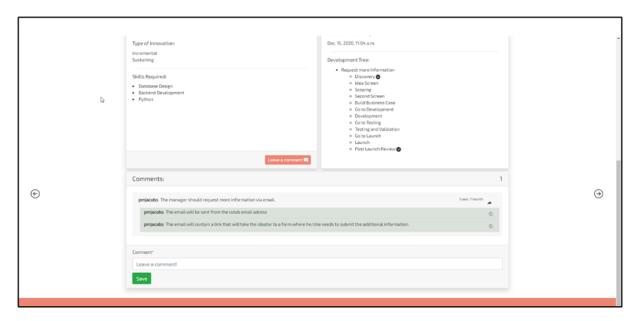


Figure D.5: Idea view comment section

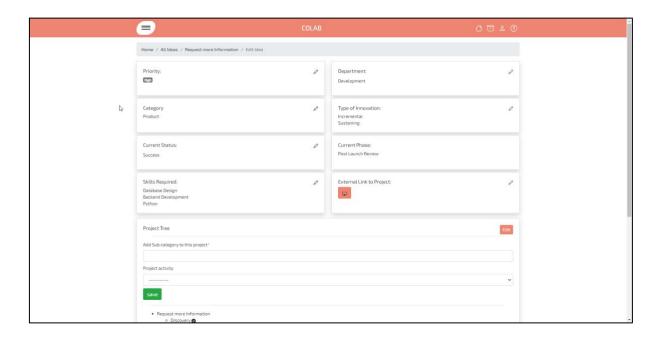


Figure D.6: Management of ideas/projects as seen by innovation managers

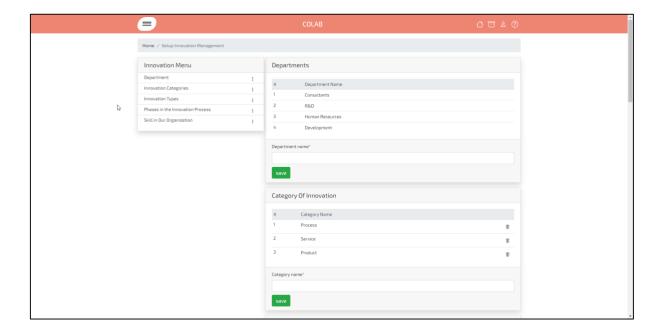


Figure D.7: Innovation management set-up page of departments and categories

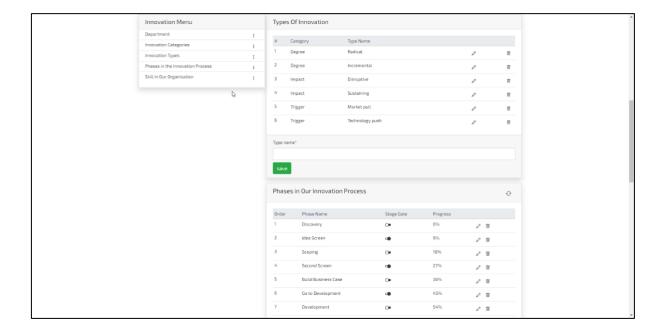


Figure D.8: Innovation management set up of innovation types and the innovation process

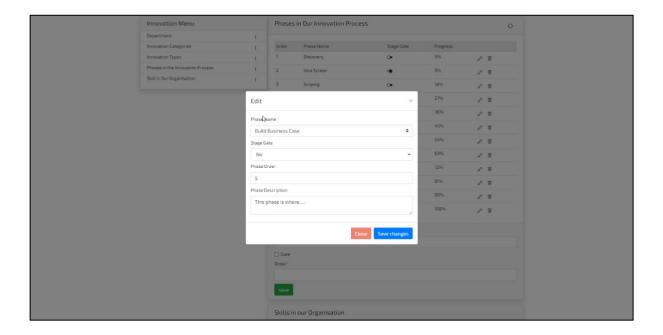


Figure D.9: Innovation management set up innovation process page

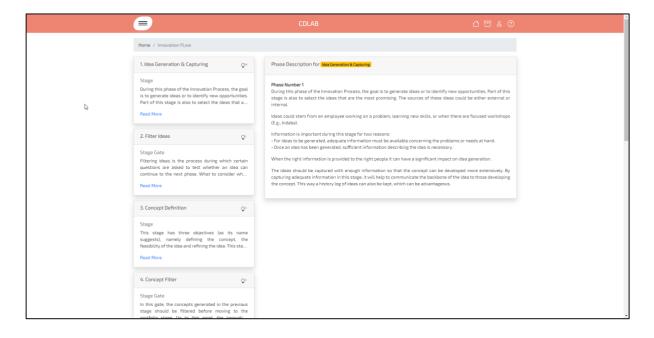


Figure D.10: Innovation process view

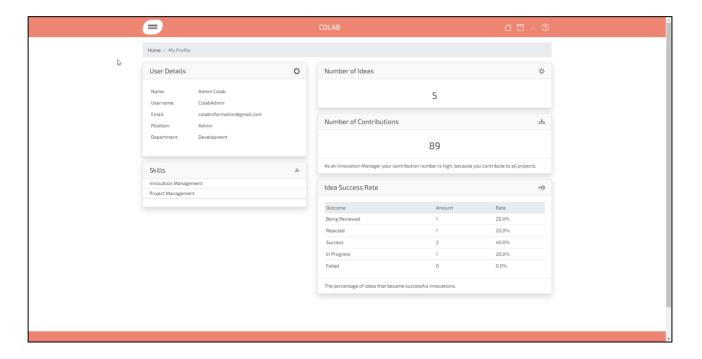


Figure D.11: User profile page