



DESIGN THINKING: SHAPING THE WAY INDUSTRIAL DESIGN BUSINESS
MODELS CREATE, DELIVER AND CAPTURE VALUE

by

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Date

ABSTRACT

The purpose of this Master's Thesis is to explore the application of Design Thinking as a valuable resource to any organisation, in this studies case the business model. Furthermore, it seeks to describe how the concept of 'Design Thinking' is shaping business models in the context of industrial design. By developing a language for and a description of these intersections and interdisciplinary roles. Consensus regarding the concepts of Design Thinking and the business model still needs development since this emerging area has become more established. An applied contextual research approach inevitably paints a new picture using the concepts and will also develop a language to assist design education, researchers and entrepreneurs in the industrial design praxis. The competitive advantage of any business is now driven even more by the intersection between different fields and disciplines. At this intersection exists the opportunity to understand the relationship between Design Thinking (a methodology that is grounded in industrial design) and the business model (a global concept for the logic of business) to help decision makers develop more sustainable pathways for design entrepreneurship. This research also addresses aspects of the changing role of industrial design and devotes the findings to the creative industries in South Africa. The research was conducted using a qualitative methodology, taking an applied context case study approach. Data were gathered from industry experts and three core cases: *Thinking* (design-maker consultants), *Research Unit* (a leather and luxury apparel company) and *Nomanini*, (provider of mobile solutions in the electronic domain).

The results show that the concepts of Design Thinking and the business model are intricately related. In addition, it is realised that the business model itself is a result or outcome of Design Thinking. Therefore, an object of design. Furthermore, the results are summarised by scoping the three main pillars of the 'business model building blocks' concept (the 'product/service'; the 'customer interface' and the 'infrastructure and management' pillars), which address the overarching question, 'How does Design Thinking create, deliver and capture value for industrial design related business models in South Africa?'.

Firstly, Design Thinking is thought to deliver value through its products and services pillar. This is achieved, by delivering new, novel and customised forms of value; satisfying the needs of the customer; and retaining customer buy-in by addressing these needs.

Secondly, Design Thinking is thought capture value by means of the customer interface pillar. This is achieved; by enabling co-creation and personalisation; by inviting critique and creating awareness through certain channels; and through applying design methods to gain customer insights and test value propositions.

Third and lastly, Design Thinking is thought to create value through the infrastructure management pillar. This is achieved, by creating value through the knowledge management, transfer and the empowerment of key resources; by capacity building to establish an input of complementary skills and partner capabilities; by transforming the user insights captured and managing this change in the key design activities performed.

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DEDICATION

To the world of design and business, let's take a moment to stand back and think about what
we've created

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GLOSSARY

Terms/Acronyms/Abbreviations	Definition/Explanation
Business model	A business model is described as the blue print for a strategy to be implemented through organisational structures, processes, and systems (Osterwalder & Pigneur, 2010).
Business model design	The basis of business model design is the use of various techniques such as customer insights, ideation, visual thinking, prototyping, storytelling and scenarios (Osterwalder & Pigneur, 2010). These can serve as Design Thinking methods to building a competitive business model.
Design management	Design managers need to speak the language of business and of design (Lockwood, 2010). It is also directly concerned with the organisational place of design (Best, 2006).
Design Thinking	Design Thinking is essentially a human-centered innovation process that emphasises observation, collaboration, fast learning, visualisation of ideas, rapid concept prototyping and the concurrent business analysis (Lockwood, 2010).
Entrepreneurship	Entrepreneurs identify business opportunities to create and deliver value for stakeholders in prospective ventures. A simple definition of an entrepreneur is someone who sets up and runs his or her own business (Smith & Beasley, 2011).
Epistemology	Philosophical discipline which deals with the nature and sources of our knowledge that informs the research (Creswell, 2003).
Industrial design	Industrial design is a strategic problem-solving process that drives innovation, builds business success and leads to a better quality of life through innovative products, systems, services and experiences (ICSID, 2016)
New product development (NPD)	The process of NPD consists of a number of key stages, including identifying customer requirements, developing a product concept, generating a detailed design, testing, and launching the product to market (Micheli, Pietro, & Keith, 2010).
Ontology	The study of reality through the conceptualisation of essences that underpin the particular domain under scrutiny, e.g. relationships (Grbich, 2007).

SME	Small and Medium Enterprise (SME) which encompass a very broad range of firms. They contribute to a country's national product by either manufacturing goods of value, or through the provision of services to both consumers and/or other enterprises (Berry <i>et al.</i> , 2002).
Socio-economic	Concerning both the social and economic factors of the independencies that are defined in culture, demographics, consumption, production and resources (Davis <i>et al.</i> , 2013).
Socio-technical	The interrelated nature of technological and social aspects of the workplace (Davis <i>et al.</i> , 2013). The theory has achieved some success in helping inform the design of new technologies and technology-led changes in the work place.
Start-up	In broad terms and more commonly used in business, "business start-ups generate wealth and innovation as these entrants seek out and create new business opportunities and activities" (Atherton, 2007).
User-centered design	Users are placed at the center of the design process. The actor, who is the designer, facilitates and mediates the task for the user in relation to the product (Kahraman, 2010).
Value Creation	Involves the continuous and on-going shaping, renewing and adapting of the underlying business model, comprised by the rationale of how a business create, delivers and captures value (Osterwalder & Pigneur, 2005).

LIST OF ACRONYMS

B Tech:	Bachelor of Technology
CCDI:	Cape Craft and Design Institute
CAD:	Computer Aided Design
CEO:	Chief Executive Officer
CNC:	Computer Navigated Cutting
CPUT:	Cape Peninsula University of Technology
DTI:	Department of Trade and Industry
FID:	Faculty of Informatics and Design
GDP:	Gross Domestic Product
ICSID:	International Council of Societies of Industrial Design
IDSA:	Industrial Design Society of America
IS:	Information Systems
IP:	Intellectual Property
NGO:	Non-governmental organisation
NPD:	New Product Development
R&D:	Research & Development
SAB:	South African Breweries
SABS:	South African Bureau of Standards
SMME:	Small Micro Medium Enterprise
TIA:	Technology Innovation Agency
TTO:	Technology Transfer Office
UFISA:	User-Centred Design for Innovative Services and Applications
UX:	User Experience

1 CHAPTER ONE: THESIS SCOPE

1.1 INTRODUCTION

It is now widely acknowledged that Small and Medium Enterprise (SME's) can play a significant role in a country's economic growth by contributing towards technology and innovation processes (Patil *et al.*, 2012) and absorbing unemployment through the production of value-added products and the provision of services (Berry *et al.*, 2002). In the context of industrial design, entrepreneurs are faced with a complex socio-technical field of product development (Meinel & Leifer, 2011). Identifying opportunities and implementing those product ideas requires both an effective business design and the management thereof to increase their likelihood as a sustainable SME.

Ever more, expanding research suggests that a key to business innovation and strategy lies within the creative thinking of the design field and the methodologies used. In just over a decade, 'Design Thinking' (in capitals) has become so popular as a methodology that even companies that do not have an academic background in design are also utilising the methodology as a valuable contribution to managers and business people alike. At the same time the changing role of industrial design is effecting a competency shift towards more responsible roles in leadership and management, whereby industrial design entrepreneurs are now more involved and are developing the capability to design the way they do business, rather than the product alone (Fraser, 2009). This concept is introduced by Fraser in the following statement:

'There is compelling evidence that the methods and mindsets behind great design in fields such as engineering, industrial design and architecture are equally powerful in designing an enterprise model'

(Fraser, 2009:58)

This shift is important, because, in South Africa, the current socio-economic placement of industrial design encourages self-employment as a likely direction to follow (Mohlabani, 2013). However, an Executive Report for CPUT done in 2013 identifies that mechanisms in the Faculty of Informatics and Design do not address the integration of design thinking in the business sphere adequately, and there is a need to encourage sufficiently the appropriate connections between this mode of thinking and the necessary economic

opportunities (CPUT, 2013: 13-14). In addition, there is little research that reflects upon and describes how industrial design entrepreneurs are applying Design Thinking in the practices of their organisation. Such research is needed to develop curricula that support this changing role of the designer. Consequently, it is important to raise the question of how Design Thinking is applied by industrial design entrepreneurs, and how it shapes their business models. The research aims to achieve this by identifying and studying the elements of the concept Design Thinking in an applied context in order to describe how the concept is shaping the way these business models create, capture and deliver value.

The research methodology of this study involves an inter-disciplinary approach that draws from two concepts in the design and business disciplines. The concepts adopted include the Design Thinking rules developed by Meinel and Leifer (2011) and applied in relation to the 'business model building blocks' concept developed by Osterwalder & Pigneur (2005) to describe the industrial design context outside of its normal boundaries. It includes a description based on a new understanding of the industrial design discipline in the context of business. Grounded by the premise that innovation and solutions congregate most successfully when created between disciplines, the research also emphasises a proposed need to educate inter-disciplinary professionals and develop an on-going design entrepreneur curriculum at CPUT.

Three case studies have been analysed through implementing a qualitative research design. These cases comprise of a design consultancy, a high-tech start up and, lastly, a luxury product design company, all of them in industrial design related industries. Selected expert consultants within the field of design and business also contributed with their knowledge, perspectives and defining roles of Design Thinking.

Significantly, this study is aligned as a reference to industrial design education at the Cape Peninsula University of Technology (CPUT) and to the Western Cape Design Strategy at the Cape Craft and Design Institute (CCDI) to promote professional development and innovative methodologies such as Design Thinking in the competitive fields of new product, service and business development.

1.2 RESEARCH PROBLEM AND BACKGROUND

1.2.1 The problem

Current mechanisms at CPUT do not address the integration of Design Thinking in the business sphere of the industrial design curriculum, in Cape Town, South Africa. Therefore, there is a need to encourage sufficiently the appropriate connections between such thinking and the potential economic opportunities (CPUT, 2013:13-14). In addition, little research has been devoted to understanding the context of industrial design business. To address the problem, this research formulates a descriptive overview of the relationships enacted between Design Thinking and the ontology of industrial design related business models.

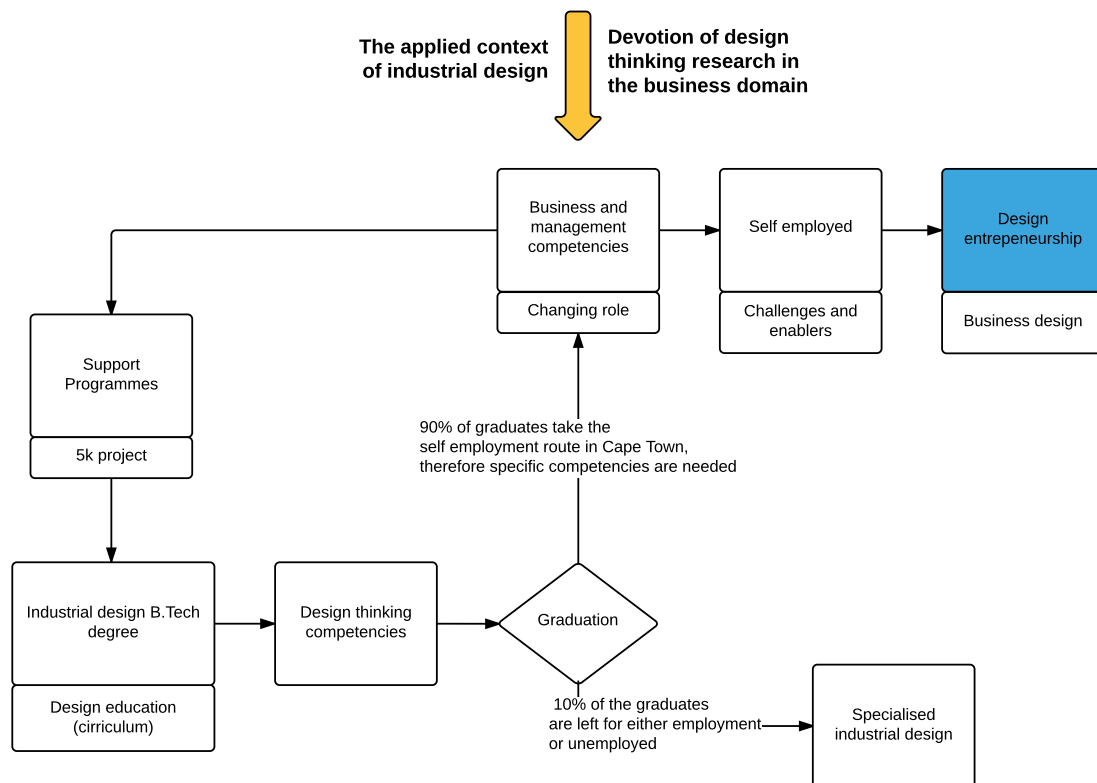


Figure 1.1: Problem conceptualisation (Authors' construct), with trends from Mohlabani, 2013

The changing role of industrial design and the points at which problems arise are conceptualised in Figure 1.1. The diagram shows that the majority of graduates are taking a self-employment route. Consequently, these industrial designers will have to start their own businesses, whether it be consulting or trying to launch a product.

1.2.2 Background to the problem

1.2.2.1 Self-employment as a primary direction to follow

Globally, the discussion continues about whether the competencies of industrial design should be specialised or generalised (Yang & Jiang, 2010), and taught as such. In South Africa, self-employment seems to be the direction which most industrial design graduates take. An alumni survey done by Mohlabani at CPUT in 2013 - and which surveyed alumni of almost 20 years - showed that 90% of graduates were self-employed and 70% said it was difficult to find employment (Mohlabani, 2013). This high percentage of self-employed graduates leads one to the realisation that the majority of them will require some entrepreneurial competencies. And the question may be: Should they, therefore, become specialists to create a niche for themselves? Or should they be generalists so that they can be versatile? And should the course include modules on entrepreneurial skills? Johan van Niekerk, the programme manager at CPUT, expressed his thoughts with regard to the concept of industrial design students being taught as specialists or generalists in an interview in 2015. Van Niekerk believes that this could lead to a lack of definition of the industrial design discipline. Van Niekerk added that he supported the view that industrial designers should not ignore the service and systems shift in industrial design. However, he also felt it was important to still keep industrial design specialised in order to meet industry standards and requirements in South Africa. However, this view was relevant to the curriculum at an undergraduate level.

1.2.2.2 Lacking business and management skills

At present, the South African Industrial design degree consists of a 3-year National Diploma in Product Design, and a 4th year if one wishes to obtain a B. Tech. Industrial Design Degree. Graduates tend to either search for employment or venture in the direction of self-employment after they exit university. After graduating in 2010, I myself took the employment route, having been offered the opportunity to work for a company in Johannesburg that I had established during my studies at CPUT. The idea of managing my own business had not come to mind yet or had somehow not seemed manageable at the time. The job consisted of commercial product development and I came to realise that the majority of the work was not very rewarding, mostly due to the little time put aside for product design, research and development (R&D) and the lack of social engagement that the work entailed.

At the time, self-employment started to look more attractive. I had two potential products that I had developed at university and which, I believed, had market value and could be developed into business models. It was, however, a matter of implementing such business models successfully which was a challenge. The need to acquire competence in business and improve my Design Thinking capability started to move into the foreground if I wanted to

become an industrial design entrepreneur. This realisation led to my present research topic, which forced me to do in-depth research in order to unearth the relevant information for industrial design students wishing to start their own business. On the other hand, it was also not clear where to start looking for information on how to design a business that is tailored specifically for the socio-technical parameters of industrial design. However some more encompassing books have been written in the last decade. They convey their information in a language that is attractive and engaging to read, such as the popular “Business Model Generation” book by Osterwalder and Pigneur (2010).

1.2.2.3 Design education

Assessments of the National Diploma and B.Tech. level of Industrial Design at CPUT have reported that the curriculum and assessment procedures do not adequately address the integration of Design Thinking in the business domain. Rather, creativity is aimed at alternative functionality, as well as aesthetic and cultural aspects, which do not make the appropriate connections with the necessary economic opportunities (CPUT, 2013:13-14). Now, with the growing potential of industrial design entrepreneurs managing the new product development (NPD) process and starting their own business, it seems appropriate that there should be more discussion and support in building entrepreneurship skills into design education. A key priority for the Panel Evaluation Report in 2013, was the development of an entrepreneurship curriculum. This internal report was compiled by the FID (Faculty of Informatics and Design) that reviewed the CPUT programme in applied design. Van Niekerk in an interview (2015) confirmed that a design leadership course is being developed for the industrial design praxis at CPUT. In a design management review called “The Four Powers of Design: A value Model in Design management” by Brigitte Borja de Mozota (2007), an influential professor at the Management Science School in Paris, she states that her study has established that designers lack the knowledge of management concepts and that of management science. Her findings match similar challenges which we have here in South Africa. In addition, she states:

“The scope of design management has changed and this is the result of business’s changed understanding of the place of design in an organisation, as well as of designers’ changed understanding of the scope of business management” (Borja de Mozota, 2007).

1.2.2.4 Global competitiveness encourages design entrepreneurship

In a global study regarding entrepreneurship, Smith and Beasley (2011) identified various themes which presented graduates with potential challenges and the enablers for these are presented in Table 1.1.

Table 1.1: Survey information concerning graduate entrepreneurs in general (Smith & Beasley, 2011)

Challenges	Enablers
<ul style="list-style-type: none">• Limited know-how on setting up a business• Financial uncertainty• Relevant work experience• Limited entrepreneurship careers guidance• Lack of awareness creativity and innovative ideas	<ul style="list-style-type: none">• Provision of sufficient enterprise modules, courses and enterprise events• Involvement with role model, mentors, and entrepreneurs in developing business ideas• Relevant work experience before and during university• Flexible learning environment

In the table above, Smith and Beasley (2011) present various challenges that are experienced by most disciplines. In the industrial design discipline, it seems that the problem is not prevalent so much in the lack of creativity or innovative ideas. Rather, as explained in the evaluation of a report by CPUT (2013), the connection between creativity and enabling modules around business are under-developed. Entrepreneurship has experienced an explosion of interest from disciplines, such as engineering, design and arts (Gunes, 2012). The new wave of entrepreneurship is about designers also establishing roles in the management and decision making of the NPD, from concept-to-market. Where traditionally the roles of industrial design have been more focused on product design.

1.3 AIM AND MOTIVATION FOR THIS STUDY

1.3.1 Aim of this research

The research explores industrial design in the business practice. Hence, industrial designers, who have not taken the typical route of finding employment, but rather those with an entrepreneurial aptitude to create their own sustainable business models. To analyse aspects of the problem area, the research attempts to compile a descriptive overview of the relationships of Design Thinking and what they are doing when they engage with such thinking in the business model context.

1.3.2 Personal and project learning objectives

There have been two primary objectives for me personally in this study. One has been to educate myself on the topic of design management, and the other has been to contribute knowledge to the changing role of industrial design, to the discourse of design entrepreneurship, and to developments in design education. On an academic level, I had the opportunity to do an exchange study at the Aalto University in Finland, 2014, a university that has established courses in Design Thinking in business at a post graduate level. The courses I completed included “Design Strategy and Innovation”, “Networked Business Processes and Models”, “Advanced Strategic Management” and “Opportunity Prototyping”. These courses shaped my personal knowledge and enhanced the ability to undertake an inter-disciplinary study such as this. On a project level, I hope that this research will contribute to the understanding of how design can be applied outside its normal boundaries, to develop the industrial design praxis here in South Africa and make sure it is responding adequately to the socio-economic opportunities.

1.4 CONTRIBUTION OF THE RESEARCH

1.4.1 Local and international directions from previous research

The theory of Design and Design Thinking helping shape a company’s vision and strategy is not a new one (Ward *et al.*, 2009). Leading authors, such as Roger Martin, Tom Kelly and Tom Peters, have written books on the topic. There are also a number of books and papers that have emerged even since I started working on this study , such as “Parts Without a whole: The current state of Design Thinking Practice in Organisations” (Schmiedgen, Rhinow, & Köppen, 2015) and “Teaching Design Thinking in Business Schools” (Glen, Suci, Baughn, & Anson, 2015). Most of these studies focus on the design process and the value that it can bring to business design or formation. In addition, case studies have been done in various sectors outside the creative industry, which are related business models. For example, a publication called “Design-driven Innovation: Why it Matters for SME Competitiveness” in collaboration with the Circa Group Europe (2015) conducted an intensive evaluation of six SMEs across a range of sectors that were applying a design-driven approach to grow and evolve as business. Given the above, it seems that great amount of literature has been dedicated to the application of design outside its normal boundaries. Especially, because great design has long been recognised as an important strategy for enterprise success (Fraser, 2009).

Fraser (2010), from the Rotman School of Management, took research outside its normal boundaries, thereby acknowledging that the same methods and mind-sets that create new objects of desire, are also instrumental in enhancing services and user experiences, as well as in the business itself. Fraser's journal article "Designing business: New models for success" (Fraser, 2010), is a starting point for this thesis and the conceptual development. However, Fraser's research was developed to describe a methodology for designing; this study is more focused on how the organisation is actually influenced by design, the business model as a 'end-product' rather than the design process.

1.4.2 Practical contributions

1.4.2.1 Contributions to the curriculum at CPUT

The research is associated with design entrepreneurship, as well as with the Design Leadership course which is being developed at CPUT. Furthermore, it aims to raise a description for the definition and features of industrial design business models. My research, in general, is aimed at generating a description that can become resources to motivate further research in the interdisciplinary field of FID.

Post-graduate courses are also an area that is developing, if we compare CPUT to a university, such as the Aalto University in Helsinki, Finland, that has a wide selection of postgraduate courses. If Design Thinking or Design Management related courses become more structured in the future, it is important to have context based research in place as a foundation. This research can then be used to develop courses that prepare graduates to develop products, services and ultimately sustainable business models.

1.4.2.2 Meta contributions

As the global economy is becoming more and more competitive, many companies have recognised the importance of innovations not only driven by technology, but also by design (Gunes, 2012). In effect, the creative industries have to deal with the concept-to-market process, which is also called the creative economy. In report by the United Nations, the creative economy is believed to be a leading component of economic growth, employment, trade, innovation and social cohesion in most advanced economies and seems to be feasible option for developing countries (Panitchpakdi and Dervis, 2008).

Now that the creative industries has also been identified by the Accelerated and Shared Growth Initiative of South Africa (ASGISA) as the drivers of sustainable opportunities and livelihoods for local communities (Avril *et al.*, 2008), it has the potential for both rural and urban job creation, with a larger aim of developing international competitiveness for South Africa. It is also stated by Zyle (2007) that economic success and impact are results made possible by managers with an understanding of the role and value of design.

1.4.3 Theoretical contributions

Design Management and Leadership courses are not yet offered at postgraduate level at CPUT. Considering the current global challenges and competitiveness, these interdisciplinary modules offering Design Management are becoming increasingly popular, hence from my experience during the UFISA at Aalto University, I found that Finland has vast array of established courses for post graduates on these topics. However, applied research on the ground, on the topics such as design entrepreneurship, Design Thinking, design management is relatively new and under developed in South Africa and this is proved through the literature review of this study. Potentially, these concepts are becoming more developed internationally and fortunately they are increasingly becoming more rigorous. Therefore, applied context research in South Africa is also a valuable contribution to this international rigour and it will aim support the growing scope for research on the Design Thinking phenomena here in South Africa.

1.5 PRELIMINARY LITERATURE REVIEW: BACKGROUND AND CONTEXT

1.5.1 Introduction

This exploratory and descriptive research approach is based on the current state and knowledge of Design Thinking and its influence on shaping business models in the context of industrial design, which is affiliated with the umbrella of the creative Industries and I've also posed the use of the term creative economy in this literature review. The data presented in this thesis aim to describe how current industrial design entrepreneurs are using Design Thinking in the business practice. Most design research and practice has addressed design in terms of added value that it brings to the product through Design Thinking and processes that bring returns on investment through successful consumer buy-in. Therefore, this research primarily looks at how design influences the business model, which suggests Design Thinking as a link between design and business.

This research also speaks to the broader need to address design entrepreneurship and research needed for design education and support programmes in the region. Therefore, background topics, such as design entrepreneurship, will assist the reader to understand the context and placement of this study. The key literature topics that give some background to this study are the following:

- The creative industries
- The industrial design discipline
- The changing role of industrial design
- Design entrepreneurship
- New models for the design business

1.5.2 The creative industries

Before we focus on the underpinned discipline of industrial design it is important that we understand the creative industries into which industrial design fits. We need to create some premises around the conceptual and theoretical boundaries and understand this sector. Therefore, we need to look at what the creative industries are and what practitioners do within the creative industries. The industry sector comprises a large variety of creative fields, from those that are heavily industrialised, such as advertising, marketing, and broadcasting, the film industry, Internet and mobile industry, to those that are less industrialised, such as the performing arts. Other creative industries include the domains of craft, fashion, design industry that include industrial design, architecture, cultural tourism, and even sport (Collins, 2010:18-19).

In broader terms, the creative industry is defined by the creation of new content and intellectual property in one of the key activities mentioned above (Collins, 2010). Creative businesses are, generally, idea based in terms of product/service development and business practice. These businesses also seek to create new markets. The sector is made up of small to medium sized companies that work within complex ecosystems on which others rely on, such as the manufacturing or engineering sectors (Collins, 2010).

Therefore, the creative industries are a diverse set of different industries that have much in common, and industrial design is a core discipline in those industries. However, industrial

design, in the more traditional sense, has not always been known to satisfy the business practice, but rather add value to aspects of the new product development (NPD) process.

1.5.3 The industrial design discipline

Industrial design is a relatively young and evolving profession. On a global level, industrial design is recognised as a powerful corporate tool and it plays an increasingly critical role in competitiveness (Er, 1997). In other words, industrial design may be defined as a strategic process containing knowledge about a product from which the latter can be materialised. The skills and abilities embedded in this knowledge apply a process that involves differentiation or identity, which is usually in line with the company's vision and brand. The Industrial Designers Society of America (IDSA) describes industrial design with more traditional description in a book called "Product Design and Development" (Ulrich *et al.*, 2008).

"The professional service of creating and developing concepts and specifications that optimise the function, value, and appearance of products and systems for the mutual benefit of both user and the manufacturer"

The Industrial Designers Society of America (IDSA)

Ulrich suggests that this definition is broad enough to include the activities of the entire product development team. In fact, he explains that industrial designers focus their attention upon the form and user-interaction of products. In brief, the skills and competencies of industrial designers are those that allow for a strategic product design process - namely, the utility of the product: in that the product is easy to use, intuitive, safe and a functioning whole. The appearance of the product, its form, proportion and colour are to make an aesthetic whole. The product should demonstrate and communicate how it can be maintained. The cost of product features and form will also have a significant impact on the tooling and production costs. The product should communicate the corporate design philosophy or its brand through its visual qualities (Ulrich *et al.*, 2008). These qualities of industrial design, as outlined by Ulrich, signify what is being considered when designing, and they apply to product design in particular.

1.5.4 The changing role of the industrial design

From the definition of industrial design, the profession follows a design activity and has been for a long time accredited for shaping the appearance and the usability of products (Valencia *et al.*, 2013). However, and like most disciplines and professions, the industrial design profession has constantly been evolving, with multi-disciplinary roles emerging in the 21st century thinking. The broader spectrum of design is expanding its disciplines, and conceptual, theoretical and methodological frameworks, to encompass ever-wider activities and practices (Goldschmidt & Rodgers, 2013). Now that industrial design has become significantly more of a multi-disciplinary profession globally, it covers a wider range of skills (Yang *et al.*, 2005) in communication, design process, design methods, visualisation, problem solving, product development and design management. Design Thinking in practice has proved to be an effective skill to have in order to solve complex socio-technical challenges; its problem solving ability allows a better understanding of the issues which people are experiencing and the concept generation of effective innovations that address these (Plattner *et al.*, 2012).

As existing products in the market place are now being rapidly replaced, the steadfast development of new successful products is one of the most essential challenges for new businesses (Soukhoroukova *et al.*, 2007). The process of creating, evaluating and employing new product ideas is essentially also one of the major challenges for the industrial design practice. Taking those product ideas and transforming them into a business requires additional competences that exhibit the entrepreneurial characteristics of the industrial designer.

There is, however, compelling evidence that the methods and mind-sets behind great design in fields, such as engineering, architecture and industrial design, are equally powerful in designing a business (Fraser, 2010). Goldschmidt and Rogers explain their perspective on this role and the competency of designers in the statement 'Design thinkers are expected to constantly challenge the boundaries of known solutions and venture to uncharted territories. The designer, it seems, is expected to demonstrate an entrepreneurial approach, even when someone else can initiate the task' (Goldschmidt & Rodgers, 2013:468). The Design Thinking process shares an identical nature with the entrepreneurial process, and the changing role of the industrial design professional is moving towards the creation of business rather than solely the traditional specialised skill of product design (Gullberg, Widmark, Nystrom, & Landstrom, 2006). This concept is illustrated in Figure 2 below:

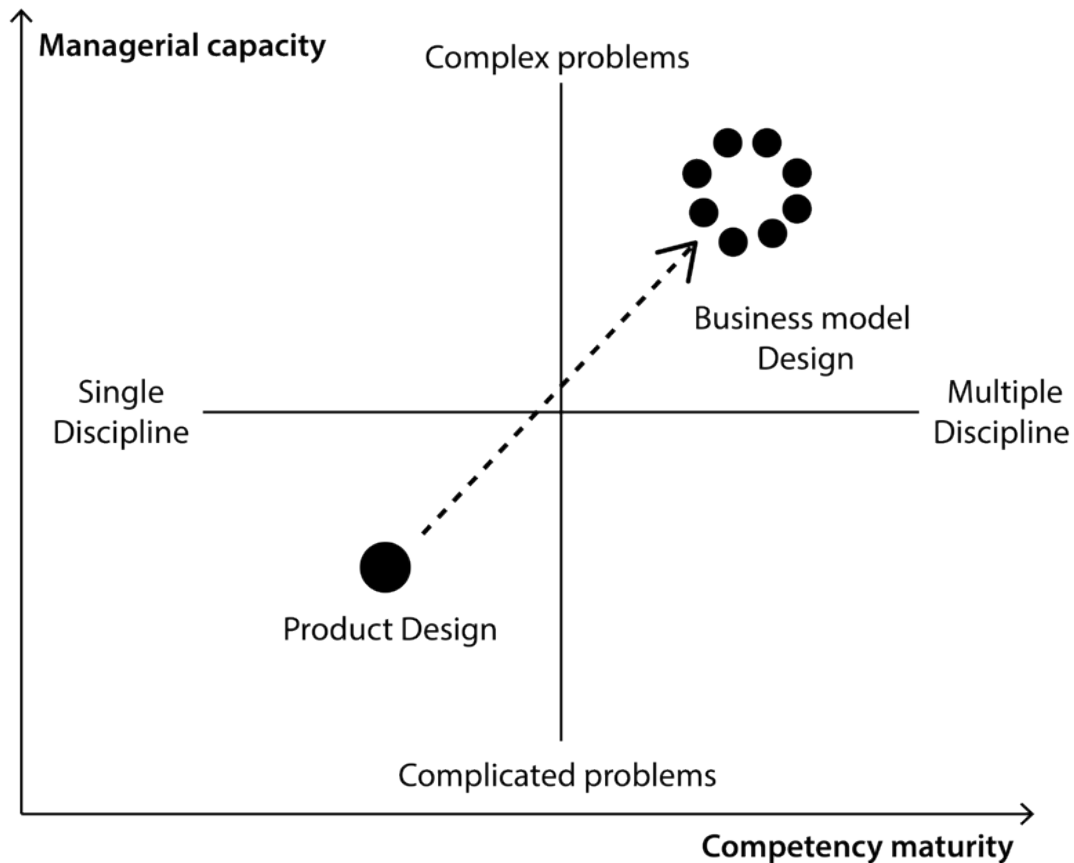


Figure 1.2: Changing role of the industrial designer (adapted from Gullberg et al., 2006)

1.5.5 Design entrepreneurship

Alongside the development of Design Thinking, there has been a new interest in entrepreneurship, not only from the business-orientated disciplines but also those of medicine, engineering and even arts (Gunes, 2012). According to Christensen (2005), design activity includes cognitive processes, such as problem solving and creativity, that share roles with entrepreneurs in two different domains, as explained by Owen (2007:17). Owen describes these two domains, saying there is “the finder who discovers through analysis and makers who synthesise”. These are both roles required by entrepreneurs and design thinkers.

The processes that are driven by Design Thinking can be compared to an entrepreneur synthesising the process for the construction of the business model and not only products. Consequently, Design Thinking does not limit itself, such as in the industrial design case, to the design of products and branding, but also involves designing the organisation. Thus an

important aspect that entrepreneurs also hold is using Design Thinking to translate their idea into something. This can be achieved by the advancement of creativity to be able to identify an opportunity that leads to new ventures. According to Von Korfleisch et al. (2013), creativity intersects both design and entrepreneurship. Gunes (2012) expresses the view that the industrial design profession is ultimately an entrepreneurial act.

Adams, Dally and Mann (2011) equally interpret the professional practice of a designer in a similar way: they see professionals as learners of the knowledge they gain from dealing with different situations. This emerges through acting as a 'form of practice' that develops their skills and will evolve qualitatively in different ways as a 'form of being'. In this way they map Design Thinking in the context of professional practice as the interconnected space of knowing, acting and being (Adams *et al.*, 2011), qualities that it shares with design entrepreneurship.

Industrial design entrepreneurship is often based on a single product or a single area of expertise that can be production-based. Rees and Wilson (2008) believe this more specialised or more single-minded approach can limit the product, service or organisation and is unlikely to deliver growth or sustainability. Fraser maintains that one way to address this is to expand Design Thinking across the organisation and throughout the business development process. Fraser believes this will open up new opportunities and evolve the business model to better seize market opportunities (Fraser, 2009).

1.5.6 New models for the design business

Typically, industrial design graduates tend to find themselves working for a corporation, working in a design consultancy, starting their own consultancy, selling their products to companies, and selling their own products (Siegel, 2012). There is a worldwide emergence of new business models, and a study by Cooper et al. (2011) identified 10 new business models for the design industry, in which industrial design plays a major/significant part. The study had focused on the UK and indicated that the emergence was very much dependent on the context. Some of these new models include design strategists, global design non-governmental organizations (NGOs), IP investors, Mega Design Corps, own brand entrepreneurs and small independents. Literature regarding the South African situation is under-developed and does not make a distinction between emerging business models in this industry. In South Africa, the design sector is driven by small business (Joffe, 2008). However, if we look at the context, it consists of small independents, who are regionally focused and personality led.

1.6 RESEARCH OBJECTIVES

The main objectives for this study are the following:

- Explore the meaning, perspectives and general concepts of Design Thinking in practice
- Describe the features of an Industrial design related business model
- Analyse and describe in what way Design Thinking and the business model are related

1.7 RESEARCH QUESTIONS

The overarching and sub-questions for this thesis are outlined in Table 1.2. The overarching research question results in an overview of what the thesis aims to answer. The sub-questions set the structure for the thesis, and this structure is outlined in the literature review, research methodology and the findings and data analysis chapters.

Table 1.2: Research questions

Overarching research question:	
<i>How does Design Thinking create, deliver and capture value for industrial design related business models in South Africa?</i>	
Sub-questions	
1	What are the different perspectives and conceptions of Design Thinking which practitioners in Cape Town embrace?
2	What are the features of business models in an applied context of industrial design?
3	How does Design Thinking give shape (applicable relationships) to industrial design related business models?

1.8 ASSUMPTIONS

Some of the underlying assumptions that were identified in the background literature are the following:

- Design Thinking is a key methodology to unlocking innovation; creativity and innovation are drivers of competitive advantage; in turn competitive advantage and innovation drive economic growth (CCDI, 2012)
- the design community has the potential of bringing differentiation (Borja de Mozota, 2007) into their value offering that can be a role model for other industries and business sectors
- the role of the designer has changed fundamentally (Ullmark, 2011).

These assumptions are based on developments in research that suggest that design already offers competitive advantage through differentiation; and even despite socio-economic influences, it still has the ability to do this. The changing role of the industrial designer is an indication that a design thinker adjusts to the economic conditions.

1.9 LIMITATIONS

This research project presents only one aspect of the bigger picture outlined in the above assumptions. The intention of developing references for the industrial design curriculum limits this study to describing relational measures between the application of Design Thinking and the industrial design business practice. The overarching question does not set out to understand the full potential that Design Thinking brings to industrial design entrepreneurship, but rather coincide with existing research and resource for the development of the curriculum in the industrial design praxis.

1.10 ADDRESSEES OF THIS STUDY

The addressees of this study are the following:

- Design Thinking practitioners

Because of the vast and disparate understanding of Design Thinking, this study aims to describe how practitioners in Cape Town utilise Design Thinking outside its normal boundaries.

- Design leadership

It aims to present a picture of the challenges and best practices in design entrepreneurship, highlighting aspects that are associated with a Design Thinking mind-set.

- Scholars and design education

It carries out empirical yet also interpretive research, which may result in further exploration or investigation for scholars and curriculum development.

- For those with a broader interest in Design Thinking

It represents an explorative view for design thinkers in practice.

1.11 INTRODUCTION TO THE RESEARCH DESIGN AND METHODOLOGY

1.11.1 Introduction

The function of a research design is to ensure that the evidence obtained enables us to answer the initial question as unambiguously as possible. This research aims to create a shared language that can describe and visualise how the application of Design Thinking shapes the business model in the applied context of industrial design. The following represents the research design type classification (Mouton, 2001) that best represents the study:

- the study is non-empirical in its nature; however, it does use empirically derived causal variables
- a qualitative methodology will inform an interpretivist approach
- both primary and secondary data are collected
- textual data are analysed, using qualitative content analysis methods
- there is a medium control of the design, due to the deductive and inductive approach
- the research aims to describe the phenomenon, rather than test or prescribe any particular type of business model influence by Design Thinking.

1.11.2 Descriptive research

A fundamental purpose of descriptive research is to add to our knowledge of the shape and nature of our society (Broadhurst *et al.*, 2012). In this case we are looking at how Design Thinking shapes the rationale behind business models in the context of industrial design. It

also looks at a more abstract reasoning of the behavior in the business and design management domains. By demonstrating the existence of relationships, competent descriptions can challenge assumptions about the way things are, and can provoke action. This takes us back to the problem area and objectives of understanding how we might equip students with entrepreneurial skills, how Design Thinking can be employed in designing business models and address aspects of the need to contribute to the little research that exists in this inter-disciplinary field of design education here in Cape Town, South Africa.

1.11.3 Probabilistic concepts of causation

The term 'probabilistic' means the increased chance that, if Design Thinking is employed effectively, it will translate into benefits for the company or will contribute to an innovative outcome. However, there could be factors, such as management competences (or age, education, personality, experience) that could otherwise affect the outcome (Broadhurst *et al.*, 2012). It goes with the comparable assumption that young adults are more likely to be equipped for the working world if they have gone through a tertiary level education system.

The complexity of human behaviour, and the subjective, meaningful and voluntary components of human behaviour, will mean that this study will not be able to arrive at non-causal statements. There will always be other subsequent factors that will have an impact on the ideal situation. For example, university graduates from different institutions are differently equipped when they graduate, based on both the internal and external influences of their education. This means that most causal thinking in the social sciences is probabilistic in its nature, which means it will never achieve deterministic explanations (Broadhurst *et al.*, 2012). Social sciences, therefore, work on the premises that any given factor increases, or decreases the probability. Broadhurst (2012:5) explains this clearly:

"People construct their social world and their creative aspects to human action but this freedom and agency will always be constrained by the structure within which people live."

Therefore, under these premises and the type of causalities that are bounding, such as if an entrepreneur is taught Design Thinking then they will achieve in business or if you apply Design Thinking then your business is likely to be more successful, we can state that this is a non-empirical study. It also means that the author does not have full control of the design, for these causalities also shifted throughout the process of the study. Refining the aims and

research design has been part of a learning and refining process, especially as the topic involves a focus on the social sciences, rather than the natural sciences.

1.11.4 Theory application in context

The primary question in this research project takes a conceptual application approach in the applied context of industrial design. The schematic in Figure 1.3 presents the deductive approach taken which frames a starting point to describe observations on an empirical level.

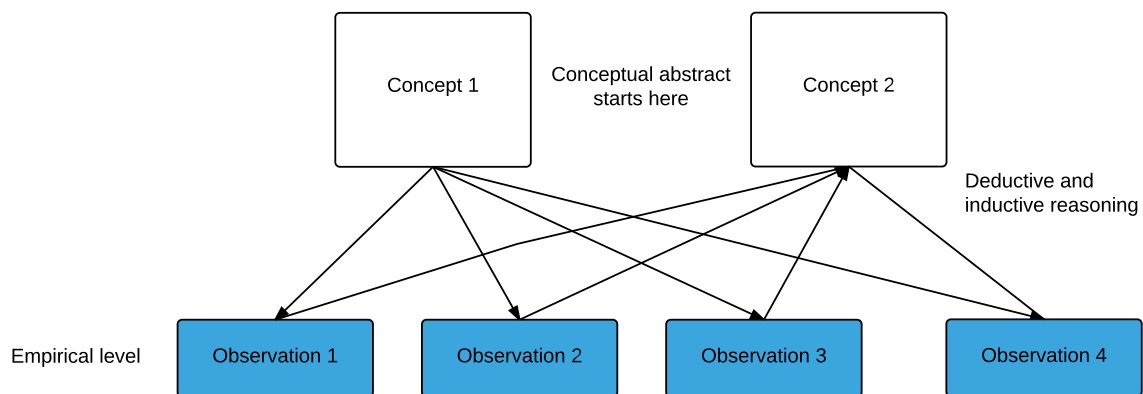


Figure 1.3: Deductive approach (adapted from Broadhurst *et al.*, 2012)

Generally, a theory-directed approach begins with a theory and uses theory to guide which observations are to be made. It moves from the general to the particular in the study context (Broadhurst *et al.*, 2012). Therefore, these observations should test the worth of the theory, requiring a deductive approach. A well-structured conceptual analysis makes conceptual categories clear, explicates theoretical linkages and reveals the conceptual implication of different viewpoints (Mouton, 2001).

This requires developing propositions so that, if the theory is true, then certain things should follow (Broadhurst *et al.*, 2012). Even though this research starts with a theory, we must also be aware that it induces data and connections; therefore, there are some categories that are emergent from the observations. Each question is based on a different approach in this case. The description will take an interpretivist stance - the way which the relationships identified are perceived and interpreted - that also shares characteristics with an inductive approach. Sub-question uses aspects of grounded analysis process to understand different perspectives of Design Thinking from open ended questions. Sub-question 2 describes, by deducing the conceptual framework and then compares these findings. Sub-question 3 deduces a rigorous concept, as a frame to guide interpretive categories. Therefore, the rules

(outlined in the literature review) are deduced to capture codes and categories. The emergent categories are then induced to understand the relationships between the two main concepts.

1.11.5 Interpretivist research strategy

The nature of this research enquiry and the purpose of this research are the origin of the topic, but my epistemological, ontological and research approaches provide the rationale for the adoption of a qualitative approach. This position is later covered in the case study motivations. However, since the research approach leans towards a deductive one and contains elements of an inductive approach to the generation of categories, Bryman and Bell (2011) argue that a qualitative strategy is suitable for an interpretivist and constructivist research regarding the epistemological and ontological orientations. The descriptive study then uses these conceptual lenses to find out what is happening in the applied context and the interpretivist approach applies to the causal relationships described based on the conceptual understanding.

1.12 STRUCTURE OF THE THESIS

The thesis is structured on the basis of a research process in the following way:

Chapter 1: Sets up the preliminary literature review and research design, while also combining the background, conceptual lenses and brief description of the research structure.

Chapter 2: The concepts are presented to build a conceptual framework which addresses the study aims. Representing what is already known on the topic and where this conceptual framework is built up from.

Chapter 3: The methodology used to conduct the research and fieldwork is formulated. In particular, the study will discuss the rationale for selecting the case study research methodology, as well as the qualitative methods of data collection and analysis.

Chapter 4: The context to which the case study design has been applied is discussed, and the practical application of Design Thinking within this frame. The findings are discussed in this chapter to bridge the gap between theory and practice. Furthermore, this chapter portrays an interpretation and representation of how Design Thinking shapes the business

model for the purpose of describing the relationships between Design Thinking and the business model.

Chapter 5: The interpretation of the results are represented and discussed in relation to the significance of the findings and their potential contributions. Furthermore, the scope for further research is proposed.

2 CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

The aim of this chapter is to discuss and demonstrate the extent of knowledge and literature in the field of Design Thinking, especially employed in business model development. It will discuss perspectives highlighted by prominent authors in the field and their critical evaluation of the concepts they have theorised. The chapter will present a novel synthesis of the existing works and their relationships by looking at new ways to present the subject and identifying gaps in the literature. Limitations, as well as contexts, of this study shall be commented upon and critiqued. This chapter sets up the conceptual framework in relation to the study area it would like to explore. Consequently, it does its best to bring rigour to the literature review and support for the methodology used in this study.

During the literature review, the following questions by Smith and Jackson (2008) were considered:

What is already known about the topic?

Has anyone else done anything identical to what is proposed here?

Has anyone done anything that is related?

Where does my work fit in with what has been done before?

Why is my research worth doing in the light of what has already been done?

2.1.1 Delineation of the references

The literature is arranged in three categories based on the conceptual framework introduced through the questions. Table 2.1 outlines the questions in different sections and presents the main authors who contribute to the conceptual framework of this study.

Table 2.1: Literature review sections and the key authors referenced

Sub- question	Sections	Key authors
What are the different perspectives and conceptions on Design Thinking which practitioners in Cape Town embrace?	Various Perspectives of Design Thinking	Simon, Lockwood, Plattner, Meinel, Leifer, Tschimmel, Brown
What are the features of business models in an applied context of industrial design?	The business model concept	Osterwalder & Pigneur, Morris, Zott & Amit
How does Design Thinking give shape (applicable relationships) to industrial design related business models?	Applying Design Thinking in business	Zott & Amit, Fraser, Osterwalder & Pigneur

2.1.2 Search and preparation for the literature review

The starting point of this study was to become familiar with the different channels of resources in order to access the right information on the topic. Several search engines became most relevant to accessing the right papers to inform the conceptual framework and the methodology. Table 5 presents the main search engines and databases.

Table 2.2: Search engines and databases used for the literature review

Search engines
EBSCOhost, Emerald, Google scholar, ProQuest, SA-ePublications, Sabinet, Sage Research Methods, Science Direct, Scopus, Springer link, Taylor & Francis

During the literature review process, and in order to find the most appropriate sources, it was best to become familiar with the journals and literature in the field. This was done through iterations and many cycles of using a wide range of terminology to find the most prominent and relevant literature. Table 2.3 gives some examples of search phrases used to find the relevant content that shapes the conceptual framework.

Table 2.3: Search phrases used to search for literature in the field of study

Search phrases
Business, Business Design, Business Model Design, Business Models, Business Processes, Creativity, Design Education, Design Science, Design Strategy, Design Thinking, Design Innovation, Design Management, Design Entrepreneurship, Industrial design, Product Design, New Product Development, Professional Practice, Product

In order to give some validity to the decision to take a deductive approach and to understand the cross-over of the primary references to the conceptual framework, Table 2.4 indicates the number of cites in relationship to the references from the concepts Design Thinking and the business model.

Table 2.4: References in terms of the conceptual framework

Journals and books	Number of Cites
Meinel, C. & Leifer, L. 2011. Design Thinking research (pp. 1-10). <i>Springer Berlin Heidelberg</i> .	29
Osterwalder, A., Pigneur, Y. & Tucci, C.L. 2005. Clarifying business models: Origins, present, and future of the concept. <i>Communications of the association for Information Systems</i> , 16(1), p.1	1815

The journal written by Osterwalder and Pigneur (2005) has been cited considerably more often than that of Meinel and Leifer (2011) as referenced in Table 2.4. After becoming familiar with the research, it seemed to me that there are more research projects associated with business related topics than of Design Thinking. The book “Business Model Generation” (2010) also by Osterwalder and Pigneur (2005) has contributed to awareness of the business model concept. This is also because of the books interdisciplinary nature. The d-school concept established in the “Design Thinking Research” book is part of a series of books published through the Springer publishing company. Therefore, it has a reputable position in academia, with reference to research institutes such as Stanford University and the Hasso-Plattner-Institute of design in Postdam, Germany.

2.2 CONCEPTUAL FRAMEWORK AND DEMARCATING THE LITERATURE

2.2.1 Demarcating the literature

An important aspect to consider when starting an interdisciplinary study like this is to structure the literature review in a way in which it aims to inform the field of study. Therefore, the literature review is structured in the following way:

- The evolution of Design Thinking
- The design theory
- The d-school Design Thinking rules

- The application and diffusion of Design Thinking

First the concept of Design Thinking is explored and determined. In doing so the evolution of Design Thinking is discussed and the concept is informed using various authors perspectives. Secondly, the section on the concept of business models is explored and it is structured in the following way:

- The definition of the business model
- The business model canvas

These outline the premises for describing a business, built up from a set of interdependencies that make up a generic value chain which leads to running a successful business. Lastly, the literature review looks at the application of Design Thinking and how it is related to the business models. This section is structured in the following way:

- The rise of Design Thinking
- Business model design
- Designing new business models for success

Not all the concepts discussed are used in the conceptual framework of this study; rather they serve as reference points to justify aspects of the findings and build a picture of what others have been exploring in this field

2.2.2 Introducing the conceptual framework

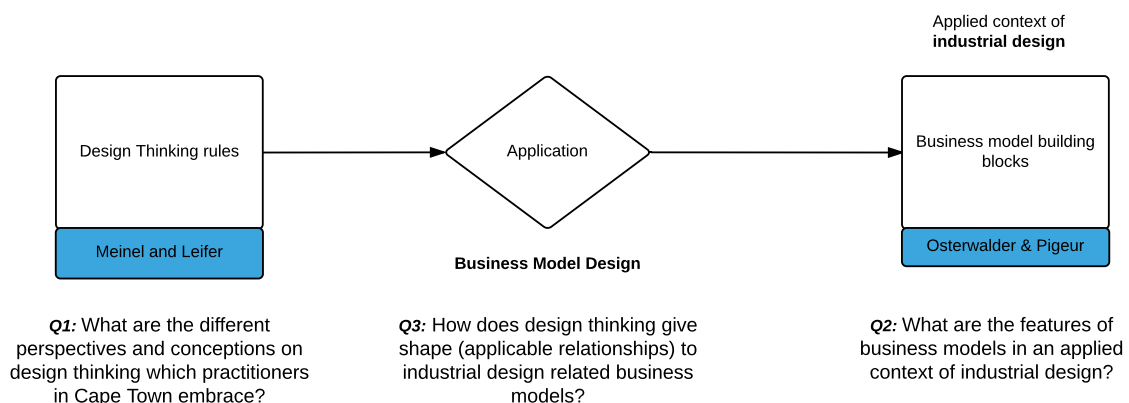


Figure 2.1: Conceptual framework (Authors construct)

The conceptual framework in Figure 2.1 outlines the two concepts that are used in this inductive and deductive research design. It is based on two concepts, of which one concept was developed by the d-school and the other developed by Osterwalder and Pigneur with their knowledge of the business model.

2.2.3 Rigour behind the Design Thinking concept

The Design Thinking concept developed by Meinel & Leifer (2011) was chosen for its global rules and the encompassing interpretation of the concept. The research was carried out by the Hasso-Plattner-Institute Stanford Design Program that offers graduates a degree in Design Thinking and is well respected for its contribution to the development of Design Thinking research on an international basis, having published various academic books on Design Thinking. The books have been published by Springer, a research database providing scientific and professional communities with superior specialist information.

The main authors behind the concept, are Meinel and Leifer of the Hasso-Plattner-Institute (HPI) and Leifer from the Centre for Design Research (CDR). The research partners formed the HPI-Stanford Design Thinking Research program, which started in 2008. The Hasso-Plattner-Institute encourages rigorous research aimed at a scientific understanding for why innovation through Design Thinking is important. The first Design Thinking programs, commonly known as d-schools, are offered at Stanford University in Palo Alto, California, and at the Hasso-Plattner-Institute in Postdam, Germany. This year, 2016, the d-school has started a cooperation with the UCT Graduate School of Business (GSB), and is operating a pilot programme as of 2016.

2.2.4 Rigour behind the business model concept

Osterwalder and Pigneur's (2005) concept of the 'business model building blocks' is positioned as the dependent concept used in this study, for which Osterwalder received his Ph.D. degree in 2004. The concept of the business model building blocks focuses on the ontology of the business model. This was later developed into a book called "Business Model Generation " (2010), which sold over a million copies worldwide.

2.3 VARIOUS PERSPECTIVES OF DESIGN THINKING

2.3.1 The evolution of Design Thinking

Design Thinking has been part of our consciousness and it has been used as a term in theory, concept and practice contexts since it first appeared in the title of a book by Rowe in 1987 (Dorst, 2011), called Design Thinking. Researchers started to explore the design methodology, viewed from a Design Thinking perspective, in 1992 (Dorst, 2011). Since then multiple models of Design Thinking have emerged, based on the different ways in which one can perceive a Design Thinking situation. This is broadly stated in the following observation:

‘Together, these streams of research create a rich and varied understanding of a very complex human reality’ (Dorst, 2011: 252).

Presently, Design Thinking (Schmiedgen *et al.*, 2015) is understood as a way of thinking which leads to transformation, evolution and innovation. It is a new way of living and working, especially the way in which we manage our businesses (Tschimmel, 2012). Two decades before becoming popular with regard to innovation, the concept was being studied solely as a cognitive process (Tschimmel, 2012). At the time the research was more intended to understand attributes of design creativity, to improve Design Thinking abilities in the individual and collective design processes in education and practice (Tschimmel, 2012). Creativity at this point was seen as being of major importance to Design Thinking (Owen, 2006). It has also been known to complement scientific reasoning and encompasses some of distinct qualities of decision makers (Owen, 2006).

More recently, the concept of Design Thinking has been intersecting with and not limited to the academic lines and disciplines it has always been associated with. Two authors who have contributed to the movement, reconfiguration and different perspectives on Design Thinking, are Brown with his book “Change by Design: How Design Thinking Transforms Organisations and Inspires Innovation (2009)” and Martin with his book “The Design of Business: Why Design Thinking Is The Next Competitive Advantage (2009)”. Even more so now than before, Design Thinking has become more established as a paradigm for dealing with problems in some very complex human realities. The notion of adopting these design practices in other fields has created a demand for definite knowledge about Design Thinking (Tschimmel, 2012). Consequently, researchers have sought to define and delineate Design

Thinking, in areas such as its definite principles and methods. However, because Design Thinking has a subjective interpretation, the research community value the multiple perspectives that can be interpreted when the methodology is applied in different contexts.

2.3.2 The design theory

Simon (1996:11) described design as a 'course of actions aimed at changing existing situations into preferred ones'. Nevertheless, there are several interpretations of design. It is, however, important that a few concepts are clarified to portray the context of industrial design. In a journal of engineering and technology, design is described in broad terms as encompassing both the object and the design process underlying the creative activity which results in such objects (Valencia *et al.*, 2013:365). Therefore, the result of a design process is either a product or an object that is designed in a course of actions. This process is ultimately a methodology and, in principle, 'Design Thinking' (as put in capitals). As stated by Adams *et al.* (2011:598), 'the idea of Design Thinking has typically represented what designers understand about design and how they go about the act of designing based on this understanding'. Johansson *et al.* (2011) also describe the process of design as 'designerly' thinking, later discussed in the discourses of design (Johansson-Sköldberg *et al.*, 2011).

Traditionally, designing has relied on a designer's capacity to consider all at the same time: human needs, available material and technical resources, as well as the constraints and opportunities of a project (Tschimmel, 2012). This explanation demands that designers have the ability to be analytical, empathetic, rational, emotional, methodological and intuitive. Some authors see this ability and nature of thinking as abductive (Tschimmel, 2012; Dorst, 2011). Abduction is explained by Magnani (2005) as a process of reasoning that only generates "plausible hypotheses" (selective or creative), it is also understood according to Magnani (2005:2) as an "inference to the best explanation". Therefore, design is known to be both practical and interpretive in its nature bringing us back to its constituent parts of the process that are both objective and subjective.

2.3.3 The Design Thinking rules

The Design Thinking rules that are at the core of this conceptual framework are validated by the compelling evidence that Design Thinking activities have long been important. Meinel and Leifer co-authors of the book "Design Thinking Research" (2011) have emphasised the

on-going need to understand Design Thinking when applied in various contexts. The following comment introduces some of these concepts:

‘The most global truth lies in the fact that every single physical product delivers a service, that every service is manifested through physical products, and without an insightful enterprise strategy, it matters little that one has products or services’
(Meinel & Leifer, 2011:xiv)

This provides the frame for the study and its main questions in that the study aims to generate a description of Design Thinking when applied to the context of the industrial design business practice. The rules developed by the Meinel and Leifer (2011) are the human, ambiguity, re-design and tangibility rules. In the following section each rule is introduced by an explanation and a comparative literature analysis.

2.3.3.1 The human rule: all design activity is ultimately social in nature

The human rule regarding Design Thinking is discussed by most researchers, because Design Thinking is acknowledged for creating an end-user focus, with a relation to multidisciplinary, collaborative and iterative improvement (Meinel & Leifer, 2011). Design Thinking is also described as a powerful tool for achieving desirable, user-friendly and economically viable solutions. All of these terms (end-user, multidisciplinary, collaborative, desirable, user-friendly, economic) have human elements. The statement below explains this thoroughly in terms of the human rule:

‘There are studies that substantiate the assertion that successful innovation through Design Thinking activities will always bring us back to the “human centric point of view”. This is the imperative to solving technical problems in ways that satisfy human needs and acknowledge the human element in all technologists and managers’ (Meinel & Leifer, 2011: xv).

In disciplines, such as industrial design, graphic design and architecture, which are all part of the greater design discipline, the core activities are guided by the users’ needs, in relation to a product, service and even the brand reflects their needs in the output of the design process. Therefore, designers always focus on the ‘human-centric point of view’ (Johansson

et al., 2011). Design Thinking is also seen as a human-centric methodology that integrates expertise from design, the social sciences, engineering and business (Cerejo *et al.*, 2012). Here it suggests that the main focal point is human-centric, which encompasses related themes such as creativity, human behavior, technology and economics. This suggests that there should be no dividing line between design and the business functions. The human factor on which designers have always focused, is also core to how business functions on all operational levels. Another perspective is that creativity thrives where ideas and knowledge collide (Lyons, 2005). This statement suggests that the key to innovation is the appropriate intersection between disciplines, teamwork and knowledge that individuals have to contribute to the product/service development, for example.

2.3.3.2 The ambiguity rule: design thinkers must preserve ambiguity

The ambiguity rule is another core higher order rule for Design Thinking in its broad application. It captures a feature of Design Thinking that most literature seems to find difficult to define how designers go about dealing with uncertainty and processes, such as idea generation. The following statement by the HPI-Stanford Design Thinking program illustrates its understanding of this rule:

‘There is no “chance discovery” if the box is closed tightly, the constraints enumerated excessively, and the fear of failure is always at hand. Innovation demands experimentation and the limits of knowledge, at the limits of our ability to control events, and with freedom to see things differently’ (Meinel & Leifer, 2011:xv).

The discovery stages are one of the most critical stages and makes the best use of a designer’s knowledge and skills. It also refers to the ‘fuzzy front end’ and is critical to defining the nature of the problem being addressed through design (Koen *et al.*, 1996). It also refers to the stages of New Product Development (NPD). There is an increased level of ambiguity at this point and the process is largely unstructured (Design Council, 2007). Managing uncertainty is one of the main challenges that design entrepreneurs face today (Kirkland *et al.*, 1997). Lyons (2005) sees the benefits in Design Thinking when he states that, if one can imagine the result at the outset of the design process, then the results will probably not be much of an innovation. The key message here is that uncertainty is necessary and bound to come at the start of any process. If the process starts with a fixed

target, in essence it will mean that it will be less likely that the outcome will be an innovation. Lyons (2005) further elaborates that if the process should be liquid, ambiguous; one would encounter more interesting results this way. This implies that disciplines that apply Design Thinking in their rigid work processes will have challenges implementing it effectively, because it requires a flexible and less restraint approach. The guiding principle, is that fixed targets should be managed in certain ways, and Design Thinking achieves this through various methods and iterative development.

2.3.3.3 The re-design rule: all design is re-design

The redesign rule is at the core of creativity, a long-standing nature of design and the creative industries. Design thinking, in a general definition, is an analytical and creative process that engages a person in opportunities, to experiment, create and prototype models, gather feedback and redesign (Razzouk *et al.*, 2012). This concept is clearly expressed in the statement below:

'The human needs that we seek to satisfy have been with us for millennia. Through time and evolution there have been many successful solutions to these problems. Because technology and social circumstances change constantly, it is imperative to understand how these needs have been addressed in the past. Then we can apply "foresight tools and methods" to better estimate social and technical conditions we will encounter 5, 10, or even 20 years in the future' (Meinel & Leifer, 2012:xv).

Industrial design, as it was explained in the first chapter, creates and develops concepts for clients. In order to do this, foresight tools and methods are applied to achieve an outcome that is unique and custom-made for the client or user's needs. However, industrial design also has to take into account ergonomics and economic principles to reach a larger customer segment. Testing, building and experimenting aid the process at many levels, generating various results and avoiding failure based on the specific requirements (Lyons, 2005). Involving change in the product development process, rather than having the perfect launch, means the company can get feedback before any large investment has been made.

2.3.3.4 The tangibility rule: making ideas tangible always facilitates communication

Tangibility is not a term shy of industrial design; it is when one engages with the application of Design Thinking in a context that is not product orientated that the literature becomes vague. However, in a simplified manner the tangibility rule relies on communication and also relates to something that is more 'hands-on' and involves doing, as expressed by Meinel & Leifer (2011).

'Curiously, this is one of our most recent findings. While conceptual prototyping has been a central activity in Design Thinking during the entire period of our research, it is only in the past few years that we have come to realise that "prototypes are communication media." Seen as media, we now have insights regarding their bandwidth, granularity, time constants, and context dependencies' (Meinel & Leifer, 2011: xiv).

A major element of the tangibility rule is to create a common understanding. In the attempts to start with the abstract and move to the concrete, visualisation proved to be most helpful (Lyons, 2005). It also seems to share a relationship with the re-design rule by assisting with its ability to deal with change through certain measures that are created objectively.

2.4 THE BUSINESS MODEL CONCEPT

2.4.1 The definition of the business model

A business model can be referred to as an architecture, design, pattern, plan, method and statement (Morris *et al.*, 2005). Morris *et al.* (2005:727) describe the concept in following the statement:

'A business model is a concise representation of how the interrelated set of decision variables in the area of venture strategy, architecture, and economics are addressed to create sustainable competitive advantage'.

A business model is also described as a related number of managerial activities that capture the components of the business plan. Osterwalder *et al.* (2010:4), prominent figures in business model research and literature, explain the definition of a business model in the following statement:

'The rationale of how organisations create, deliver and capture value'

Osterwalder and Pigneur (2005) looked at clarifying business models from a range of understandings and perspectives, and by creating premises and an ontology used to describe the business model. The literature examines business models by considering the theory of their origins, as well as the present and future of their concepts. Their work is presented as an abstract overarching concept that describes the world of business (Osterwalder, Pigneur, & Tucci, 2005). However, each business type has its own instance. Authors writing about business models, present aspects of how they conceive and conceptualise a particular business model logic shared across the world.

To understand the nature of business models, Morris (2005) portrays a business model as not being a strategy. However, it has elements of strategy. Similarly, it is not an activity set, although it is supported by a set of activities that are elements of the model. Therefore, a business model can also be seen as an object that is built up of interdependencies (Morris *et al.*, 2005), developed from a process of design elements, and all elements depend on the business model design that consists of a value chain (Osterwalder *et al.*, 2010, p. 244) similar to that of the Design Thinking process. Zott and Amit (2010:220) see a business model as depicting 'the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities', which is further discussed in business model design.

2.4.2 The business model canvas

The business model canvas is made up of constituent parts. Figure 2.2 gives a visual interpretation of the business model and essential building blocks. These building blocks are the following:

- The value proposition
- Customer segments
- Channels
- Customer relationships
- Key resources
- Key activities
- Key partners

- The cost structure
- Revenue streams

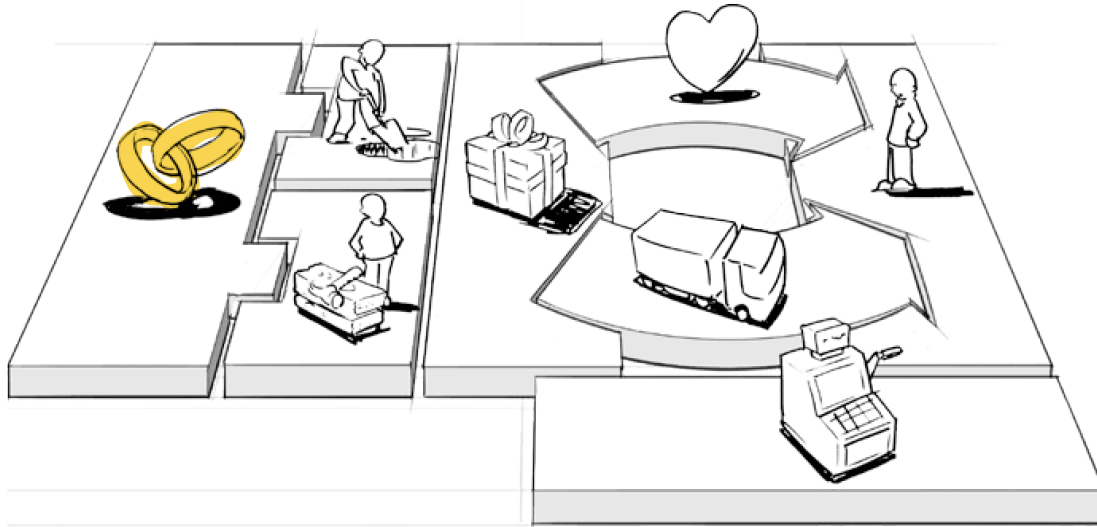


Figure 2.2: Conceptual image of the business model building blocks (Osterwalder & Pigneur, 2010)

The following paragraphs explain in detail the nine building blocks of the business model canvas developed by Osterwalder and Pigneur (2010) and also reference literature in comparison.

2.4.2.1 The value proposition

As Osterwalder and Pigneur (2005:10) see it, the value proposition is meant to “give the overall view of the companies bundle of products and services”. A more scientific stance would describe value propositions as coordinating and motivating resource access across service system entities (Maglio & Spohrer, 2013). Various authors see the value proposition as the main objective in helping the customer ‘get the job done’ (Osterwalder *et al.*, 2005; Zott *et al.*, 2010; Burnette, 2011). Thus a strong value proposition either satisfies a customer’s need or a customer’s problem.

2.4.2.2 Customer segments

The term describes the segments of customers whom a company wants to offer value (Osterwalder *et al.*, 2005). It is the customers or clients for whom the company aims to

create value. These groups may have different behaviors or needs, and they are not necessarily the end user. The customer segment is best described as the company's group of customers with distinct characteristics (Weeks *et al.*, 2010), in which it generates revenue from.

2.4.2.3 Channels

Channels are the different means which a company will use in order to get in touch with its customers (Osterwalder *et al.*, 2005). The activities of communication, distribution and sales create an interface to connect with the customer or client directly. From a business model design perspective it is seen as architecture for product/service/information flows, scope and value, and logistical streams (Im & Cho, 2013). Opportunities for design in the customer interface are: making the customers aware of the value proposition, allowing customers to evaluate the proposition, allowing the customer to purchase the offering and, finally, the support and delivery of the offering.

2.4.2.4 Customer relationships

The customer relationships play a key supporting role in relation to the channels and customer segments; it is the consistent relationship which the company establishes with its customers. Osterwalder and Pigneur (2005) describe it as the kind of links which a company establishes between itself and its different customer segments. Customer relationships are very diverse and can be used to acquire new customers, retain existing customers, or boost sales.

2.4.2.5 Key resources

This component of the business model building blocks is the most important, because without resources the business will not grow. The resources, support all the other components of the business model by creating and offering a value proposition, reaching markets, and maintaining relationships with customer segments (Osterwalder & Pigneur, 2010). To name a few resources: it could be physical or IP related resources, as well as human resources that contribute through either specialisation or labour force. In essence, the resource component of the business model building blocks are very broad. However, there are definite resources such as human resources that particular business models may rely on, for example business models in the creative industries are generally knowledge intensive (Osterwalder & Pigneur, 2010).

2.4.2.6 Key activities

These are the most important actions taken in order to 'get the job done' (Osterwalder & Pigneur, 2010). Activities vary, depending on the business model. Clearly there will be a differentiation between a manufacturing and a business services company: the one may be heavily involved in assets and labour, and the other may be heavily involved in research and management. In the case of, for instance, a private banking model which Osterwalder and Pigneur (2010) propose in their book "Business Model Generation", key activities are to advise, product/service R&D, marketing and platform management. On the other hand, LEGO, the toy company, has a new business model type that provides customer-design kits: the key activities involve managing the platform, logistics, packaging and delivery, in addition to the product specific activities such as design and manufacturing.

2.4.2.7 Key partnerships

If we continue with the LEGO case that is presented in Osterwalder & Pigneur (2010), we see that the partners in the customer-designed kits are the customers who build the new Lego designs and post them online. They are, therefore, key partners in generating content and value to the overall business model. Key partners also represent the network of suppliers and partners that an enterprise uses to make its business model function. Generally, enterprises create partnerships to optimise and create economies of scale, reduce risk or uncertainty, or acquire resources and activities (Osterwalder & Pigneur, 2009).

2.4.2.8 The cost structure

Although the scope of this thesis will not go into too much detail in the cost structure, it is still important to understand the associated costs involved in building a business in order to render a functional business model. All the business model building blocks involve particular costs. One core distinction in the cost structure is whether the business model is cost-driven or value-driven (Osterwalder & Pigneur, 2010) that all business models fall between. Value-driven companies are less concerned with the costs and focus on personalised services and high quality products. Cost-driven companies focus on minimising cost at all costs. The two distinctions have the following characteristics: fixed costs, variable costs, economies of scale and economies of scope.

2.4.2.9 Revenue streams

Every business needs revenue in order to survive, whether directly or indirectly. The author, Gordijn (2002) sees it as the value exchange - in a sense, the exchange of inputs and outputs that brings returns. The source of this revenue may vary significantly and can be described as the revenue streams and ways a company makes money through a variety of revenue flows (Osterwalder and Pigneur, 2005). There are several ways to generate revenue streams: Selling ownerships rights to a physical product (asset sale), payment for the use of a particular service (usage fee), selling a continual access to a service (subscription fee), granting someone exclusive rights to the use of an asset for a fixed period in return for a fee (lending/leasing/renting) and giving customer the permission to use protected intellectual property for in exchange for a fee (licensing).

2.4.2.10 Business model canvas layout

The business model canvas depicts a meta-model for the world of business. The template in Figure 2.3 will be used as a tool for description in the methodology. These categories contain further sub-variables or categories that help distinguish one business model type from another. Some of the main categories and sub-categories are stipulated in the methodology chapter of this study.

The Business Model Canvas

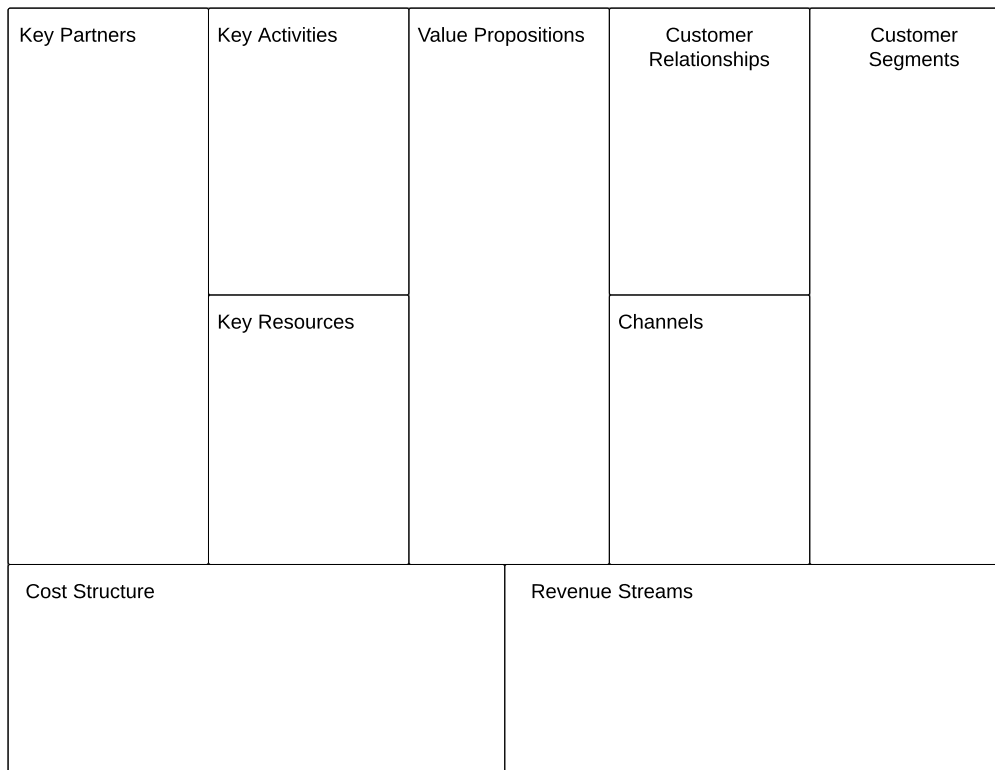


Figure 2.3: The business model canvas (Adapted from Osterwalder & Pigneur, 2010)

2.5 THE APPLICATION OF DESIGN THINKING IN BUSINESS

2.5.1 The rise of Design Thinking

There has been some debate around the idea of designers becoming involved at a very early stage of the formation of an organisation's strategy or business design, and that their ability to solve problems is a much needed one (Cooper *et. al*, 2011). Companies, such as IDEO, a leading Design Thinking consulting firm, who are globally renown, have been leading the way in terms of focusing on the business model design. IDEO indicated that only 15% of their time is spent on this type of activity (Brown, 2008). Design Thinking and designing beyond the artefact is becoming less exclusive and Cooper *et al.* (2011) believe that this will develop into an alternative scope for the design sector: designers will become more involved in these business design activities.

In the last decade, the question has been asked regarding what processes designers go through when creating a product, service or even an enterprise (Meinel & Leifer, 2012).

Organisations, such as the Hasso-Plattner-Institute, have dedicated research to building an insight into new tools, activities and values in their Design Thinking research programme. Design Thinking is being framed as an iterative series of major stages (define problem, understanding, brainstorm, prototype, test) that integrates both human, business and technological factors. Figure 2.4 simulates a generic Design Thinking process developed by the d-school.

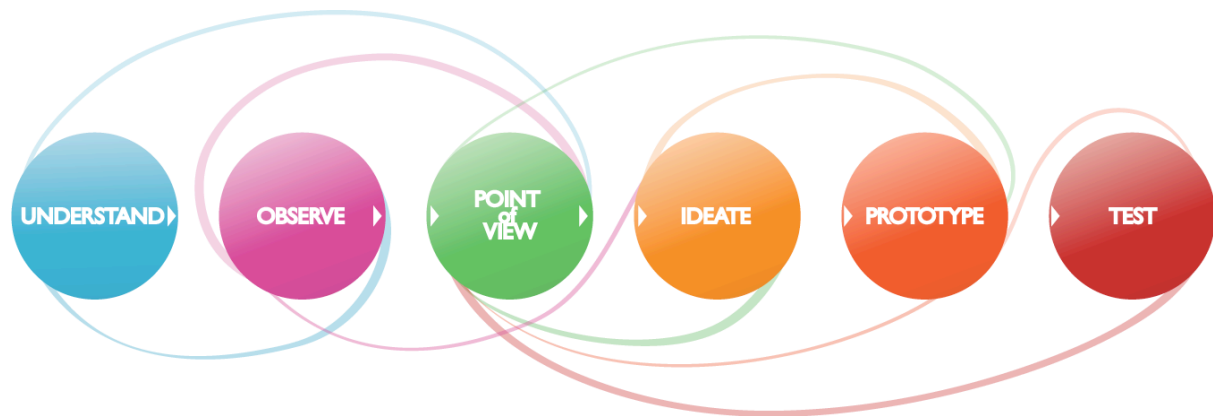


Figure 2.4: Design Thinking model of Hasso Plattner institute (Tschimmel, 2012)(Meinel & Leifer, 2011)

As explained by Meinel and Leifer (2012), ‘Design Thinking is about the creation of, as well as the adaptive use of, a body of behaviours and values’ (Meinel, & Leifer, 2012). Another prominent figure in Design Thinking research is the president of the Design Management Institute, Lockwood, the author of the book “Design Thinking”, who implies that Design Thinking is integrative thinking that requires both right and left brain thinking, similar to a concept which Martin (2009) explains in his book “The Design of Business”. He believes that learning and discovery are a process of moving through a ‘knowledge funnel’, and people need creative thinking at different points of the funnel. Lockwood, furthermore, describes Design Thinking in his book in the following statement:

‘essentially a human-centred innovation process that emphasizes observation, fast learning, visualization of ideas, rapid prototyping, and concurrent business analysis, which ultimately influences innovation and business strategy’ (Lockwood, 2010, p. 20).

All the authors I have just referenced contributed to the rise of Design Thinking, who speak of the concept as a link between design and business.

2.5.2 Business model design

From the literature covered, it appears that there is an abundance of literature on business models, and only a few studies have focused on the business model design process. The process is described by Zott and Amit (2010:218) as the

'purposeful weaving together of interdependent activities performed by the firm itself or by its suppliers, partners, and/or customers- is the essence of the business model design'.

In the decision-making activities, the design of the business model is up to the entrepreneur who creates the new enterprise. The interdependencies are created or allocated by the entrepreneur who then shapes and designs the organisational activities (Zott & Amit, 2010). The main objective is to maximise the business opportunity in the way it is designed by creating value for the parties involved. The latter are all dependant on the parameters that capture the purposefulness of the business model (Zott & Amit, 2010).

The business model design is described as an activity systems framework that is broken down into design elements and design themes (Zott & Amit, 2010). The design elements that have been previously referenced in the definition of the business model (2.4.1) are characterised as 'content', 'structure' and 'governance'. The content consists of what activities should be performed. Structure is defined by how these activities are linked and sequenced. Most importantly, the governance performs these actions or actions within activities (Zott & Amit, 2010). These activity systems can also be described as design themes in the value creation. They can be applied to components within the business domain, such as people, organisation and technology (Peppers, et al., 2012).

The business model design themes highlighted by Zott and Amit (2010) include 'novelty' and how the designer adopts innovative content, structure or governance. The 'lock-in' theme relates to the principle of retaining business model stakeholders, for example, the customers. The 'complementary' theme relates to bundling activities, or, in the industrial design context, could relate to generating complementary products (Ulrich *et al.*, 2008) or complimentary team structures (Cross, 2011). In effect, the 'efficiency' theme is created by reorganising these activities and interdependencies to reduce transaction costs (Zott & Amit,

2010). Each of these four sets of examples shows how a firm’s business model is shaped according to an overriding design theme. In many cases this results in models that are significantly different from their original designs and have created new value.

In relation to the themes described by Zott and Amit (2010), Osterwalder and Pigneur (2010) observe that there are a number of tools and techniques that can help design effective business models. As discussed previously, Simon (1996) described the designer’s aim as generating new options and creating what does not yet exist. The authors feel that the tools, methods and the problem solving attributes that designers have constitute pre-requisites for success. The tools and techniques Osterwalder and Pigneur (2010) suggest are similar to those involved in the concept of Design Thinking as described by Lockwood (2010). These are customer insights, ideation, visual thinking, prototyping, storytelling and scenarios (Osterwalder & Pigneur, 2010:126). Figure 2.5 demonstrates the stages and a “context” at which these tools are most appropriate to apply and when the entrepreneur defines and design a business model that responds to the market circumstances. The first stage is to design the business model followed by the finance business model and the implementation of the model. In the same instance the designer needs to respond to the market circumstances through his social and user-centred attributes (Wormald, 2010). This reinforces the concept of the application of Design Thinking not being limited to a product or graphic design, for example, but any context or environment that can be changed or even just manipulated in some way or another.

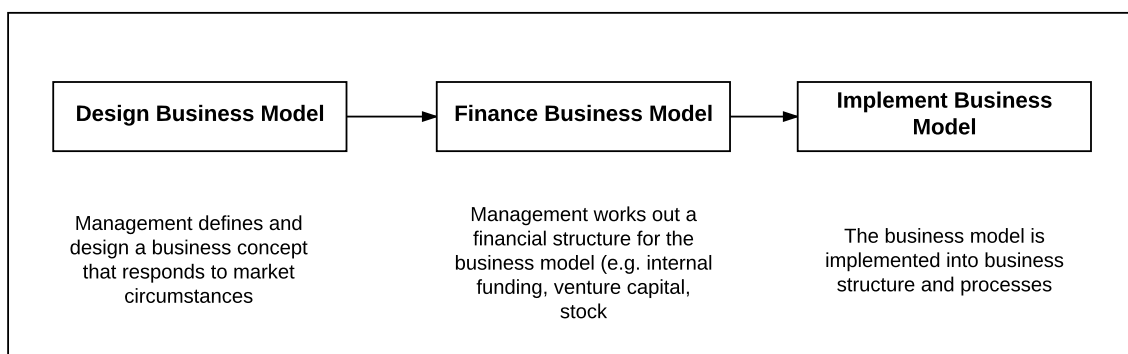


Figure 2.5: Stages of business design (Osterwalder & Pigneur, 2005)

2.5.3 Designing new models for success

Understanding a business model is the first step to designing completely new ones. As discussed in this chapter, there has been the expansion of the design field beyond just the design of objects to the design of services, systems and even the business model itself. The

view of using design processes and methodologies in the context of business model design lies at the intersection between Design Thinking and business models, a prominent theme that comes through in the literature. Many thought leaders in the design and business domains encourage this expansion of the design field (Burnette, 2011; Wyatt, 2010; Martin, 2009). Traditionally, design was considered to be separate to business (Fraser, 2009), a reason being that industrial design, for example, would be outsourced as a corporate tool to develop a company's products (Ulrich *et al.*, 2008). It is not independent to the product development anymore. Product development was usually left to the managers of the company and industrial design was used as a specialisation in the product design process (Ulrich *et al.*, 2008). This was generally the case still in larger corporates. However, this distinction has become less pronounced in SME's that are Industrial design related. Today Design Thinking is seen more as a methodology (refer to Figure 2.3) that, we recall, can be applied in various contexts. However, as Zott and Amit (2010) observe, this is a very broad view of business model design and it depends on the way it is governed. Those who govern it, the designers or by business terms the director, respond to the market circumstances by the way they structure the content.

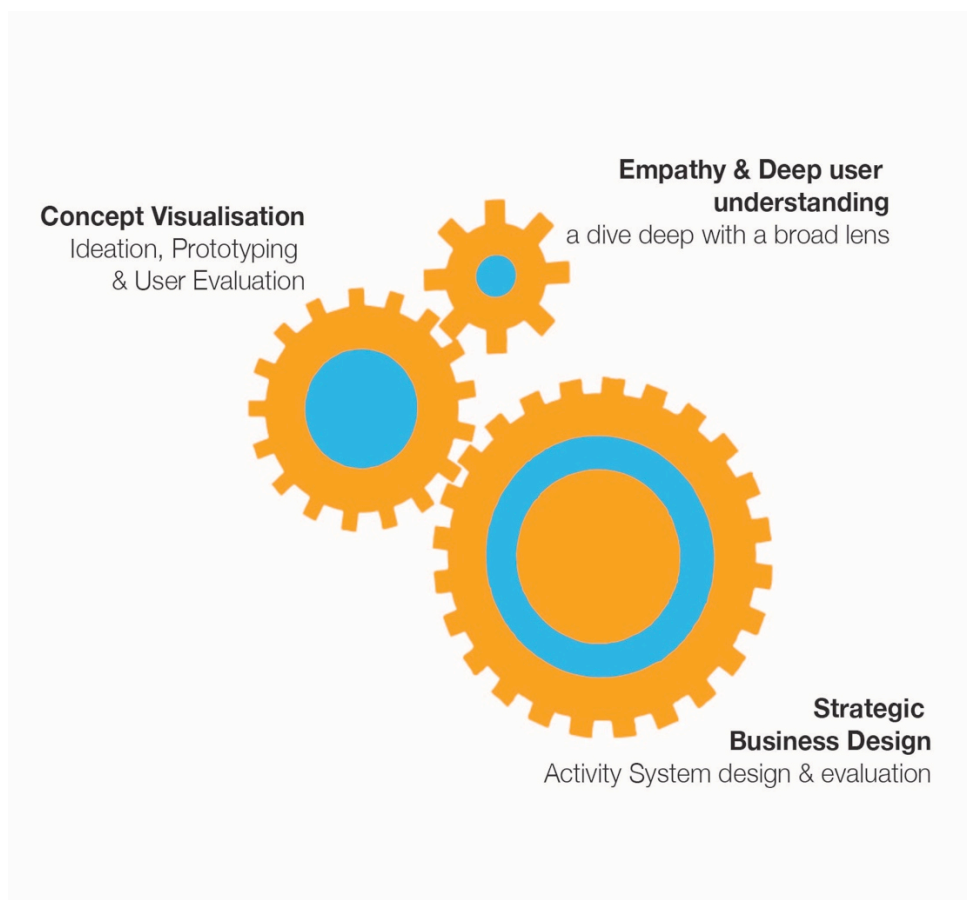


Figure 2.6: Designing business, new models for success (Fraser, 2010)

Figure 2.6 illustrates a methodology for business design that is more Design Thinking driven, a concept Frazer (2009) developed. Fraser maintains that the biggest pay-out of Design Thinking is in the design of the business model itself. Fraser suggests that, by expanding Design Thinking across the organisation, it can open itself up to new opportunities, set dramatic growth strategies and evolve its business model to better seize markets and opportunities.

Fraser (2009) proposes a methodology called the 'three gears of business design' (Figure 2.5). According to Fraser, it is not in any way a linear process; this methodology includes three primary gears 'empathy and deep user understanding', 'concept visualisation' and 'strategic business design'. This concept shares similarities in the way authors Meinel and Leifer (2012) have described the Design Thinking rules. Frasers concept portrays a primary focus on the human rule at the core, but not limited to. The human rule is key to understanding and delivering value the customer, it is the core of where a business models value proposition is derived. The gears concept visualisation and strategic business design share traits with the way the authors Plattner *et al.*, (2012) describe the re-design and ambiguity rules. The gear concept visualisation, refers to envisioning new possibilities. It shares traits of how the re-design rule is portrayed, to address what been done in the past and to apply design methods to estimate what could be encountered or is possible for the future (Meinel & Leifer., 2012). The gear strategic business design, looks at the overall business model itself as the design of the interrelated activities that add up to a commercial gain and the competitive advantage the business aims to achieve (Fraser, 2009). If ambiguity is preserved on all accounts of the strategic business design, it nurtures innovation and "chance discovery" to withstand this competitive advantage (Plattner *et al.*, 2012).

The strategic business design calls for an intrinsic and stringent application of all the Design Thinking rules, if design were to be effectively embedded across the organisation or business model. This is re-affirmed in the statement, whereby Meinel and Leifer (2012) states '...that every service is manifested through physical products, and without an insightful enterprise strategy, it matters little that one has products or services'.

Osterwalder and Pigneur in their book "Business Model Generation", describe the tools and methods that can help design better and more innovative business models. The authors state that a designer's job is to extend the boundaries of thought, to generate new options and ultimately create value for users' (2010:125). This statement is broad in describing

design in general, but it also echoes Simon's (1996:111) explanation of design as being 'a course of actions aimed at changing existing situations into preferred ones'. Osterwalder and Pigneur (2005) in a journal article entitled, "Clarifying Business Models: Origins, Present and Future Of The Concept ", describe value configuration as the arrangement of activities and resources. In a sense, this resembles characteristics of design and they maintain that business people are designing unknowingly every day. Applying methodologies that lead to the design of organisations, strategies, business models, processes and projects (Osterwalder & Pigneur, 2010).

2.6 TO CONCLUDE THE LITERATURE REVIEW

This chapter demonstrates the extent of literature in the field and also describes the authors' perspectives. In the approach of this study, the aim was to critique the literature, finding gaps and creating an overarching conceptual framework that differentiates itself from other studies, but also in the way that these concepts are applied to the context of industrial design. What is clear from the literature is that business design is not a new concept. However, it is not clear in the literature how the principles of Design Thinking, such as Design Thinking rules are shaped by design thinkers. It has also been made clear that there are very different viewpoints about both meta-concepts, Design Thinking and the business model embraced by different authors, validating that we are dealing with probable and casual variables that will be outlined in the next chapter.

3 CHAPTER THREE: METHODOLOGY

3.1 INTRODUCTION

This chapter represents an in-depth qualitative approach introduced in the research design in chapter one, and which addresses the overarching research question:

How does Design Thinking create, deliver and capture value for industrial design related business models here in South Africa?

This research is framed in such a manner as to form a logical sequence of activity. In this way the epistemological orientation guides the research questions, the sample, units of analysis, variables and methods used to capture the data. In essence it is the methodology employed to achieve the objectives.

The fundamental elements of Design Thinking in practice can be framed through exploring how industrial design entrepreneurs apply Design Thinking within their business practice, including their mind-sets, knowledge and skill sets. However, this thesis does not have the capacity to explore all of these attributes in depth. The question, 'how (in what way) is Design Thinking shaping Industrial design business models?', can only be achieved to its best ability through an applied context approach. This means that fieldwork had to be done, while secondary data alone would not have been adequate to demonstrate unique results. To manage this research design, an interpretivist approach is taken as a methodological approach. This kind of approach aligns with the nature of this study which adopts a qualitative epistemological standing point.

This chapter will start with a discussion of the paradigm of choice that guides the philosophical underpinnings and approach taken in this research project, therefore informing the overall methodology and methods used. It was necessary to outline the research design in the first chapter, because it introduces the priori variables and conceptual frameworks that are grounded by the literature review.

3.2 PHILOSOPHICAL UNDERPINNINGS

Current theories of learning and approaches to curriculum typically emphasise the epistemological dimensions and neglect the ontological dimensions of learning (Adams *et al.*, 2011). Understanding the knowing, in the case of this study, resembles the act of skills sourced and how they are developed that make us what we are. This is part of the ontological framework, which is generally focused on performance, dependent on the qualities of epistemological sources and the implementation thereof. Design Thinking in its nature works with an integrated sense of both epistemological and ontological dimensions (Rotman, 2006) and its performance is dependent on the quality and combination of these dimensions.

3.2.1 Interpretivist view point

One of the core ideas of interpretivism is to work with certain subjective meanings in the social world, acknowledge their existence, understand them to avoid distorting them, and construct them in order to use them as building blocks in further theorising (Goldkuhl, 2012). Design Thinking in the industrial design context shares epistemologies that are in the interpretive sociology variant, such as in the four paradigms developed by Morgan and Burrell (1979) for the analysis of social theory. The ontological alignments can, therefore, be aligned to an improved way of being such as in Adams' concept of knowing, acting and being (Adams *et al.*, 2011). There are, however, numerous examples of attempts to create a solid philosophical ground for design. There are two extreme views: firstly, an objectivist view which assumes a concrete structure of the social world, and, on the other hand, the subjectivist approach to understanding and mapping out the social structure, which Morgan and Burrell (1979) described as two dimensions.

As the thesis outlines in the first chapter, studies that are focused on the social sciences tend to work with probabilistic measures that are more subjective in their epistemology. The aim of understanding the subjective meanings of persons in studied domains, is essential in the interpretive paradigm. However, design itself is a good example of constructivist knowledge, a meaning that Goldkuhl (2012:2) describes in relation to pragmatism as follows; 'Pragmatism is concerned with action and change and the interplay between knowledge and action'. It differentiates itself by intervening in the world and not merely observing it. An example, would be a design intervention that changes the structure of an organisation or building artifacts to improve the workflow. This study is not using design theory as a methodological framework for research; rather it aims at the interpretation and understanding of how design is applied (Goldkuhl, 2012), in opposition to design science research methodology that aims to prescribe and which usually starts with 'how can'

questions, rather than 'how does'.

Therefore, the theoretical perspective and philosophical stance of this research will inform the methodology to answer the questions. The methodology will attempt to find answers to the research questions. This approach represents, an interpretivist theory (Creswell, 2003).

3.2.2 Constructivist ontology

Paradigm researchers believe an interpretivist view point is dependent on a constructivist ontology. Goldkul (2012:4) explains that 'ontologically, interpretive research assumes that the social world (that is, social relationships, organisations, division of labours) are not given'. Rather, the world is produced and reinforced by humans and interaction. In this way the author describes social relationships, organisational aspects and divisions of labour as elements that exist in this world. From an interpretivist perspective, the relationships are the essential parts. This is further expressed by the view of Orlikowki and Baroudi (1991) in the following quote:

'The aim of all interpretive research is to understand how members of a social group, through their participation in social processes, enact their particular realities and endow them with meaning, and to show how these meanings, beliefs and intentions of the members help to constitute their actions'

This interpretive orientation is meant to help the researcher understand the actors (Goldkuhl, 2012). The researcher's aim is to understand and interpret the 'existing meaning systems shared by actors' (Goldkuhl 2012:6), and in a sense, to construct a reality based on a common understanding which has developed out of knowledge that supports this meaning. Furthermore, the aim is to construct a descriptive ontology based on the applied context.

3.3 RESEARCH DESIGN

Addressing the rationale of the study required a multi-method design that has both inductive and deductive characteristics.

3.3.1 Qualitative research approaches

One of the first considerations involved in choosing an appropriate methodology for this research was guided by the research sub-questions.

The sub-questions support this research question by asking 1) What are the different perspectives and conceptions on Design Thinking which practitioners in Cape Town embrace? 2) What are the features of business models in an applied context of industrial design? 3) How does Design Thinking give shape (applicable relationships) to industrial design related business models?

If we look at these questions again from a meta-level, and our intent is to describe, then the main purpose is to identify causal relationships between Design Thinking and the business model building blocks, such as in sub-question 3. For example, to conclude one variable has direct influence or relationship on the another. Therefore, a quantitative methodology would not have been an effective method for addressing this purpose. The research intends to identify and qualify the nature of some relationships that exist in the context of industrial design business models by applying Design Thinking concepts. This intention requires in-depth case studies contextualised within the provisions of Design Thinking and how it relates to how the the business model was formed. Therefore, the study will assess Design Thinking against a relevant sample of industrial design business models and describe relationships that emerge between these conceptual models and the pre-determined constructs.

Qualitative research methods are necessary for finding out how individuals feel about their world (Atherton, 2007), allowing for a detailed exploration of this phenomenon. This methodology will inform the broader contexts and the social dynamics that are informed by Design Thinking. The result will be a descriptive account of the setting or practice and the adoption of a form of interpretive sociology (Guest, 2012:10). Descriptive meanings are framed in this study to convey an understanding, based on the interpretation of the particular relationships established through the conceptual lense. These consist of relationships between certain variables or constructs of Design Thinking and the business model building blocks. It must be considered that the researcher in a qualitative research project plays an important role since the data gathering and analysis is all done based on the researcher's knowledge of the topic, ability to interpret meaning and the methods used to address the questions adequately (Guest, 2012:10).

3.3.2 Applied context

The notion of an applied context is the main approach embedded in the research design of this thesis. Collins (2010:45) refers to this approach as follows:

“When you carry out a piece of work in a real context using a theory or techniques that you have used on the course.”

Investigating a particular context is a characteristic of this approach. Much research has been done which has explained the benefits of Design Thinking. Consequently, it seemed more appropriate to investigate and describe industrial design business models' use of Design Thinking here in Cape Town, so as to contribute to knowledge of the local context of this particular industry. However, the research approach still attempts to describe alternative actions and possibilities, as well as to generate appropriate academic reflections and conclusions that may be relevant elsewhere.

3.3.3 Case study methodology

The case study methodology is another approach that is used within the applied context approach. It is aimed at understanding the dynamics that are present within single settings. It also aims to raise the premises which identify a case study as being an empirical enquiry. This explanation is further supported by (Yin, 1994:13) in the following statement:

‘... that investigates contemporary phenomena in depth and within their real-life context, especially when the boundaries between phenomena and context are not clearly evident’

Case studies are known to be a prime example of qualitative research (Broadhurst *et al.*, 2012), which involves an interpretive approach to data, studying aspects of cases within their context and considering the subjective meanings that people bring to the situation. Some data collection methods in this case study methodology involve interviews that are semi-structured, analyses of documents and other unobtrusive methods. The comparative case study approach covers more than two cases in order to produce more generalisable knowledge about causal relationships. Also the case study design of the sample, tended towards that of industrial design related business's. However, because the cases were not from the same industries it meant a comparative study could be undertaken to distinguish similarities and differences between the cases.

3.3.3.1 Relativist approach

The case study approach in this study takes a relativist position. It is an approach that has been developed particularly through the work of Eisenhardt *et al.*, (2007), which draws from both the positivist and constructionist epistemological positions. The main feature of this ontology is that it is established at the outset, but researchers then become flexible with regard to their adaptation in the methodology (Esterby-Smith, 2008), recommending that data collection can take place through multiple methods and can be conducted both within case and across case analyses. Yin's (2009) approach takes a more positivist stance which shows resemblances to a deductive and hypothesis led methodologies by having a structure and set of measures from the start. Eisenhardt's approach is more appropriate to this study because it is concerned about building theory from case based research and this takes the form of developing hypotheses.

The stages in which hypotheses can be formed are the following:

- Sharpening the constructs, and iterative processes which move between the constructs and data.
- Verifying the emergent relationships between the constructs and the data
- Case study evidence informs the emergent relationships between constructs.
- The third stage involves comparing the emergent theory/concept with the existing literature. In this regard it is important to pay attention to the literature which is contradicted by the evidence, to make the research more explicitly validated.

The application of case study research is complex, and there are variations in case study design. The key features that best describe this type of case study approach are in the following Table 3.1:

Table 3.1: Case study methodology from a relativist point of view (adapted from Eisenhardt *et al.*, 2007)

Relativist point of view	
Design	Consists of a flexible design
Sample	Multiple cases can be employed to collect data.
Analysis	Requires across and within case analysis
Theory	Directed Generation forms part of the theory building process

This case study design is necessary when the data are captured in one specific exercise/ activity. The reason for this is that the main question takes an instant view of the relationships that design has with the business model. We assume that the case studies that have been chosen are already competitive in their industry. Therefore, it is not necessary to use other strategies, such as a longitudinal case study design that would highlight the company's growth, and the positive and effective input which Design Thinking activities would have had over time, for example.

3.3.3.2 Comparative case studies

When case study research involves multiple case studies, it is can be distinctive to the comparative case method (Yin, 2009). Sub-question 2, and question 3 require the methodological approach of a description of the similarities and differences found between the cases, to generate a holistic view that address the overarching research question. It also interprets implications of those similarities and differences across cases.

3.4 SAMPLING

3.4.1 Introduction

Essential to the validity of this study, the process of sampling begins by selecting the right individuals, organisations, objects or events representing the population (Sekaran & Bougie, 2013). The research will not only be limited to design entrepreneurs having walked the path of successful business. Sub-question 1 also involves perspectives from experts in design education and design-related consultants.

The sample groups shown in Table 3.2 below are relevant only to sub-questions 2 and 3, where there is a primary focus on the cases studies:

Table 3.2: Sectors represented in the case study sample

Sector description	Type of respondent	No. of firms	No. of employee's
Apparel and leather	Director	1	1-10
Maker and creative	Director	1	1-10
Consultancy			
Mobile products	CEO	1	1-50

3.4.2 Delineation of the study

Geographically, the study will be delineated to data collection from informants in Cape Town. However, the conceptual models are referenced in terms of international literature. Therefore, the concepts used will be applied in the industrial design context of South Africa, Cape Town.

Industrial design graduates tend to find themselves working for a corporation, working in a design consultancy, starting their own consultancy, selling their products to companies, and selling their products themselves (Siegel, 2012). In this research design, the route of framing the sample of companies that are industrial design related is taken. In the context of industrial design, it must be considered that the boundary between products and services has more or less disappeared. Therefore, the design process is not just a once-off exercise; it has to run parallel with the use of product systems, services and environments (Ullmark, 2011).

3.4.3 Sample groups

The context of the South African industry generally shapes the way business models are formed in every sector. From the literature, it also seems clear that the changing role of the industrial designer has moved away from only products to services as well to withstand competitive advantage in the global context. Therefore, the case study sample is delineated to both consultancy/service and product offering business models in the industrial design related industry addressing sub-questions 2 and 3. The experts sample, supports data only for the sub-question 1, to understand the different perspectives and perceptions of Design Thinking, with the aim of introducing Design Thinking from a emergent perspective. Table 3.3 delineates the various sampling groups to capture the primary information from fieldwork.

Table 3.3: Sampling groups

Category	Type	Profile	No.	Data collection technique
Case studies	Entrepreneurs	Director	3	Interview, workshop exercise
Experts	Lecturer, Professional Agency	Programme directors, consultants	3	Interview

The sampling strategy is of a comparative nature in the sense that it will look at commonalities and emergent descriptions represented from evidence from the cases and the expert interviews, to also inform the perspectives and conceptions of Design Thinking.

3.4.4 Sample in terms of questions

The sample for the sub-question 1: What are the different perspectives and conceptions of Design Thinking which practitioners in Cape Town embrace? (See Figure 3.1) involved gathering data from sources that included all the participants of both case studies and expert interviews. The reason for this was to allow for various perspectives to arise, using an inductive analysis approach. This approach allows the sub-question 1 to withhold as backbone for conceptual framework and priori presented in the d-school concept that follows in sub-question 3.

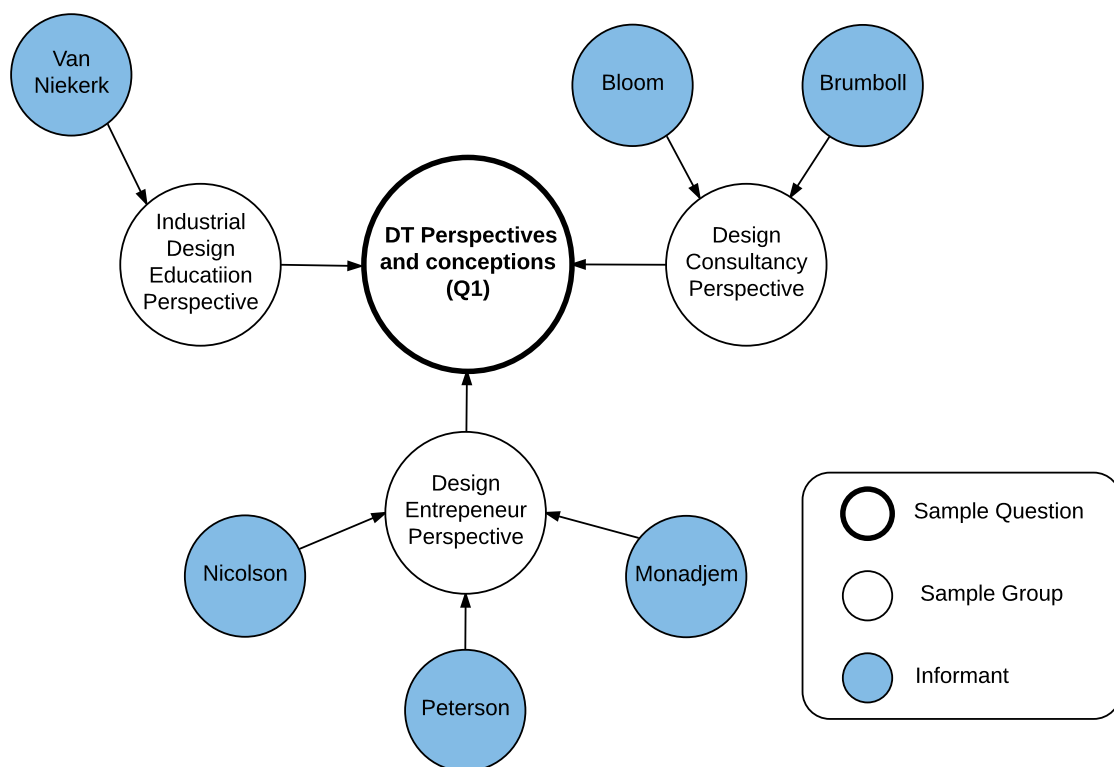


Figure 3.1: Sampling of sub-question 1 (Q=sub-question)

The purpose of the interviews with the consultants and case study informants was to understand the respondents' conceptions and experiences of Design Thinking in practice across a broad range of contexts in order to describe some of the commonalities. The aim of the data collection of this sample was to:

- gain a wider insight into the meanings of Design Thinking, and
- understand what terms comprise Design Thinking from a grounded analysis approach.

Data from the cases inform sub-question 2 and sub-question 3 (See Figure 3.2), the key informants here being Chad Peterson, Marc Nicolson and Vahid Monadjem.

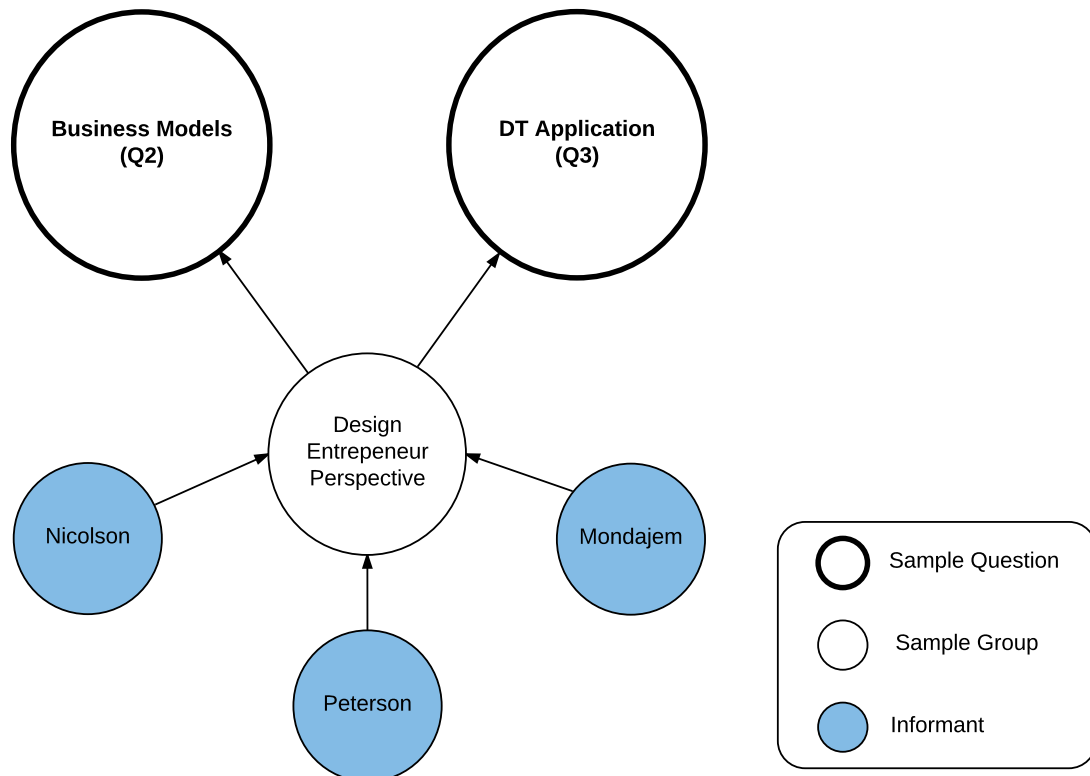


Figure 3.2: Case study sample for sub-question 2 and 3

The purpose of this sample was to:

- describe the use of Design Thinking from the case perspective; therefore, setting a premise for the sample that informs data for the main questions,
- undertake an in-depth study through using case study methodology, and
- establish relationships between the data sets, using primary data.

3.5 UNITS OF ANALYSIS

Certain entities, such as objects or activities can be referred to as the units of analysis, these entities can include people, social roles positions and relationships (Durrheim, 2006). The units of analysis in Table 3.4 represent which units of analysis are selected against the research questions. This also then introduces the variables based on the conceptual frameworks deduced in the literature review.

Table 3.4: Research questions and the units of analysis

Research sub- questions	Units of analysis	Analysis
1. What are the different perspectives and conceptions on Design Thinking which practitioners in Cape Town embrace?	Individuals (entrepreneurs, consultants), companies (cases)	A description of emergent Design Thinking perspectives and conceptions
2. What are the features of business models in an applied context of industrial design?	Companies	A description of the industrial design business model
3. How does Design Thinking give shape (applicable relationships) to industrial design related business models?	Individuals, companies	A description of Design Thinking applied in relation to the business model building blocks.

3.5.1 Variables

As discussed previously in the literature review and conceptual framework, the focus is on concepts that have presented for their meta categorisation (rules, main and secondary categories), such as in Table 3.5 and 3.6. In this way it takes an applied context approach to Design Thinking, using the provisions of Design Thinking and the business model building blocks. The operationalisation of the Design Thinking concept seeks to understand these rules and gives a way to approach the data.

3.5.1.1 The d-school Design Thinking rules

The main features of Design Thinking chosen in Table 3.5, and as discussed in the literature, are used as a concept developed by the authors Meinel & Leifer (2012) at d-

school, which will then inform aspects of the qualitative content analysis process. These applicable categories that are to be applied to the evidence in the cases and the business model buildings blocks and provide components to identify emergent relationships. The secondary categories from the Design Thinking rules have been operationalised to create sub-categories for directing the coding process. Operationalisation is the process of defining variables, based on concepts that are potentially underpinned by a higher order category (Easterby-Smith et. al., 2008). In this study the Design Thinking rules are a conceptual framework of these higher order categories. Some of these operationalised terms are influenced by normative claims from Design Thinking literature and some are based on an interpretation based of the rule.

Table 3.5: Operationalisation of the Design Thinking rules (adapted from Meinel & Leifer, 2012)

Rule	Main Category (Operationalisation)
Human rule	Human centric (serving the needs of people) Empathy (understanding the personal values of people) Multi-disciplinary (generates values from different specialisations) Team work (stimulates different angles of input)
Ambiguous rule	Uncertainty (is present when creating something new) Managing uncertainty (through testing and iterative development) Failure (failure as part of the learning process)
Re-design rule	Foresight (engaging in opportunities) Iterative (cycles of refinement) Testing (the process of feedback to develop refinements) Reflecting (what has been done; how can it be improved)
Tangibility rule	Communication (means to facilitate communication) Visualisation (sketching as a means to process what is possible) Prototyping (creating measures with which to gain feedback)

3.5.1.2 The business model building blocks

The variables developed by Osterwalder and Pigneur (2010) in the book “Business Model Generation”, have sub-categories that give a more detailed description for different types of business models. These categories were used to assess the business models of the case studies.

Table 3.6: Business model building block categories (Osterwalder & Yves, 2010)

Main Category (Derived from literature)	Sub-categories (Derived from literature)
Value Proposition	newness, performance, customisation, “getting the job done”, design, brand/status, price, cost reduction, accessibility, convenience

Key Activities	production, problem solving, platform/network,
Key Partners	partners, suppliers, key resources
Key Resources	physical, intellectual (brand patents), human, financial
Customer Relationships	personal Assistance, self Service, automated services, co-creation
Key Channels	awareness, direct, online store, retail & whole sale, social networks, partner
Customer Segments	mass market, niche market, segmented, diversified, multi-sided platform
Costing	asset sale, usage fee, subscription, lending, renting/leasing, broker fee, advertising
Revenue	cost driven or value driven, fixed costs, economy of scale, economy of scope

3.6 DATA COLLECTION

3.6.1 Gaining respondent participation

Access was granted to each respondent personally; therefore, direct contact was made with the respondents. Each respondent was informed about the purpose of the research in an email, with a consent form that stipulated the different uses of the information.

3.6.2 Main information sources

The main sources of data include:

- Primary data: sample of key informants that address all the research questions (interviews, business model exercise)
- Secondary data: limited to only the cases that address sub-question 2 (archive data and publications, etc.)

The respondents involved in the data collection, industrial design entrepreneurs and the experts from the field of design, business and education, required different methods of data collection. In the case of the primary data collected, open-ended and semi-structured responses were appropriate. The open-ended methodology for the sub-question 1 meant that it aimed to generate emergent categories; the semi-structured and directed approach to the data collection in sub-question 2 and 3 started with a conceptual framework and the operationalisation of the variables/categories. However, because they were not closed-ended (a characteristic of quantitative methodology) the views and codes also came about in an emergent manner.

3.7 OVERVIEW OF THE PARTICIPANTS IN THIS STUDY

3.7.1 Participants in the study

The informants involved in this study include industrial design entrepreneurs, design educators as well as experts in the field of Design Thinking. Case study representatives were also interviewed. Each participant's background is detailed below.

Table 3.7: Overview of the participants

Name	Participant code	Gender	Position	Formal education in Design	Data informing sub-questions
Marc Nicolson	MN_1	M	Director	Y	Sub-question 1,2,3
Chad Peterson	CP_2	M	Director	Y	Sub-question 1,2,3
Vahid Monadjem	VM_3	M	CEO	N	Sub-question 1,2,3
Robert Bloom	RB_4	M	Director	N	Sub-question 1
Elain Brumboll	EB_5	F	Director	N	Sub-question 1
Johan Van Niekerk	JVN_6	M	Programme manager	Y	Sub-question 1

3.7.2 Case study respondents

3.7.2.1 Marc Nicolson: *Thinking*

Marc Nicolson is a partner and director of the design agency Thinking which is based in Woodstock, Cape Town. He has an Industrial design degree from CPUT. After having graduated he was employed by Rocket Fuel (also a design agency), before co-founding his own company in partnership with Lyall Sprong. Sprong is also an industrial designer, and together they have managed a consultancy that specialises in making and installing creative concepts, particularly as a service to advertisers. Nicolson is also interested in the craft and social development sectors, and this filters through in his work and the types of clients which the company attracts.

3.7.2.2 Chad Petersen: *Research Unit*

Chad Petersen is the founder and creative director of the company Research Unit. His academic record consists of a diploma in Mechanical Engineering and a degree in Industrial design. Before Peterson started his own company, he worked for XYZ Design, an industrial design consultancy in Cape Town. Here he was exposed to other aspects of the business, gaining about three years' work experience. Peterson describes himself as an ambitious character. During his time at XYZ Design he felt he needed to learn new things. Consequently, he decided to 'spread his wings' after three years. In 2011, he started to conceptualise his business idea while co-founding Research Unit with Erin Lee, his wife. He resigned from his position at XYZ Design in 2013.

3.7.2.3 Vahid Monadjem: *Nomanini*

Vahid Monadjem is the CEO of Nomanini. After having graduated from the University of Cape Town with a degree in Mechanical Engineering, he started a company with two friends, consulting in electrical engineering. They worked on various projects, from baby toys and farm weather sensors to machine communication systems. It was with this experience that he moved on to one of the main industrial design consultancies in Cape Town, XYZ Design. At XYZ Design, the company combined the concepts of 'space of technology' and 'needs of people' (a socio-technical environment) in their projects. Monadjem later gained experience in business and management consulting, while working for Mckinsey in Johannesburg. The concept at the core of Nomanini began to crystallise while he was working at Mckinsey. After having resigned from McKinsey, he started Nomanini.

3.7.3 Expert Respondents

The expert respondents provided different perspectives on Design Thinking. Their thorough knowledge of Design Thinking and practice in the field of either design consultancy and education provided reliable material which led to the emergence of findings that pertain to sub-question 1.

3.7.3.1 Johan van Niekerk: *FID at CPUT*

Johan van Niekerk is an industrial design lecturer at CPUT. He qualified with an industrial design degree in 1999. During his studies he gained work experience and started teaching

industrial design in 2005. He has qualifications in industrial design, Psychology, Engineering, Drafting and Higher Education. As of 2015 Van Niekerk is the programme leader of the B. Tech. in industrial design course in the Faculty of Informatics and Design (FID) at CPU and has been teaching there for nine years. Given the above experience, Van Niekerk has an extensive knowledge of the industrial design profession here in South Africa.

3.7.3.2 Elain Brumboll: *Graduate School of Business*

Elain Brumboll is a lecturer at the Graduate School of Business (GSB), teaching a course called the Acumen for Artists. The Acumen for Artists is a curriculum developed for artists to introduce them to the basic concepts of managing a business, taking creatives out of their usual space of becoming too focused on the product. Brumboll is also the managing director of the The Creative Leadership Consultancy, a learning agency based on global collaborations to build more agile, playful, curious and energised leaders. In addition, she is an internationally accredited master LEGO Serious Play practitioner and the course uses the 'hands on' Lego Play method which is associated with the Design Thinking to simulate uncertain and complex environments. This course is targeted at strategic management for teams, individuals and organisations. With a Master's background in Philosophy, she believes her work is in line with the constructivism philosophy.

3.7.3.3 Robert Bloom: *Design Thinkers Group*

Robert Bloom is the founder and managing partner of the Design Thinkers Academy in South Africa, the headquarters of which are based in the Netherlands, and with offices in the UK, Spain, Brazil and the USA. The agency offers co-creation training programs for professionals and teams in corporate and governmental environments. Bloom has an academic background in business. However, during his career he has worked with XYZ Design. Bloom has also been involved with some contractual work with the CCDI, doing a situational analysis of the design industry in the Western Cape. Bloom now runs a number of service design projects in public sector, in which Design Thinking tools and methods, such as customer journey mapping, are used. The aim is to improve service quality and empower health practitioners on the ground to be able to use these methods, for example.

3.8 DATA COLLECTION METHODS & FIELD WORK PRACTICE

The primary data collection was undertaken in Cape Town with the relevant informants. Table 3.8 gives a description of the data collection methods used.

Table 3.8: Data collection methods

Methods	Description
Literature review	Research that critiques, analyses, and extends existing literature and attempts to build new groundwork, e.g. it includes meta-analysis (Maree & Van Der Westhuizen, 2009).
Case study	Study of a single phenomenon (e.g., an application, a technology, a decision, an organisation) (Yin, 2009).
Interview	Research in which information is obtained by asking respondents questions directly. The questions may be loosely defined and the responses may be open-ended (Tucker & Meyer, 1995).
Secondary Data	A study that utilises existing organisational and business data, e.g., financial and accounting reports, archival data, published documents, etc (Maree & Van Der Westhuizen, 2009).
Action research	A study that involves a business model/workshop exercise, in which the respondents could select variables/categories that describe their business model and explain how it relates to their day-to-day business.

A valid process of analysing the qualitative data of the research is data triangulation. This will include four types of triangulation such as data, investigator, theory and methodological triangulation (Tucker & Meyer, 1995). The triangulation method will validate the information captured from various sources by means of the 5 data collection methods listed in table 3.8. Triangulation is important, so that the qualitative data collection methods used will inform the research questions in various ways. Table 3.9 indicates the data captured from interviews, case studies, and documentation, in relationship to the research questions.

Table 3.9: Primary methods of data capture in line with the research questions

Research Questions	Interviews	Literature	Case studies	Secondary data	Action research
What are the different perspectives and conceptions on Design Thinking which practitioners in Cape Town embrace?	✓		✓		
What are the features of business models in an applied context of industrial design?		✓	✓	✓	✓
How does Design Thinking give shape (applicable relationships) to industrial design related business models?	✓	✓	✓		

3.8.1 Interview procedure

Qualitative data were collected from interview notes; transcripts and answers to open-ended and semi-structured questions. Each interview was carried out at the work place, with the exception of one case. The interview with the participant Nicolson (Thinking) was carried out at his home (at his discretion) after-hours due to his heavy work schedule and with the

intention of avoiding interference in the workplace. The interviewer began with a personal introduction. The subject was introduced at a very general level, allowing the interviewees to speak freely and naturally. As the questions moved through the categories, the interviewer responded with comments or questions that elicited more thought. Some of these questions aimed to encourage the interviewees to elaborate more and give examples of their experience.

After the interview, a sheet was filled out that served as memo for the interview, giving the overall feeling of the interview, key insights and whether the interviewee felt comfortable.

3.8.1.1 Interview with case study respondents

The interview questions started with an open-ended structure aimed at data collection for research sub-question 1. The second part of the interview introduced semi-structured questions directed by the d-school concept (for the purpose of reference see an example of the interview with Mondajem in the Appendix C).

3.8.1.2 Interview with expert respondents

The interviewer began with a personal introduction. In this section, the interview took a different approach: questions were less structured, open-ended and led by a discussion.

3.8.2 Questionnaire construction

3.8.2.1 Addressing sub-question 1

This question started with understanding what the different perspectives of Design Thinking are. The idea of this question was that it should not be grounded by any pre-determined conceptual framework, but was rather aimed at open-ended questions. Therefore, this question takes more of an inductive approach by asking the following questions:

- How do you think you use design approaches in your work practice? What is your association with design?
- What do you think are the key qualities of a designer?
- What does Design Thinking mean to you?

- What is Design Thinking in your opinion? We are interested in what you think characteristics of a design thinker are?

These questions were intended to identify commonalities and emergent descriptions shared by the respondents. They were also intended portray and explore interpretations of Design Thinking before the Design Thinking rules were applied in sub-question 3.

3.8.2.2 Addressing sub-question 2

After the interview, the case study respondents were asked to participate in the business model canvas exercise, explained in the literature review. The business model canvas is split into components (such as in the literature review) and has a clear framework (see Figure 3.3) and set of variables to select from. The use of this framework led to a very positive encounter for the respondents and were definite in their description of the variables.

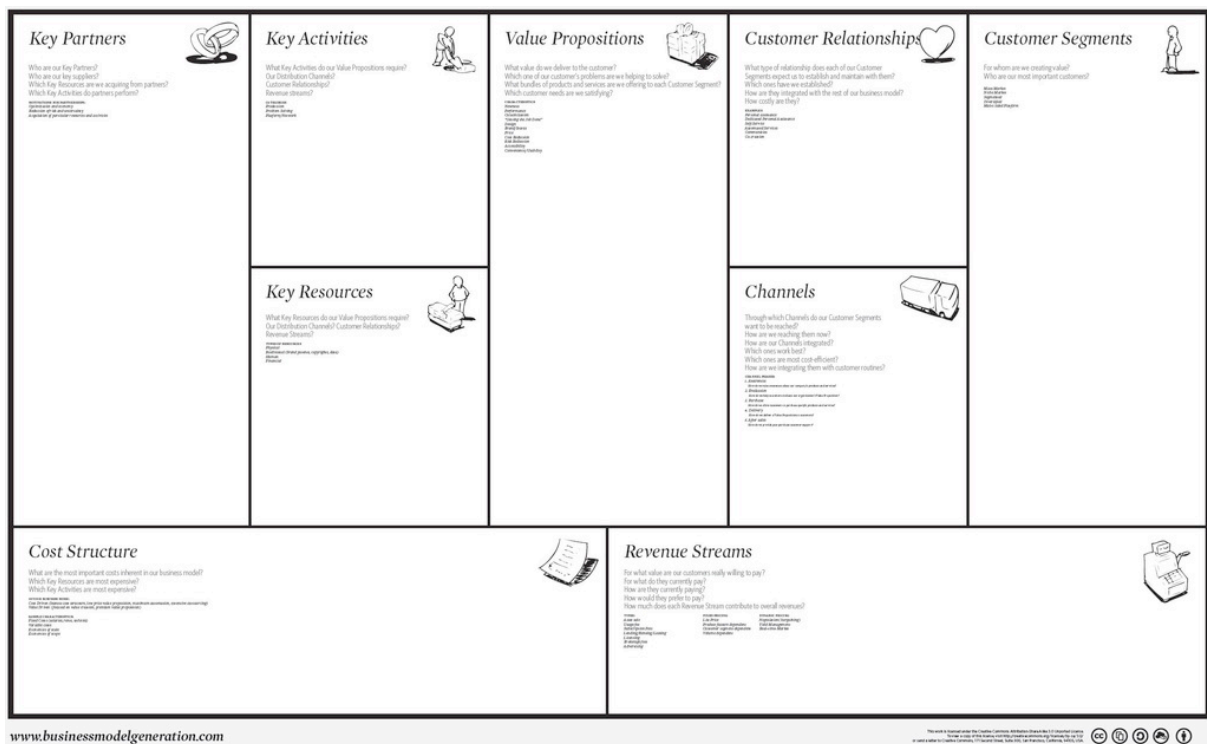


Figure 3.3: Business model canvas used in the workshop exercise (Osterwalder & Pigneur, 2010)

Utilising the business model canvas, meant that it served as a common tool, and the results led to a rapid description of business model. Every case study respondent, each representing one company, participated in the business model canvas activity and secondary data was referred to in the data analysis process if further detail were necessary.

3.8.2.3 Addressing sub-question 3

This sub-question formed the bulk of the main interview and involved asking semi-structured questions. These questions were directed by the Design Thinking rules. Three or four questions were asked based on each category of the Design Thinking rule (see Appendix C to reference the questions). The researcher also added an associative question or asked the respondent to elaborate further when it was necessary.

3.9 DATA CAPTURING AND EDITING

3.9.1 File management

Research and the respondents' data were captured, using the methods in the previous section, and then archived into certain folders for each case and expert interview. The recorded interviews were stored in Atlas.ti for transcribing. Once the transcriptions were completed, they could be used for the data analysis. The business model canvas was done on an A0-size poster during the exercise. After each exercise the poster was photographed and redrawn on the Lucid Chart (flowchart maker and online diagram software) and represented in Chapter 4.

3.9.2 Editing and transcribing

All the six interviews recorded were transcribed by me personally. Even though it was a time consuming activity, it helped to understand aspects in the recordings that may not have been visible in the transcript. The recordings gave one a better idea of the mood that prevailed during the interview, the unexpected directions which the questions initiated, as well as the overall flow of the interview.

The audio was captured through a Bell recorder, which worked well for the type of recording done. However, there were contexts in which the interviews took place in noisy environments. This did affect the quality of transcribing, and in these cases, some of the sections in the recording had to be reviewed and this meant it took longer than expected.

Steps in preparation for the analysis that took place:

- Create Microsoft Word documents of all the transcripts, which included six documents.
- Convert the documents into text files and assign them as primary documents in Atlas.ti.
- The primary documents were then assigned a name to indicate the following: (a) the type of source from which the data were collected (interviews or secondary), and (b) the respondent's number. Naming the documents ensured that they related to a research activity.
- The next step was to prepare the units of text for analysis

3.10 DATA ANALYSIS

3.10.1 Introduction

The primary data analysis approach is a qualitative content analysis. Content analysis mainly deals with methods of analysing written text and verbal communication messages (Elo & Kyngäs, 2008), either to test conceptual issues and/or enhance the understanding of the data. A content analysis methodology guides the process in the study's nature of both inductive and deductive analysis of qualitative data, involving multiple analytical steps. This involves identifying implicit and explicit ideas that emerge from the data. Codes were developed that represent aspects of the categories that are derived from the raw data (Guest, 2012). The general analytical process starts with reduction, segmentation, categorisation and relinking aspects of the database prior to final interpretation and abstraction (Grbich, 2007).

3.10.2 The qualitative content analysis process

Qualitative content analysis is a valuable alternative to more traditional quantitative content analysis, as the researcher is working in an interpretive paradigm (Zhang & Wildemuth, 2009). The approach can involve both an enumerative and a narrative of descriptive data, bringing together the categorisation and interpretation of written text in response to open-ended and semi-structured questions. Content analysis can be used in an inductive and deductive way; the approach is dependent on the research question and purpose of the study. If there is not enough former knowledge on the topic, or it is fragmented, then an inductive approach is appropriate (Elo & Kyngäs, 2008). Categories are derived from data in an inductive content analysis. On the other hand, deductive content analysis is used when

the structure of an analysis is operationalised on the basis of previous knowledge, and the purpose of the study may be testing the concept or starting with a guiding framework (Elo & Kyngäs, 2008). In sub-question 1, the inductive approach, an open and emergent methodology, allows for the concepts that emerge during the review of the data to be identified.

“Content analysis is a type of qualitative design to develop categories from the text collected for “data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify core consistencies and meaning” (Patton, 2002:453)

Therefore, to reduce the number of codes used, the researcher needs to combine a group of similar codes, sharing consistencies and meaning, into a single category of codes. During the coding process, the researcher reads the raw data and interprets them, based on the context, to determine which codes to link to them. In its process, inductive analysis moves from the specific to the general, so that particular instances specific to the data can be observed and moved into larger statements, categories or themes.

To address the sub-question 3, the deductive approach is based on an earlier concept, theory or model, also known as priori, such as the d-school Design Thinking rules, therefore moving from the general to the specific (Elo & Kyngäs, 2008). Inductive and deductive analysis processes are not always independent from each other, therefore sub-question 3 starts with a concept and then descriptive categories come about in an emergent manner, which also has characteristics of an inductive approach.

Table 3.10: Analysis approaches in relation to sub-questions

Research sub-questions	Inductive	Deductive
1. What are the different perspectives and conceptions of Design Thinking which practitioners in Cape Town embrace?	✓	
2. What are the features of business models in an applied context of industrial design?		✓
3. How does Design Thinking give shape (applicable relationships) to industrial design related business models?	✓	✓

Sub-question 1 in Table 3.10 looks at the perspectives of Design Thinking using an inductive approach. It takes a different sample to the case study sample aimed at sub-question 2 and 3. It was felt that it was not necessary to use the pre-determined concept, but rather see

what emerged from the variation of design practitioners. Sub-question 1 takes an open-ended approach to understanding how each participant perceives Design Thinking and how the conceptions of Design Thinking might be connected. The questions were open-ended in order to induce meanings and the respondents' perspective. The approach to the analysis process for each question, is derived from the multiple methods of qualitative content analysis outlined in Figure 3.4.

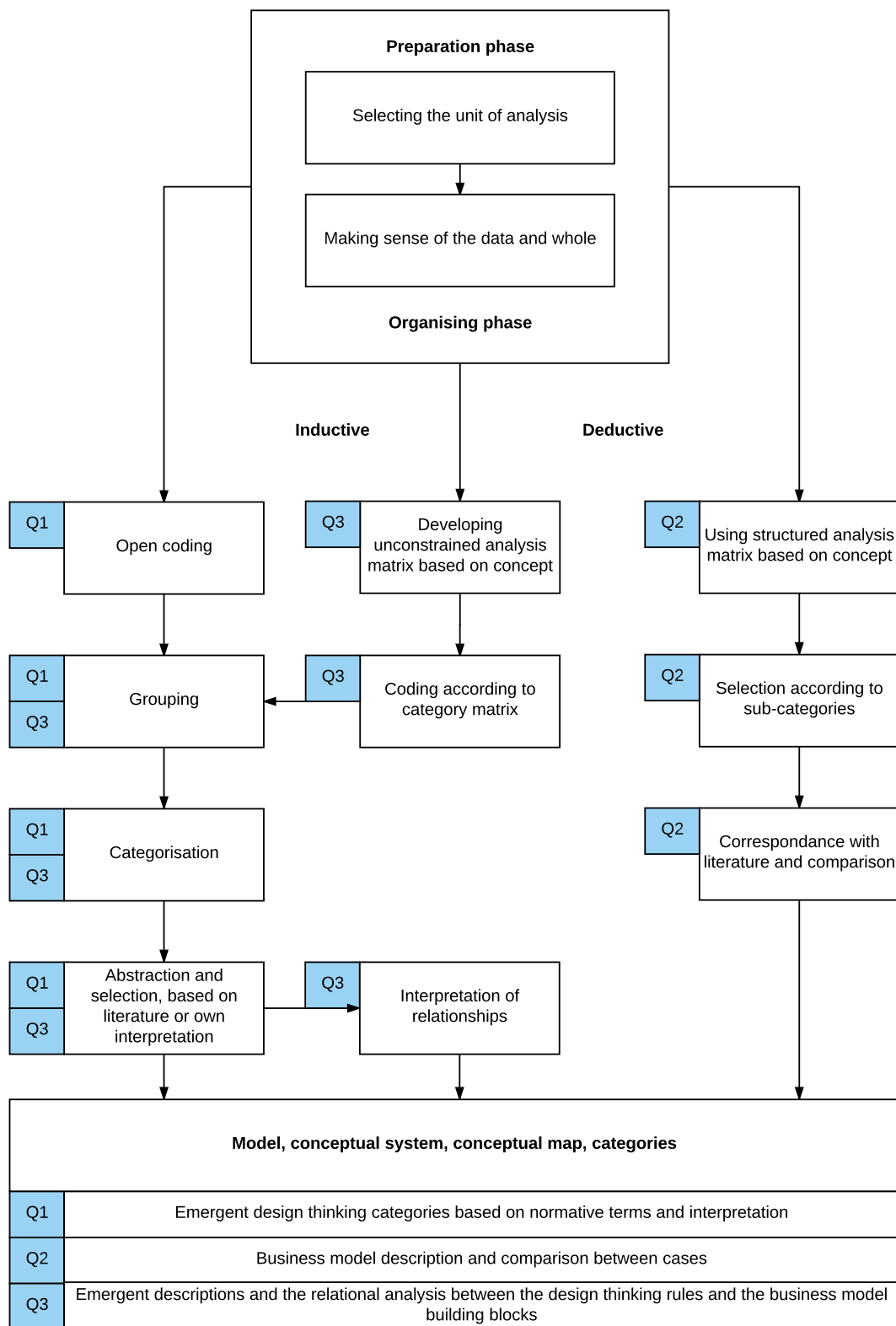


Figure 3.4: Preparation, organizing and resulting phases in the content analysis process for each sub-question (adapted from Elo & Kyngäs, 2008). Q=sub-question

3.10.2.1 Analysis process for sub-question 1

The analysis for this question was broken down in two separate analysis phases in A and B:

A. Perspectives of Design Thinking

- Open coding in Atlas.ti (identifying units of text)
- Selecting and separating quotes in the design or business domains
- Discussion and triangulation with literature and the background

B. Conceptions of Design Thinking

- Open coding in Atlas.ti (identifying units of text)
- Grouping individual codes
- Categorisation based on normative terms of Design Thinking
- Abstraction and logical inference
- Resulting with description of emergent categories

3.10.2.2 Analysis process for sub-question 2

The analysis for this question was broken down in two separate analysis phases in A and B:

A. Description of the business model case

- Preparing business model canvas
- Workshopping business model canvas using structured framework
 - Discussion and explanation of main categories
 - Selection according to sub-categories
- Resulting in a description of each case

B. Comparative analysis between cases

- Presenting similarities and differences between cases
- Resulting in a comparative matrix

3.10.2.3 Analysis process in sub-question 3

The analysis for this question was broken down in two separate analysis phases in A and B:

A. Application of the Design Thinking rules

- Pre-determined main categories (operationalised by Design Thinking rules)
- Coding based on main categories (see table 3:12)
- Grouping
- Emergent descriptive categories

B. Relationship of Design Thinking and the business model building blocks

- Recoding of units of text using the business model sub-categories
- Abstraction and interpretation by identifying relational codes under the main categories
- Resulting in the diagrams presenting the relationships between the two concepts

3.10.3 Codebook

During the qualitative content analysis process, the codebook in Table 3.11 portrays the process to develop emergent categories that are addressed the sub-question 1. This analysis was done in atlas.ti and is represented in Table 3.11.

Table 3.11: The main emergent categories of Design Thinking from the respondents interviews, and examples coding from quotes in sub-question 3

RES.	UNITS OF TEXT/QUOTE	CODE	Selective category/conception
MN_1	<i>'What sets us apart is the fact that, instead of just responding to the brief, we will go all the way back to what is the core aim of what the client is asking for.'</i>	Establishing and satisfying needs	Problem solving
RB_5	<i>'this kind of out-of-the box thinking, the ability to understand a need and then to translate the need into something'</i>	Lateral understanding of the problem area	Need finding
MN_1	<i>'We obviously have to take into consideration all things as a designer, social things, the aesthetics and how things work. It is very much this under-defined very broad way of</i>	Systems understanding-broad way of looking at a problem	Design ability

	<i>looking at things. Trying to look at things from more than one angle...'</i>		
CP_2	<i>'Understanding the customer is the main thing to making something that's useful.'</i>	Human purpose and need informs usability	Customer/user led
MN_1	<i>'Looking at things from not only the technical side but perhaps how aesthetics would affect how people interact with things or how people's background would affect how people interact with something and the actual object effect, how people interact with it.'</i>	Consideration for the social background and interaction of the customer/user	Cultural associations
EB_6	<i>'I think that, in order to really be able to embrace Design Thinking, you have to be able to be curious. You've got to be able to go "Oh, ok. I wonder why..." and that's where it starts with the prototype- iterate- prototype-iterate process.'</i>	Generating and constructing the problem	Generative
JVN_7	<i>'So you make prototypes and you get user feedback and you iterate, iterate, iterate, iterate.'</i>	Feedback and measurement cycles (cycles of improvement)	Iteration
RB_5	<i>'this kind of out-of-the box thinking, the ability to understand a need and then to translate the need into something, the ability to prototype, the ability to test, all of the skills'</i>	Creating measures and preparing for feedback	Prototyping
VM_3	<i>'For me it's listening to your end-user and being able to test the hypothesis and the change. You could say that is Design Thinking. You could say that is good business. You could say that's lean start-up stuff. You could say that it's a scientific method.'</i>	Proof of concept Feedback method from customer/user	Testing
EB_6	<i>'I don't think I ever mentioned the word. Maybe I did. For me the Design Thinking that is used just informs everything. If you had to speak to them about what you are doing around design: that's what we do. But we don't call it that. We definitely take it from the self; I need to generate and take this on myself, I need to co-create, I need to work with other.'</i>	Working with others Peer learning	Co-create

Tables 3.12 and 3.13 in the following pages, represent the example of the coding addressing sub-question 3. These table's are also represented from the coding done in Atlas.ti and category matrix developed that addresses the analysis Phase B in sub-question 3 (also see Appendix E for further examples).

Table 3.12: An example of coding the data to the categorisation matrix for the human rule in sub-question 3

	Human Centric	Empathy	Multi-disciplinary	Teamwork
Human rule	<p>Human centric by serving the needs of the customer Human centric by empowering the employees of an organisation Human centric is about hiring the right people Human centric has a strong relationship with empathy Human centric by looking after customers Human centric by aspiring to what you do Human centric as a means to engaging with customer</p>	<p>Empathy is researching the unmet needs of the customer Empathy is employing responsibility in the employee of the company Empathy as a holistic understanding of someone Empathy as a scope to question assumptions Empathy as allowing colleagues to try new things in the company Empathy as autonomy Empathy as establishing customer relationships Empathy as holistic to the company Empathy as listening Empathy as responsibility Empathy as the ability to challenge Empathy as user role playing Empathy builds employee dedication to business Empathy by touching people's aspirations Empathy by understanding what customers want and need Empathy can move into other avenues of the company Empathy created through experience of the product Empathy drives customer's unmet needs Empathy is for a nice customer segment Empathy with customer drives product quality Empathy refines quality Empathy requires research Empathy consequently improves employee satisfaction Empathy through customer's touch with product Empathy through the aesthetics of the product Empathy as a means to facilitate communication with the user</p>	<p>Multi-disciplinary work brings a broad set of views to a task that solves a problem for the customer Multidisciplinary bringing a broad set of disciplines to task Multi-disciplinary work broadens the scope of projects in the company Multidisciplinary means leadership different levels of the company Multidisciplinary with specialists Multidisciplinary as resource</p>	<p>Teamwork takes the development further than one would have imagined oneself. Teamwork builds internal company relationships Teamwork facilitates different input and refinement Teamwork of specialist and generalists structure forms a stronger whole Teamwork takes it further than you would have imagined your self Teamwork as cross functional Team work refers to collaborative input</p>

Table 3.13: An example of the categorisation matrix based on the human rule in sub-question 3

RES	MAIN CATEGORY	QUOTE	CODES	EMERGING SUB-CATEGORIES	RELATIONAL BUSINESS MODEL BUILDING BLOCK CATEGORY
CP_2	Human centric	People are quite understanding, because we had stitches come loose before, but because you are quite open with your business, where it is an artisan kind of craft business, these kind of customers don't say 'Ah' my thing broke, they say.... ah don't worry if you only send me a little rivet to NY I'll be happy and then you just send one, it's easy like that.	Human centric by having personal contact with the customer	Customer relationship management Personal contact	Customer Relationships Personal assistance
CP_2	Human centric	We took the harder route, not by choice, because we had to. We took the manufacturing under our roof, design everything, so PR, literally everything, except making the actual fabric to make the leather, is done in house, but it does give us complete control over our product, we know how to, because we own our stores, we have one in the biscuit mill and the watershed store and we have a store in Berlin opening up. So the best people that can give an experience of a product are the people that own the store.	Human centric through personal experience of product	Customer relationship management Personal assistance Customer retention	Customer relationships Personal assistance Channels Own stores
VM_3	Human centric	So I think as a company we are very much led by that, I don't think it starts with product development, to be honest, I think it starts with hiring; it starts from the kind of people you get to work on a problem, need to be people who care, I think it starts there.	Human centric by valuing employees	Employee relationship management Nurturing employee values Motivated team to work on problem	Key resources Human

3.10.4 Data analysis software: Atlas.ti

Despite the relatively small scale of this project, Atlas.ti was very useful in managing the documents, quotations, codes and memos. The software helped in a variety of ways, but particularly in creating groups and also to present an enumerative data analysis of the I. Each question was managed in separate projects on Atals.ti. This meant that data sources in relation to the questions could be managed, with the intention of directing the outcomes.

3.11 SHORTCOMINGS AND POSSIBLE SOURCES OF ERROR

We must take into account that Design Thinking has been considered to be under-defined and subjective in its theoretical grounding. So the quality of the interpretation is based on the researcher's knowledge to be able to identify suitable descriptions and relationships. Therefore, my knowledge of Design Thinking and understanding meanings of particular terms prior to analysis were important.

Some of the following observations came through in the methodology:

- Some of the questions have more evidence backing them than other questions
- Some of the data sources may have also come across incomplete
- Piloting was part of the research process; therefore, the first case study interviews went through some change of improvement and directness in the course of the interviews
- Some questions came across as leading in the interviews
- Separation of the data sets created some ambiguity between them

3.12 ETHICS

Due to the nature of the study, especially in terms of the business relations and the competitiveness amongst enterprises, much of the data analysis may be sensitive to the enterprise's intellectual property (Sekaran & Bougie, 2013). Businesses are also reluctant to release business performance figures, such as profit/losses or give away key management ideals and methods. The project, was therefore, careful in the way it obtained the participants' informed consent before these were included in the study. This will also have to be considered when it comes to the publication of the individual's data capture. In all cases,

the researcher honours the participants' desires for the non-disclosure of sensitive information. In this case the anonymity or an appropriate ascription of authorship and publication were requested from the participant. Each informant signed and gave consent stating the following stipulations:

- My image may be used in both the thesis and in research publications
- My name may be used in both the thesis and in research publications
- My exact words may be used in both the thesis and in research publications
- Any other data that I provide may be used in both the thesis and in research publications

With a wide range of stakeholders contributing to this research, the ethical considerations will be taken into account at every level, as described by the set of principles by Sekaran and Bougie (2013) in Table 15 below.

Table 3.14: Ethical considerations (Sekaran & Bougie, 2013)

Informant	Researcher
A requirement prior to research will be a signed consent form (see Appendix 1) in order to continue with the research.	Developing the form and ensuring that the data collection and interpretation is not biased .
Potential informants are not compelled to participate in the study.	Appropriate methodology used when conducting the study.
The research component will discontinue if it creates a conflict of interest with the participant, informant, or subject.	The researcher upholds and accepts the code of ethics .
Realistic schedules and adequate notification will be arranged prior to the action research.	
	The research will comply with the ethical standards and respect intellectual property of the university's code of ethics.

In addition to the above, the FID Research Ethics Review Checklist was completed before commencing with the research. See Appendix A for a copy.

4 CHAPTER FOUR: DATA ANALYSIS AND DISCUSSION OF FINDINGS

4.1 INTRODUCTION

This chapter presents research findings and a discussion with respect to the perspectives of Design Thinking, features of an industrial design business model and the application of Design Thinking by industrial design related business models.

4.1.1 Summary of the sections

The chapter is structured in such a way as to address the above. It presents the data analysis and summarised findings to address the three main sub-questions of this study in the following manner:

- **Sub-question 1 is answered in Section 4.2 (Current perspectives and conceptions of Design Thinking)**

This question aims to describe different perspectives of Design Thinking. These include the views identified in the industrial design business cases, in industrial design education, as well as those held by consultants practicing and teaching Design Thinking. Presenting two discourses touched upon by different views of Design Thinking by participants. It also studies the various conceptions that emerged in order to give meaning to Design Thinking and discusses the interdependency and logic of how these conceptions are related.

- **Sub-question 2 in Section 4.3 (Industrial design related business models)**

This section introduces the cases in their context and describes each business model according to the 'business model canvas' framework developed by Osterwalder and Pigneur (2010). It presents aspects of the conceptualisation and the which underpins each individual case. Similarities and differences across cases are discussed.

- **Sub-question 3 in Section 4.4 (The application of Design Thinking in industrial design related business's)**

This section describes how Design Thinking is being applied by each case through the lens of the Design Thinking rules and points out their relationships with the business model components.

4.1.2 Overview of the results

Qualitative content analysis is the primary analysis method used to gain insight into the semi structured and open-ended responses addressing sub-questions 1 and 3. Overall, the coding procedure of content analyses resulted in 500 codes. Approximately a hundred codes were introduced in the open coding stages, and two hundred category-based (directed) codes in sub-question 3. The latter were then grouped. In section 4.3 the business model categories went through a selective and comparative process of analysis. In section 4.4 each major concept the associated concepts are presented in tables. With regard to the business model building blocks (business model canvas), not all categories were confirmed.

The aim of this structure is to create a premise for the findings, therefore based on the separate data sets presented in the data analysis in Chapter 3. As an addition, the context of each case is also introduced.

4.2 CURRENT PERSPECTIVES AND CONCEPTIONS OF DESIGN THINKING

4.2.1 Introduction

This section presents research findings based on the data collected from both the Case Study and Expert sample groups, providing primary information for sub-question 1. It presents perspectives on Design Thinking, as well as various descriptions of the concept. Therefore, this section addresses the question:

What are the different perspectives and conceptions of Design Thinking which practitioners in Cape Town embrace?

During the analysis and while extracting perspectives on the Design Thinking phenomena, the following two perspectives emerged from the data:

- Design Thinking from the perspective of a 'design discourse'

- Design Thinking from the perspective of a 'business discourse'

The first perspective is derived predominantly from the perception of design at the work practice level. As a disciplined methodology for developing new products and services, this is the space in which industrial design feels more comfortable. In comparison, the second perspective is derived from a contemporary viewpoint, in which Design Thinking is a way of problem solving at an organisational level and can be intrinsic to the overall culture of the organisation. This means that design is not just looked at as an external resource, such as industrial design to develop the product and services. But Design Thinking is embedded in the organisational culture. This viewpoint is more aligned with the literature which claims that Design Thinking is an organisational (business) resource. To avoid confusion, one needs to keep in mind that these two perspectives are not independent of each other, especially because of the changing role of industrial design, the profession having moved into the service and systems space. Also, it must be considered that industrial design entrepreneurs, managing their own business, take on roles which require competencies and knowledge different to those taught in industrial design. For example, Nicolson, has an industrial design background, but no formal business education. His roles, once he had started his own business, include both business and design management. This is also a reason why the cases were chosen on this basis; namely, to understand more about industrial design entrepreneurship and the role of Design Thinking in these companies.

The second phase of the analysis was to understand the various conceptions with regard to Design Thinking. This differs from understanding the different perspectives; it aims to understand the notions that make up the concept of Design Thinking. The first part of the interviews inquired about people's understanding of Design Thinking and the respondents answers informed the following emerging categories:

- Design Thinking involves 'problem solving'
- Design Thinking requires 'design ability'
- Design Thinking is both 'user and customer led'
- Design Thinking has 'cultural associations'
- Design Thinking is a 'generative process'
- Design Thinking gains feedback by means of 'prototyping'
- Design Thinking mitigates through 'testing'
- Design Thinking calls for 'co-creation'

Section 4.2.4. will further elaborate on the above conceptions and following this section 4.2.2 and 4.2.3 will discuss perspectives of Design Thinking in more detail.

4.2.2 Design Thinking in the design discourse

4.2.2.1 The professional practice of industrial design

In the design discourse, Design Thinking has always been viewed from the perspective of professional practice. It is derived from the practice of the designer and the disciplined approach to developing products, such as industrial or graphic design. This perspective is concerned with the general consensus of Design Thinking. For example in industrial design, Design Thinking has a purpose to develop pragmatic products that are user friendly. Peterson describes this in the following statement:

'I think a designer has to make something that works for another person. I mean successful things are not just beautiful products, but beautiful products that can be used.'

Here Peterson expresses Design Thinking as being a problem solving space, in which the designer is designing for a particular purpose. This purpose is to create something that satisfies another person's (the customer's) need or desire and has a certain value for the person for whom it is being designed. All the respondents describe Design Thinking in relation to problem solving, the latter coming across as the essence of the reasoning behind Design Thinking and capturing the concept for its ultimate purpose. Nicolson, in the following statement, explains and compares his thinking to that of an engineer. He likens a designer's approach to a systems approach on which he elaborates in the following statement:

'It's the way that you approach a problem from many different aspects. For example, an engineer would come from an analytical point of view of what doesn't work and planning around that. We obviously have to take into consideration all things as an industrial designer, social things, the aesthetics and how things work. It is very much this under-defined very broad way of looking at things. Trying to look at things from more than one angle'

The way in which a problem is approached is what distinguishes industrial design from other professions. The industrial designer has to consider various socio-technical aspects. Nicolson describes his competences as a generalist approach to solving problems: he emphasises the understanding of social aspects, as well as the importance of being pragmatic at the same time. All case respondents perceive Design Thinking from a product design perspective.

4.2.3 Design Thinking in the business discourse

4.2.3.1 Changing role of industrial design

According to Van Niekerk, there has been an increased emphasis on taking a generative approach at CPUT by adopting and considering aspects that go beyond the product design itself, such as the services and systems to increase the viable of the products. The systems approach can mean that the designer has to stretch themselves further, to even consider the business model to be viable. The 5k Project in the B Tech year of industrial design also takes a generative approach in business development, addressing human dynamics, human psychology and sustainable processes. Van Niekerk, believes 'the lines between disciplines are becoming permeable', and are crossing over into each other. He explains this in the following statement:

'It just so happened that they have moved into the non-product space, where industrial design used to be product only, but now it has relationships with the product- service system'.

No one can ignore the service aspects today, Van Niekerk believes. This movement has come with its own dilemmas, because it takes the focus out of the product space. Consequently, according to Van Niekerk, the B. Tech. course at CPUT could become 'diluted' by business. The course now offers an introductory module to business in the 5K Project, aimed at those students with an entrepreneurial personality trait. Furthermore, he describes the potential of Design Thinking from a perspective of business in the following statement:

'Design Thinking trains the mind to think in ways that allow leaps of logic, and most business training models don't allow for

that. They are quite structured in a linear approach. So the advantage of using a Design Thinking approach is development. The advantage of using a Design Thinking approach in business models... I don't think it can be underestimated'

Van Niekerk, therefore emphasises the important influence of Design Thinking on business models, having stepped outside its normal boundaries, such as what we are seeing in the practice of Industrial design entrepreneurship.

4.2.3.2 Design Thinking as a business resource

Robert Bloom believes that Design Thinking is not a new concept or discipline but, using a more encompassing definition, sees it as a way of solving problems. He believes that the designer needs to start with an open mind in order to be able to emphasise and understand the needs of the user. Traditional businesses employ an analytical problem solving process, without any trial and error, a characteristic of Design Thinking. Bloom elaborates as follows:

'Look at a problem, plan to do something about it, do it, study what you have done, whether it worked or not, and then act, meaning: start again. So all of that is Design Thinking; so all of that is iterations. So what are we? A learning organisation? OR (!) We need to sometimes pivot; we need to learn how to experiment, and we need to learn how to give people autonomy. So without those things, dealing with people, the way we go about change and the space and time we give for the organisation to learn.'

In the above statement, Bloom explains how organisations can potentially take the best possible direction they think appropriate through iteration, experimenting and autonomy to reach a solution. The iterations form a sequence of learning stages for the organisation. His perspective on Design Thinking, therefore is that an organisation can use it to even improve internal business processes and organisational structures.

4.2.4 Emergent conceptions of Design Thinking

The overview of the conceptions of Design Thinking is given in Table 4.1 and is explicitly aimed at describing the various perceptions of Design Thinking and what the concept means to the respondents.

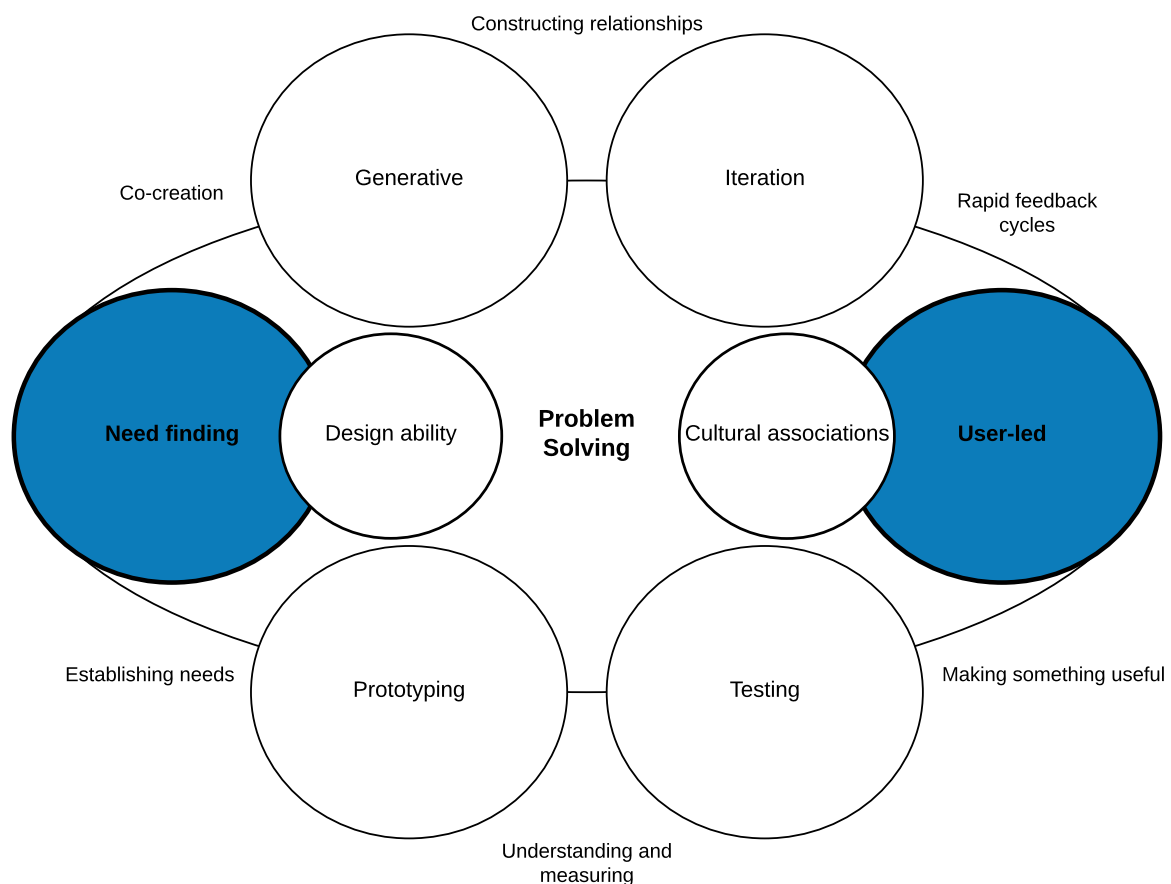


Figure 4.1: The positioning of the interdependent conceptions from the respondents interviews (Author's construct)

The overview presents aspects and varied conceptions of Design Thinking. It highlights the positions of both the needs and the end-user. The designer establishes the needs to solve the problem for the customer, and the user/customer informs the needs that address and construct formations as solutions. The customers' needs are influenced by certain cultural associations. These needs are then translated into forms through constructive and generative approaches methods, such as iterative development, prototyping and testing. The conceptions are explained in greater detail here below.

4.2.4.1 Problem solving

Problem solving is a common thread throughout the respondents' descriptions and has direct relationships with other themes. The respondents also spoke about problem solving in different scenarios. Nicolson perceives generating ideas as part of responding to the brief as, ultimately, the brief is the problem with which designers are represented. Bloom describes Design Thinking as the ability to identify the need which underlies a problem, and then to translate that need in order to solve the problem. Peterson emphasises that the main aim is to design something that works in comparison to what may be aesthetically pleasing:

'I think a designer has to make something what works for another person. I mean, successful things are not just beautiful products, but beautiful products that can be used.'

Sometimes the solution to a problem is supported by various inputs from different skills and resources. During the start-up stages of the business, Monadjem and his team had to design and develop a transaction terminal and make sure that the infrastructure would support this. As he put it:

'We had a lot of work to do, creating a transaction terminal that would work in this environment and a back-end system that could accommodate this kind of transaction.'

Monadjem also describes solutions as accommodations that address the problem. Therefore, there is a network and system that has to be designed to solve the problem, and this would involve various inputs when establishing the needs out of which the problem arises, and then addressing it to come to a solution that best fits the main objective.

4.2.4.2 Need finding

On a general level, the conception of need finding starts when a designer establishes needs in the problem area. Various other methods and processes are then employed to translate the needs into something that responds to the user.

'this kind of out-of-the box thinking, the ability to understand a need and then to translate the need into something'

Monadjem describes a method of listening to and identifying the needs of the user. Listening is interpreted as a form of research that the designer employs to retrieve information in order to construct something which responds to that need. Monadjem explains:

'For me, it's listening to your end-user and being able to test the hypothesis and the change. You could say that is Design Thinking. You could say that is good business. You could say that's lean start-up stuff. You could say that it's a scientific method.'

In the above statement, Monadjem explains that part of need finding process is also testing your hypothesis, once you have proposed a solution to a need. This feedback will furthermore inform what other needs that can be addressed.

4.2.4.3 Designer's ability

An important aspect of designing is the designer's know-how: the designer is the one who has the knowledge of how to approach the problem. Peterson explains:

'We obviously have to take into consideration all things as a designer, social things, the aesthetics and how things work.'

This interpretation necessitates that designers take a systems approach during the design process. Considering the various aspects and relationships is what sets them apart from an engineer, for example. This is not to say that engineers do not think in systems, but rather that industrial designers have to think of social factors, which can require approaching the problem holistically. The systems approach involves identifying certain considerations in the problem formulation and then seeking to establish connections among them in order to arrive at the solution. This complexity presents itself in contexts in which social and pragmatic aspects need to be considered to generate plausible solutions.

Another key feature of the 'designer's ability' conception is to be curious. In the following statement, Brumboll explains how curiosity is about challenging one's belief system.

'They say curiosity emerges when you are confronted with something that is different to how you see it. So when something in the world challenges your belief system, you have two options: you can either go "Oh, wow! That is interesting." That's curiosity. Or you go "That's rubbish!" and shut it down - and that's judgment, and I think that in order to really be able to embrace Design Thinking, you have to be able to be curious.'

Ultimately, if a designer starts off with an exploratory approach, rather than a known approach, s/he is likely to discover something new. 'This curiosity at the start means that the chances of a return with the familiar are less' (Cross, 2011). This approach requires certain capabilities and an understanding of how a design problem should be dealt with. This takes one back to Bloom's notion of 'out-of-the box' thinking.

4.2.4.4 Customer and user led

Industrial designers have to contend with problem solving in the socio-technical field; therefore, the needs are driven by either the user or the customer. Nicolson experiences this when his team is responding to a design brief, and they might not even know who the users are; however, they have to satisfy the customers' needs by wearing the hat of the user. The distinction between the concept of 'user led' and 'customer led' arose when it became clear that the user and customer may have different needs. This means that the customer might not necessarily use the product that has been designed. Nicolson describes this scenario in the following manner:

'What sets us apart is the fact that, instead of just responding to the brief, we will go all the way back to what is the core aim of what the client is asking for. Like, for instance, we just gotten a brief to design some tables for a market at Spier, for instance. So, instead of just responding to the brief which was making a kiff ply flat packable table, we've gone all the way back and thought "How is this market actually going to function?" You know. How people are going to interact with the store holders; so trying to take it all the way back.'

In the above statement the solution/s at hand need to be in line with the client brief, the customer in this case. The user needs may need to be addressed as well to make sure that the brief is met. Because Design Thinking has a greater affiliation with business, the term 'customer-led' seems to be more relevant to business managers or entrepreneurs than for industrial design professionals who are more focused on the user when designing a product. If we relate this back to the two discourses of design and business discussed in Section 3.3.2 and 3.3.4, then design associates with 'user-led' and business with 'customer-led'. However, this does not always seem to be the case.

4.2.4.5 Cultural associations

The cultural association conception emerged from the social connotation of Design Thinking and is a reason why a certain cultural knowledge is important. The attention to aesthetics was a common code with all the industrial design respondents, especially because they are involved in developing products, and the aesthetic resonates through their style, a style that needs to appeal to others. However, aesthetics was spoken about outside the product sense; it was explained in terms of marketing and the systems involved. Here we see another reference to the business perspective of Design Thinking. Whereby the values and process's, what is described by Peterson as style comes through in the way the business is run throughout and the culture of the organisation is an important aspect of this. These include the approach to marketing which is affiliated with the company's brand, a reflection of the organisations culture. Peterson states:

'We have to make sure that there is an overall aesthetic standard kept in the software, in the marketing, in the actual system.'

Another perception is presented by Nicolson who referenced the cultural aspects as the way the designers think, and this informs their style which can feed into other projects. This means that he applies Design Thinking during technical and production development, but he emphasises that aesthetics would affect how users would interact with objects (also related to the user- and customer-led conception). Furthermore, people's background would also affect how they perceive an object and interact with it – the cultural association. In addition, it also means that values are considered from both the designer's and the user's perspectives. The user is seeking to resonate with the designer's style, and the design is shaping the flow

of work around the needs of the user. These needs are culture specific; in the case of a product or even the organisation, beauty will depend on the cultural associations.

4.2.4.6 Generative

The 'generative' conception was consistent throughout the data produced by the respondents. Monadjem's association with the concept of generative related to activities such as ideation and need finding. Peterson and Brumboll also spoke about foresight methods. Nicolson referred to lateral thinking, in connection with the way in which a brief should be questioned and the ability to be curious by taking a different path. Brumboll says the following:

'I think that in order to really be able to embrace Design Thinking, you have to be able to be curious. You've got to be able to go "Oh okay. I wonder why." and that's where it starts with the prototype-iterate-prototype-iterate process'

Her statement represents a generative process, as each iteration is a generative instance of the previous one. This statement takes us back to the idea of 'curious' which is a code of the 'design ability' conception: it speaks of the process of being curious and generating by referencing the experiences that come with curiosity.

4.2.4.7 Iteration

Not surprisingly, one of the most frequently quoted categories is iteration which also has strong ties with the generative category. Monadjem spoke of rapid feedback cycles as a method to elicit a response from the user. These are all cycles that involve a series of iterations for improvement, a key feature of the design process. Van Niekerk also explains the process of iteration as a method for obtaining feedback when he says:

'So you make prototypes and you get user feedback and you iterate, iterate, iterate, iterate.'

This would mean that the process of generating concepts or prototypes to gain feedback in order to measure the strengths and weakness of the product are important for further improvement and a final solution/s to the problem. Furthermore, Monadjem highlights in the

following statement that iteration is a rapid feedback cycle and sees this as a contemporary approach spilling over into technical fields.

'It does definitely seem, that especially the modern process software being very agile, and how that's spilling over into other technical fields, of this idea of iterative development, user methods development, of kind of rapid feedback cycles.'

It becomes apparent that iteration is the continuous cycle of improvement - the cycle of needs analysis and solution construction.

4.2.4.8 Prototyping

The industrial designers discussed the construction of physical objects in order to test them by noting the users' reactions and then refining them. The prototype, in their case, is a tool to achieve the final outcome (the desired object) by having an object that the designer can measure against, to make a refinement. Monadjem described the design process that relates to prototyping and testing as a way to elicit reactions.

'So then we potentially did a beta with taxi drivers and retailers and security guards and schools kids to try getting a broad mix of reactions. There were multiple cycles like this that we refined and target market, we refined our role in the value chain, whether we are the core wallets in the payment space.'

In practice, the iteration, prototyping and testing ultimately resulted in a learning process with regard to improving the product. In essence all these actions are related to the 'problem solving' category, and should thus constitute a higher order category. Prototyping shares a similar reasoning to the 'iteration' conception, whereby it is notion and method to gain feedback.

4.2.4.9 Testing

Testing was interpreted as an analytical method of testing objectives. The core application of Design Thinking is the feedback from the user. Testing also has a clear connection with prototyping because, in the product context, prototypes are developed to test the usability,

for example. An important feature of this process, highlighted by Brumboll in her interview, is that one challenges one's assumptions of what the prototype might do by testing it with the user. Monadjem also confirmed that testing is very much a user method that entails a prototype or an object. Furthermore, Bloom described prototyping in the following statement:

'This kind of out-of-the box thinking, the ability to understand a need and then to translate the need into something, the ability to prototype, the ability to test'

Another interesting reference to testing as a notion of Design Thinking is that it enables the designer to prove his/her concept; therefore, it is a technique to justify the design - a 'proof of concept'. Monadjem refers to this in the service development context and suggests that a way to do this was to facilitate a workshop with the user.

4.2.4.10 Co-creation

This last conception, described as collaboration and teamwork, is a normative term in Design Thinking literature. Brumboll's view is that Design Thinking informs everything:

'Design Thinking that is used, just informs everything. If you had to speak to them about what you are doing around design, that's what we do, but we don't call it that. We definitely take it from the self. I need to generate and take this on myself, I need to co-create, I need to work with others. So it kind of informs everything.'

Brumboll insists that co-creation is important and that designers need to work with one another. One of the reasons why she finds it important is that peer-learning is an aspect of Design Thinking:

'The whole peer-learning network where one learns from one another and really supports one another is important.'

Co-creation was not frequently referenced within the sample of data. However, the case study respondents described their roles in the company, and these roles required

collaboration and multi-disciplinary teamwork for the type of projects on which they were working.

4.2.5 Discussion

After having interpreted a selection of conceptions based on the evidence, it became clear that Design Thinking is a problem solving concept (as stated by all the respondents), i.e all of Design Thinking is problem solving. Problem solving is inter-related with the other conceptions presented, which all support the analysis and synthesis (Dubberly, 2008) of the design process to reach an output. In this discussion, the conceptions are positioned to make logical inferences, using the Dubberly (2008) model of the design process (Figure 4.2).

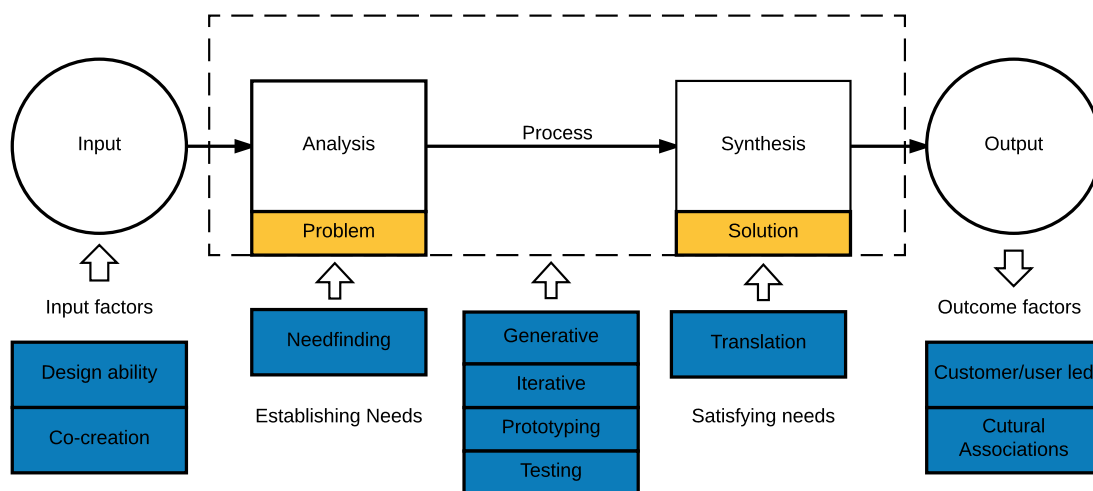


Figure 4.2: Inferences of the emergent Design Thinking conceptions, in relation to the Dubberly logic model (Authors' construct)

Before any solutions can be identified, a process of problem construction takes place. This involves establishing needs (a descriptive conception of need finding through analysis), and these are then translated through generating, prototyping and testing in order to synthesise solution spaces as an output of the activities. This process of shifting to and fro between the required purpose and the needs, and developing appropriate forms, through to prototyping is also known as abductive thinking (Cross, 2011:27). Abductive thinking requires both a combination of deductive and inductive logic. The process involves narrowing down the range of solutions induced (Cross, 2011).

Other than the conceptions identified above, the findings also lent towards another perspective from respondent feeling that Design Thinking is under-defined and that the intersections are blurred and this was apparent in the response from each respondent. The concepts that emerged in this section are all synonymous with the normative description of Design Thinking in literature and also echo relationships with the d-school Design Thinking rules. For example, 'user-led' can refer to the human rule. However, the purpose of this question was not to validate the d-school concept but rather to develop an understanding of what Design Thinking means to designers by means of open-answer responses and open coding. The question also demonstrated the key responses that describe the conceptions.

What was also interesting in the analysis was that collaboration or teamwork was not expressed as a key concept for Design Thinking. Even though the companies collaborate with others when applying Design Thinking, they did not all express the co-creation conception in the terminology the respondents used to describe this phenomenon. However, the experts did express co-create as an important trait.

4.3 INDUSTRIAL DESIGN BUSINESS MODELS

4.3.1 Introduction

This section presents research findings from the business model canvas workshop. For the purpose of recall, this section addresses the question:

What are the features of business models in an applied context of industrial design?

The context and some background are introduced in each case, followed by mapping the business model of each case. Naturally, each business has its own features and the business model canvas serves as a tool to be able to describe and differentiate between cases. The business model canvas worked well as an instrument to understand, on a broader level, all the dynamics between the various resources and the constituent parts of the company, such as their partners or the way the business reaches its customers. The aim of the exercise was not to identify appropriate futures but rather to understand and describe a once-off picture of the business model ontology (conceptualisation of domain); through the applied context it also painted a broad picture of the design industry itself.

The Table 4.1 represents the variables in this section, underpinning the main categories and sub-categories that build descriptions of the business model based on the concept by Osterwalder and Pigneur (2010).

Table 4.1: Business model building blocks main-categories and sub-categories (Osterwalder & Pigneur, 2010)

Main categories (from literature)	Sub-categories (from literature)
Value proposition	newness, performance, customisation, “Getting the job done”, design, brand/status, price, cost reduction, accessibility, convenience
Key activities	production, problem solving, platform/network,
Key partners	partners, suppliers, key resources
Key resources	physical, intellectual (brand patents), human, financial
Customer relationships	personal Assistance, self Service, automated services, co-creation
Key channels	awareness, direct, online Store, retail & whole sale, social networks, partner
Customer segments	mass market, niche market, segmented, diversified, multi-sided platform
Costing	asset sale, usage fee, subscription, lending, renting/leasing, broker fee, advertising
Revenue	cost driven or value driven, fixed costs, economy of scale, economy of scope

4.3.2 Business case: *Thinking*

4.3.2.1 Introduction

Having graduated with degree in Industrial design at CPUT, and after a successful career in the respective companies in which they worked, Marc Nicolson and Lyall Sprong founded Thinking in 2009. The company is a creative consultancy that provides creative solutions and services to the advertising industry. In a broad sense, the company’s value proposition is expressed in the following quote from their website:

‘We work with things and ideas of expression and problem solving. Our aim is to create work that increasingly reflects a deeper sense of place and understanding.’

During a design intervention, a project they were commissioned to take on during the early days of their business, a newspaper article acknowledged their work for ‘making things better’. The significance of their input to the project was that they used a particularly modest budget to improve a specific environment, not only to meet the needs of the users, but also to create, through their work, a sense of inspiration within the community. The publications that have been written about Thinking include sources from *Visi* magazine, *Weekend Argus* and the *Mail & Guardian* newspapers. The company has also won several Loeries,

Bookmarks and FWA awards, as well as the most creative stand at Design Indaba Expo 2013. They are also collaborating with an initiative of the British Council's Connect ZA Maker Library. These publications and partnerships represent their active role in the design industry.

Nicolson and Sprong have experienced a continuum of Design Thinking throughout their studies and some of their career, which they apply to the projects they do. Figure 3.3 presents a creative project they did for Bos Ice Tea, on their website it says they were asked to make it possible to trigger a sound or loop whenever a drink was dispensed and link this sound to a physical element attached to the dispenser. However, the aim of this study is not to demonstrate their portfolio, but rather to understand the nature of Design Thinking and how it has shaped their business.



Figure 4.3: An interactive installation designing a dispenser for Bos Ice Tea (Thinking website)

Table 4.2 gives a brief overview of Thingking's business, a summary of the classification of the business from secondary data.

Table 4.2: Thingking’s business summary

Year launched	2009
Business classification	SME
Offering type	Service innovation
Product and services	Creative installations
Type of industry	Creative Industry
Geographical markets	South Africa

4.3.2.2 Thingking’s business model

Thingking’s business model is almost unique to the industry; there appear to be few creative consultancies like it. According to Nicolson, their customer segment has shifted since they started. Their initial focus during the start-up of the company was a focus on products. Now the company’s main offering is creative installations for advertising companies as part of a service. Their value proposition is the ability to provide new concepts to their clients. Differing from industrial design in bigger product development firms, their focus is not necessarily the design of a product that can be replicated or mass produced for long lasting use, for which industrial design is known. Rather they use their industrial design skills and manufacturing knowledge to design innovative instalments that can be customised, as well as to reduce costs through certain production methods. In a sense they specialise in creative production, which means that the design, implemented by their team as well as their production activities all inform their value proposition.

The following mapping exercise defines Thingking’s business model based on their selection of appropriate terms that describe the different components of the business model.

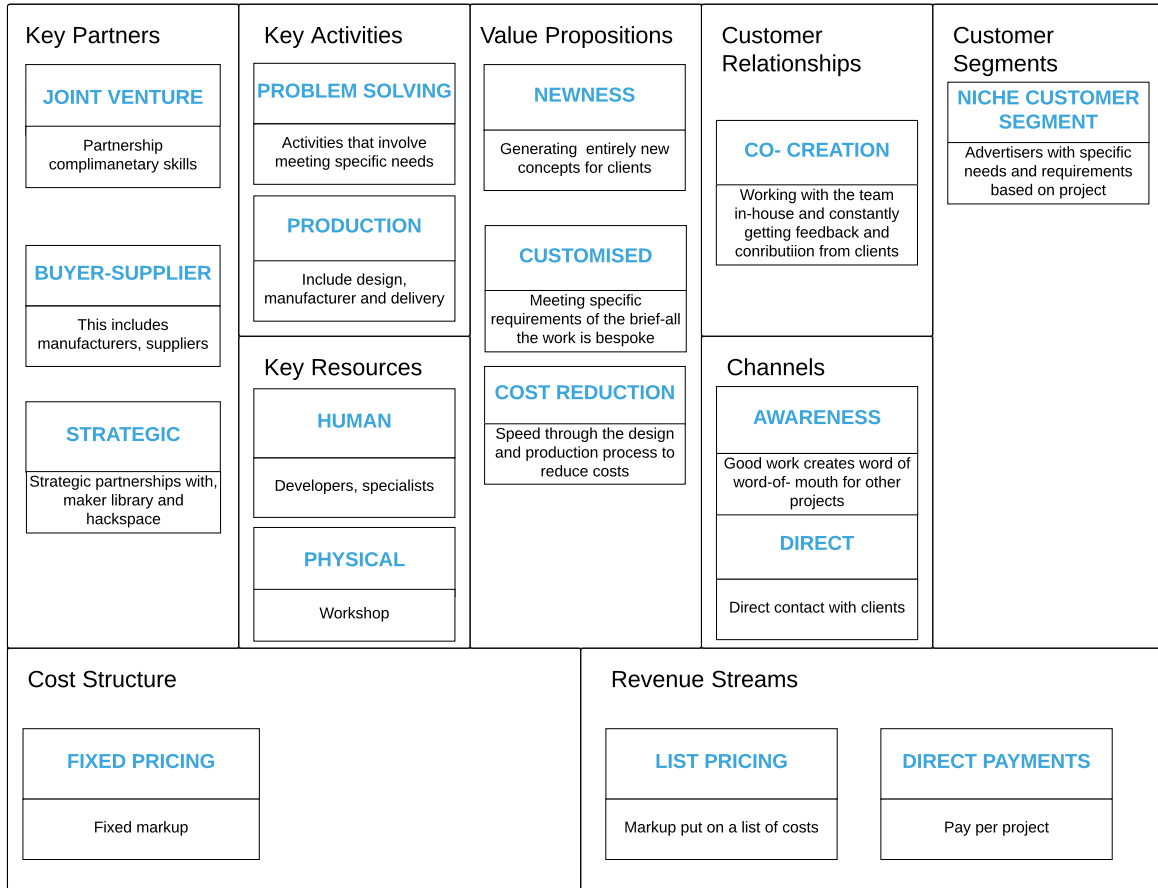


Figure 4.4: Thinking business model showing business model building blocks and the sub-categories, and their descriptions, which were identified from the business model canvas workshop (Author’s Construct)

Value Proposition: Thingking’s business model is primarily focused on problem solving and creativity to materialise concepts or generate new concepts for clients. They offer their clients solutions that address the required needs of the brief. During the business model canvas exercise the sub-categories newness, customised and cost reduction distinguished the value proposition. The company offers its clients customisation, because everything they do is bespoke. Nicolson also highlighted that one of their main value propositions is cost reduction, because they aim to do creative installations at a low cost, a skill acquired through an industrial design production knowledge. The low cost aspect is possible because of certain production techniques and CNC manufacturing which allow for quicker production and installation. What positions Thingking differently to their competition is that they do physical activations with creative thought and under shorter production time, which few other companies are able do.

Customer Relationship: The value chain in which Thingking operates is very small and is limited to South Africa. Therefore, they are able to have a personal connection with their clients/customers. They also have an accessible workshop, so that people know where to find them if they need to approach the company with regard to a problem. One of the core aspects of their business model is the ability to co-create with their clients or customers, as well as collaborate with other creatives who add value to the projects. The company collaborates with clients and partners on projects, and this approach adds value to the projects, service or product offerings.

Channels: The company's main channels are the website and word-of-mouth. They will work on projects that gain momentum through publicity, and this serves as indirect marketing for them. Nicolson says that they do not do any direct marketing, however they have direct contact with their clients and that he is not entirely sure how people became so aware of them. However, he believes that good work can open up other avenues and channels. Consequently, their channels are, in a sense, their brand, created through the sub-category awareness; namely, to be able to show consistency in their work and have a history of successfully completed projects that are innovative.

Customer Segment: The main customer segment that provides revenue to the company is its clients: advertisers, in this case, with specific needs and who require a distinct offering. The value created for the customer segment is the company's ability to provide creative installations or solve problems to meet the requirements of a campaign or project which the clients are running. Because they focus on bespoke instalments, and because the company is still relatively small, it has a niche customer segment. The company also has supplier-buyer relationship (Osterwalder & Pigneur, 2010).

Key Partners: The key partners can be categorised as both internal and external partners. Internally, a strategic partnership was established between the two directors, creating significant value through the complementary skills that both Nicolson and Sprong could contribute to the operations and the value proposition of the company. Externally, Thingking has a vast network of suppliers, such as manufacturers and raw material suppliers, as well as developers who would work on collaborative projects and various specialists who would be employed on contract. The resources that come with these partners in the supply chain are resources that influence the key activities in the business, such as the sub-categories design and production. Design will be sourced from specialists, such as developers and engineers. The production will be supported by particular manufacturing techniques that are

essential to industrial design to bring refinement and lower costs, such as CNC routing and metal bending.

Key Resources: The key resources of the company are the sub-category human resources. The knowledge intensive resources of the company itself support the value proposition, as they have Design Thinking skills that support the creative outputs. However, it also became clear that the skills of the directors are more generalist. In turn, the specialist partners add great value to technological aspects of the production process and outputs. Other resources include sub-category physical resources; the workshop and machinery are there to increase the outputs and allow for cost reduction of their production.

Key Activities: The key activities are driven by the resources that they have and intertwine with the sub-categories design and production. These include all the activities which allow for delivery of the whole project. Production is one of the main activities. However, Nicolson and Sprong also spend much time conceptualising ideas and solutions – which can happen simultaneously with the production.

Cost Structure: Maintaining the human resources salaries and the out-sourced skills, such as suppliers cost constitute the primary costs. Because of the bespoke work they employ, they will mark-up 100% on everything and this will be a fixed markup as it is assumed that the final result of the project will be a first and once-off production. Payments for jobs done are made directly to the suppliers and specialists. Costs come down by 20% if the project requires economies of scale, therefore the contrary to once-off production. For example, a stool which a supplier manufactures, would be CNC routed, and the larger the number of stools required, the less the supplier will charge. However, the 100% mark-up still applies. The company operates a little like a middle man, and some manufacturing will be done in-house to cut costs.

Revenue Streams: The main revenue stream is for the projects completed and the clients/customers will pay directly. Because the business model is more focused on bespoke jobs the revenue amounts differ greatly, depending on the job at hand. In addition, the company does sell individual products on a small scale, these products or projects will make revenue from a list cost.

4.3.3 Business case: *Research Unit*

4.3.3.1 Introduction

Research Unit is a luxury goods brand that focuses on high-end product development in the fashion and apparel industry. The company has been recognised for its growth amongst various media platforms, and it received seed funding from SAB to kick-start the business. The company was co-founded by the married couple, Chad and Erin-Lee Peterson in 2012. The company's diverse team has backgrounds in industrial design, journalism, the arts and fashion retail, and take a distinctive approach to developing processes and products. These products include iPad and iPhone covers, cardholders, wallets, shoppers and clutch bags made primarily from locally sourced leather. Figure 4.5 provides a brief snippet of a sketch by Chad Peterson, the creative director, who was conceptualising and visualising a product developed for the company. The following section will discuss their business model in more depth.

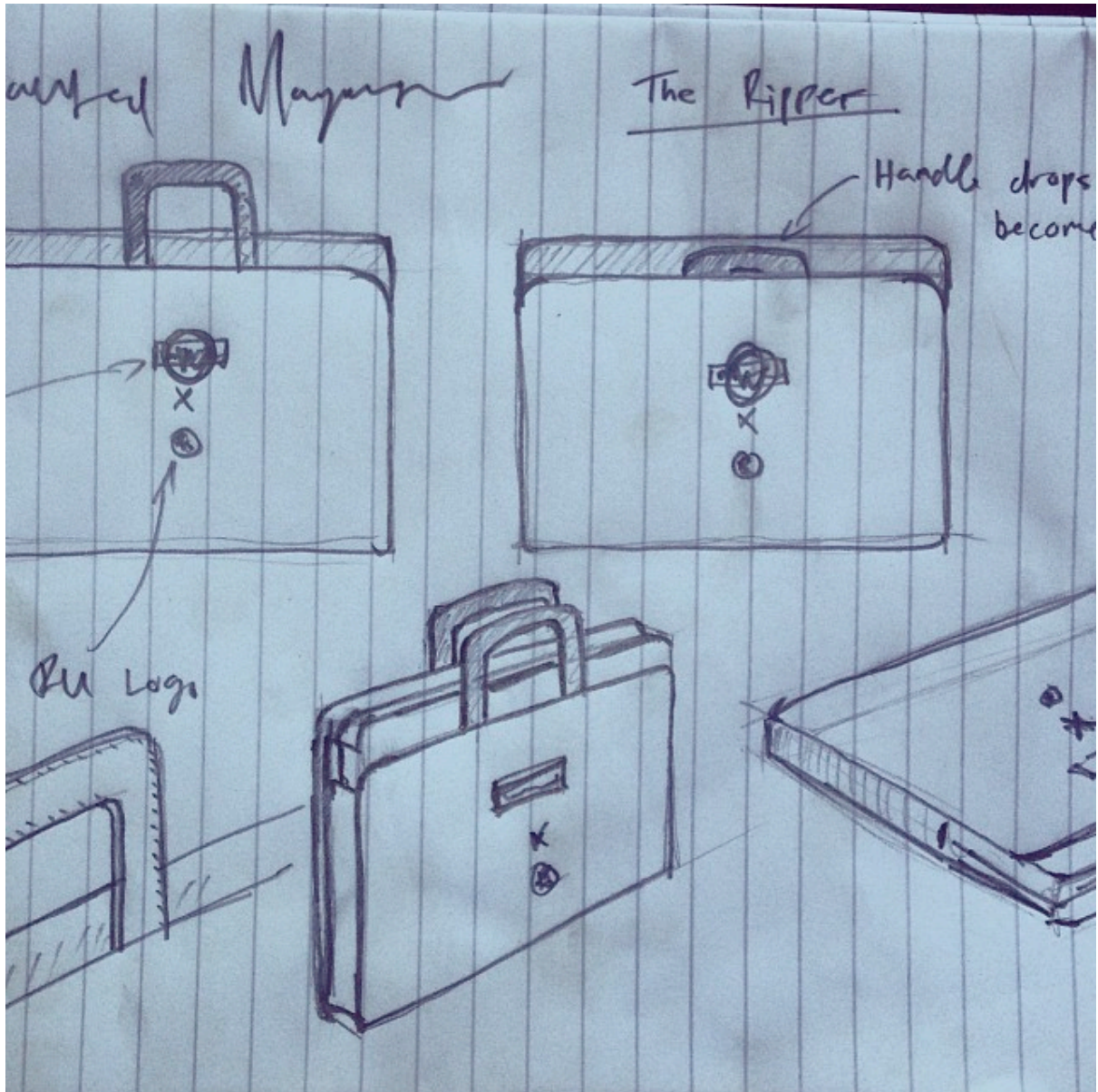


Figure 4.5: A concept drawing from Research Unit (Research Unit website)

Table 4.3 gives a brief overview of Research Unit’s business, a summary of the classification of the business from secondary data.

Table 4.3: Research Unit’s business summary

Year launched	2009
Business classification	SME
Offering type	Product innovation
Product and services	High-end fashion apparel goods
Type of industry	Creative industry
Geographical markets	South Africa, Germany

4.3.3.2 Research Unit's business model

During the business model canvas workshop with Peterson, the following features were identified (Figure 1.9).

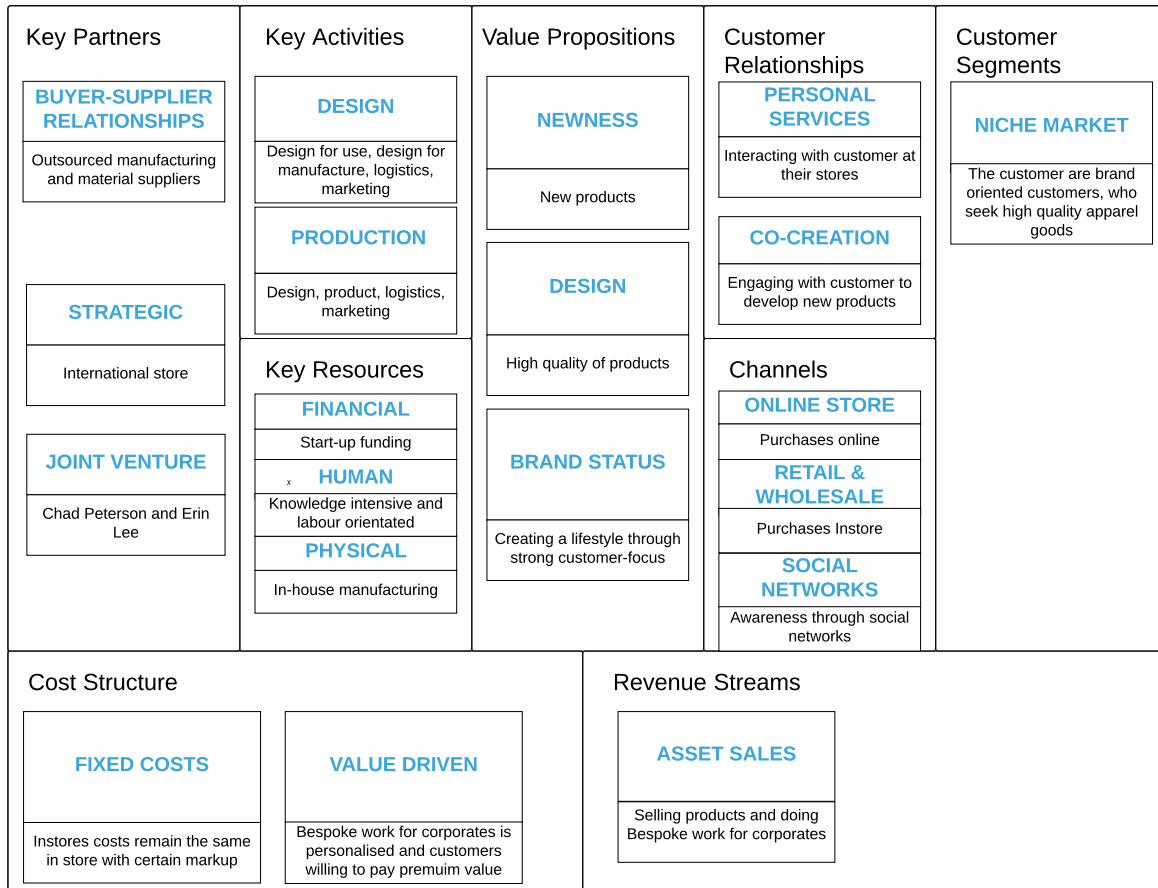


Figure 4.6: Research Unit's business model showing business model building blocks and the sub-categories and their descriptions, which were identified from the business model canvas (Author's Construct)

Value Proposition: The value proposition of Research Unit contains various attributes; however, it holds a simple value proposition that niche business models provide to their customers, and this is distinguished by the sub-category design. Not only does a customer aspire to the unique design of the products, it is by creating a lifestyle that customers aspire through which the company strengthen its brand status. The design also informs the newness of the products which they produce. An important aspect of Research Unit's value proposition is that it differentiates the company from its competitors in the marketing of products of a high quality standard. The performance of the company is also driven by the company's attitude of making sure that the products are accessible to its customer segment.

Customer Relationships: Research Unit uses its stores and outlets as key platforms to create a relationship with its customers. It also tries not to dilute the personal experience by selling their products only through their store; this means that the company's employees have personal contact with the customers. Another aspect is its ability to co-create with the customer. They are constantly putting their design out and trying to get the interests from the customer, their needs and interests and feedback on what they would like.

Channels: The primary channels that Research Unit uses to communicate with customers are social networks. However, the company uses an online store and retail stores to reach the customers. The Berlin flagship store complements their local stores at the V&A Waterfront and the Biscuit Mill. The retail stores support the type of business model which the company aims to have, allowing customers to purchase specific products, but also allowing customers to evaluate the products in person.

Customer Segments: Research Unit has a very much niche market that it satisfies; this comes with the quality and price of the product. Also, because its value proposition is focused on creating a lifestyle, it caters for a niche style that customers will aspire to. The customers have specific needs and are conscious of the brand status that Research Unit creates. These customers' needs are specific because they capture the consumer's cultural values.

Key Partners: A supporting factor in the management of the business are the Petersons' partnership. This strategic partnership was driven by their belief that their skills complement each other, according to Chad Peterson. It has also meant for Chad that he can focus on design management and creative direction. Co-partner Erin Lee has competences in journalism, and this meant that her capabilities in social media and personnel management could be addressed effectively. More recently, the company entered a partnership with two German investors, which resulted in the opening of their flagship store in Germany in 2015. The store is called The Observatory, which sells selected pieces from high-end designers in Cape Town, such as renowned architect Gregore Jenkins and the South African artist, Athi Patra. Even though most of the technical capabilities are kept in-house to maintain the quality, Research Unit has key partnerships with its suppliers of leather and particular production techniques.

Key Resources: Research Unit was given an important boost when South African Breweries Foundation decided to invest some start-up capital in the company. This investment gave it financial flow that allowed growth in certain aspects of the company's human resources and physical assets. The physical resource that Research Unit acquired is the rental of factory for the production of the goods. Research Unit also rents retail outlets in the Cape Town.

Key Activities: Research Unit is involved in various activities. However, the activities that featured most strongly as primary activities were the sub-categories design and production. The design activities were interpreted as problem solving ones: coming up with new solutions that appeal to their customers. Chad Peterson's design knowledge and capabilities are a crucial element in the company's ability to design high-quality products that appeal to a niche market.

Cost Structure: The company has a cost-structure based retail model, which includes fixed costs. This enables the company to cover salaries, rentals, manufacturing, overheads/expenses. The company is also value-driven in terms of its high-quality and more niche-orientated products which appeal to a particular lifestyle. Therefore, the customers are happy to pay more for the product. Mark-ups are high on these products because of the knowledge input.

Revenue Streams: The main source of revenue for Research Unit is the sales of its products, which are considered asset sales. The transaction sales of the company result from one-time customers. For every product sold a mark-up transaction is made. The mark-up is different depending on whether the company is selling retail or wholesale. More personalised services or bespoke work for corporates also brings in a revenue, and are based on asset sales.

4.3.4 Business case: *Nomanini*

4.3.4.1 Introduction

Founded in 2010, 'Nomanini is a South African based mobile Point of Sale service for facilitating cash transactions in informal markets' according to a publication from their website (www.nomanini.com). The point of sale terminal is design to be rugged for informal markets and has a highly scalable, cloud-based backend. Informal Retailers are able to efficiently distribute prepaid mobile, electricity vouchers and facilitate micro-payments in

frontier markets across Africa and beyond. Nomanini, also provides an online platform through which distributors can better manage their stock and agent networks.

Nomanini’s CEO Vahid Monadjem ascribes the success of the company’s business model to the ability to provide valuable, relevant and efficient products at an economic scale. Monadjem, does not have a background in industrial design, but the profession serves as a core component of the product development of the company. Also, the knowledge gained working with industrial designer’s at XYZ Design enabled him to understand crucial aspects of the product design and the NPD process.

Nomanini’s point-of-sale terminal is an industrial design product that has been designed as intuitively as possible and through a design process. The terminal creates value through both a product and service in replacement of scratch cards and offers benefits, such as less time and travel spent on re-stocking scratch cards, as well the avoidance of unreliable networks. Air time or electricity vouchers could be easily purchased at the tap of a button. This value proposition appealed to both the customers, the distributors and the merchants.



Figure 4.7: Manufacturing of the Nomanini devices (Nomanini website)

Table 4.4 gives a brief overview of Nomanini’s business, a summary of the classification of the business from secondary data.

Table 4.4: Nomanini’s business summary

Year launched	2010
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Business classification	SME
Business Model type	Customer relationships/infrastructure
Product and services	Mobile transaction utility platform
Type of industry	ICT industry
Geographical Markets	South Africa, Angola, Kenya

4.3.4.2 Nomanini's business model

During the business model canvas workshop with Monadjem, the following features were identified (See Figure 4.8).

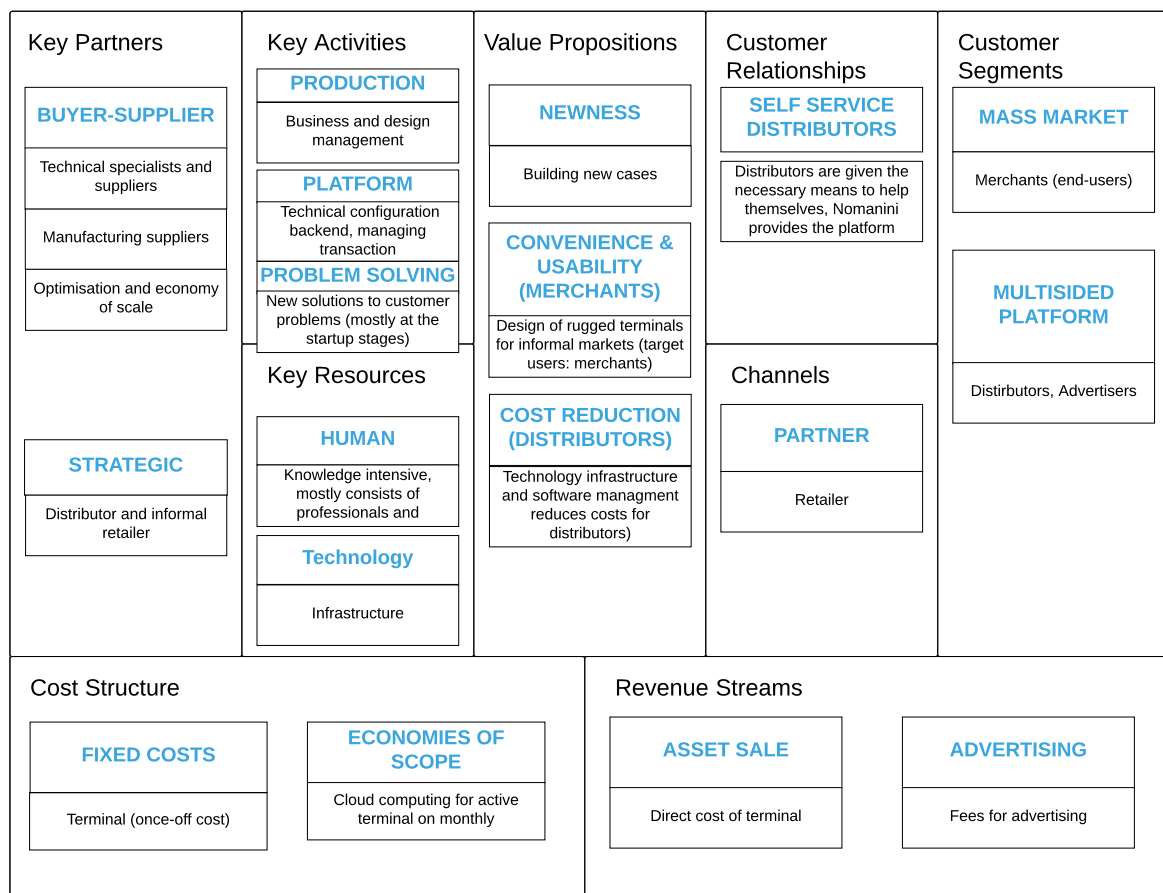


Figure 4.8: Nomanini's business model showing the business model building blocks and the sub-categories, and their description's, which were identified from the business model canvas (Author's Construct)

Customer Value Proposition: In retrospect, Nomanini's main offering is 'enabling rapid, reliable, pre-pay retail' in informal markets. Nomanini's value proposition is not straightforward, because it has a diversified customer segment and various partners that

make up the business model. The rugged terminals that it has designed for its end-users, have undergone an advanced product design process and manufacture to ensure its quality. To the merchants, the value proposition is the convenience of being able to make transactions, as well as the user ability of the product. To the distributors, it is accessibility and cost reduction. Therefore, the main standing value offerings that are described by the sub-categories are newness, convenience and usability and price, cost reduction that the Nomanini has created for this market.

Customer Relationship: Nomanini's strategy with respect to its customers include a self-service platform. This involves a user interface that the distributors can manage the terminals. This service can be accessed through using any basic web browser.

Channels: Allowing customers to purchase specific products and services plays a significant role in any distribution. Nomanini's indirect partners, the informal retailers, function as a retailers and enable access to the buyers of the services, who purchase these services such as airtime. Nomanini, in return, creates a utility device for making easy and fast transactions. The performance of the value network keeps the users happy, and, therefore, it becomes a win-win situation of keeping the channels open.

Customer Segment: Nomanini has primary customers who are the pre-pay voucher distributors, e.g. mobile airtime distributors, who use the simple online, cloud based platform to manage voucher distribution to their networks of retailers and who lease the point of sale terminals to those retailers. The distributors customers who are the retailers, make up a mass market customer segment and they then sell to the consumers of the services.

Key Partners: Nomanini has established a network of partners. Its main partners consist of of its distributor and informal retailers (merchants). Nomanini provides a proven system for pre-paid vending that is easy to administer with lower operating costs. This benefits both the distributor and the informal retailer. The distributor provides the informal retailer access to Nomanin's fast and easy solution for selling a range of prepaid solutions, in turn the informal retailer facilitates prepaid sales and helps customers. The benefits to the Nomanini are that the distributor manages the acquisition of the informal retailers and does the marketing of their product. The Informal retailers also give feedback to the Nomanini, to support iterative product design.

This strategic alliance with the distributors allows for optimisation and economy of scale, a buyer-supplier relationship that involves outsourcing and sharing infrastructure to reduce costs.

Key Resources: Nomanini relies heavily on human resources, which makes it a knowledge intensive firm. However, at the same time it is also a technology intensive firm that relies heavily on its supplier relationships and the infrastructure. It appears that Nomanini has needed physical, financial, and human resources in order to operate.

Key Activities: The company's key activities involve various complex management strategies that focus on the selection of sub-categories production, problem solving and platform management. Supporting both the product design and back-end configuration of the platform, in addition to the overall management and marketing. Nomanini, continuously needs to develop and maintain its platform to answer to the needs of technology and the needs of the customers and/or users. One aspect of the production process is the company's ability to deliver substantial quantities of the utility through building a production capacity. The company has expanded to countries, such as Kenya, Zambia, Mozambique and Ghana.

Cost Structure: The company relies on two sources of income: it sells the terminal (once off) to the merchants, and it charges a monthly access fee that is charged to the distributor, based on how many active terminals they manage. The distributor manages their network of retailers who then resell the airtime to consumers through the terminals. Advertisers also pay a fee to be included on the slip of the transaction, which is an additional revenue stream.

Revenue Streams: The company generates income from its asset sales, which means it receives direct payments for the terminals it sells, distributors also pay a usage fee. Another revenue stream is list pricing direct payments.

4.3.5 Discussion

The business model canvas worked well to capture descriptive data based on the categories and sub-categories that the business model concept has developed, because all the respondents could understand or relate the categories proposed. In this way it was able to facilitate description and some elaboration. The business model canvas worked very well in that it neither over-simplified the business, nor over-complicated the exercise of understanding the business model. All the cases have characteristics of product/service

innovation, a distinction of a business model type noted by Osterwalder and Pigneur (2010), and this becomes apparent in the value proposition, supported by how the directors of the companies have managed their key resources, activities and partners.

A key activity that cuts across the cases is problem solving. Each case has different ways of applying problem solving, depending on its customer needs. Thingking has to deal with a different brief for each project, which means their work is constantly on a bespoke basis. Research Unit, on the other hand, has to keep in line with its customers' needs and trends, and develop new and desirable products of a high quality to satisfy the lifestyle of its customers. Both these cases, Thingking and Research Unit, have a niche customer segment. Nomanini has a mass market customer segment. However, it still uses problem solving to create convenience and usability of the terminal and the interface that the distributors will use to manage their terminals.

To compare aspects of each case's business model, the discussion uses the pillars of the business model building blocks developed by Osterwalder and Pigneur (2005) to break the discussion into presentable sections. Pillar one is the 'product/service', an overall view of a company's bundles of products and services, which is outlined as the main-category value proposition. Pillar two is the 'customers' interface', consisting of the main categories customer relationships, channels and the customer segments. The pillar three in focus is the 'infrastructure management' that consists of the main categories key resources, key activities and key partners.

Each case has different ways of managing the infrastructure of the company and the customer interface that the customers engage with. A cross case analysis is presented in the following table. The colour coding of green and orange represents similarities across the cases. Green for across two cases, orange for across all three cases, and no colour where a single description signifies only one case.

Table 4.5: Cross-case analysis of the product/service pillar based on the categories

Business model building blocks	CASE: Thingking	CASE: Research Unit	CASE: Nomanini
Value Proposition			
Newness	X	X	X
Customisation	X	X	
Design		X	
Cost reduction	X		X
Convenience and usability			X

The cross-case analysis (Table 4.6) gives an overview of the companies' bundles of products and services. Newness is a value proposition that is shared across the cases. Methods of design have been employed that support this value proposition. Monadjem's background in engineering and business management is also evident in aspects of the value proposition. For example, there is clear focus on the backend cloud technology that supports the cost reduction and the design informs the convenience and usability.

Table 4.6: Cross-case analysis of the customer interface pillar

Business model building blocks	CASE: Thingking	CASE: Research Unit	CASE: Nomanini
Customer Segments			
Niche market	X	X	
Mass market			X
Customer Relationships			
Personal services	X	X	
Co-creation	X	X	
Self-service distributors			X
Channels			
Direct	X		
Partner			X
Online store		X	
Retail and whole sale		X	X
Social networks	X	X	X

The customer interface also differs considerably between the *niche market* customer segments and the *mass market*. Thingking and Research Unit have, in most cases, personal contact or they co-create with their customers. Nomanini, on the other hand, has developed automated *self-service* interfaces that customer manages themselves. These systems also provide feedback to support the iterative product design process of improvement.

Table 4.7: Cross-case analysis of infrastructure management pillar

Business Model Building Blocks Themes	CASE: Thingking	CASE: Research Unit	CASE: Nomanini
Key Resources			
Physical	X	X	X
Human	X	X	X
Financial		X	X
Key Activities			
Problem Solving	X	X	X
Production	X	X	X
Platform			X
Key Partnerships			

Buyer-supplier relationships	X	X	X
Strategic	X	X	X
Joint Venture	X	X	

There are significant similarities between the cases with respect to the key resources. Human resource seems to play an important role in their value proposition. Therefore, all the cases are interpreted as knowledge intensive. This means that the skills and competences of the employee and manager are highly important aspects to supporting other components of the business model building blocks. Physical resources also play an important role for each case, some more than others. Nomanini is reliant on its partners in the value chain in order to extend its capabilities and the performance of the terminal it sells. Whereas, Research Unit's factory is important for managing the manufacturing process that is essential to the high quality finish of their products. All the cases share similar features in terms of the key activities that they run, which involve production and problem solving. Nomanini, on the other hand is required to continually develop and maintain its transaction platform. This requires activities that are related to supporting this platform for the distributors, informal retailers and the consumers.

4.4 THE APPLICATION OF DESIGN THINKING IN INDUSTRIAL DESIGN RELATED BUSINESS

4.4.1 Introduction

The literature review in chapter two, gave an overview of how organisations apply Design Thinking in a multitude of different ways. The main concepts in this study, the Design Thinking rules and the business model building blocks, are represented in the present section of this chapter as constructed from the case study evidence. The aim of Section 4.5 is to address the research question:

How does Design Thinking give shape (applicable relationships) to industrial design related business models?

In order to describe this particular phenomenon, or verify the conceptual framework, the first part presents findings and a description of the application of Design Thinking in association with the coding scheme derived from the Design Thinking rules. This includes the human rule, ambiguity rule, re-design rule and the tangibility rule. The second part of this section

presents relationships between the Design Thinking rules and business model building blocks. Each one of the rules was confirmed by evidence in the data analysis.

To re-affirm the main categories were developed from the Design Thinking rules and the operationalisation of these resulted in the main categories in Table 4.8, which has been represented from the methodology chapter for the purpose of reference. The identification of sub-categories and interpretations came about in an emergent manner (See an example in Table 4.9).

Table 4.8: Revisiting the main categories based on the Design Thinking rules

Rules	Main categories (operationalised by the author)
Human	Human centric (serving the needs of people) Empathy (understanding the personal values of people) Multi-disciplinary (generates values from different specialisations) Team work (stimulates different angles of input)
Ambiguous	Uncertainty (is present when creating something new) Managing uncertainty (through testing and iterative development) Failure (failure as part of the learning process)
Re-design	Foresight (engaging in opportunities) Iterative (cycles of refinement) Testing (the process of feedback to develop refinements) Reflecting (what has been done; how can it be improved)
Tangibility	Communication (means to facilitate communication) Visualisation (sketching as a means to process what is possible) Prototyping (creating measures with which to work)

4.4.2 Enumerative results

Nine categories based on the Design Thinking rules formed part of a coding scheme. We were interested to learn how these categories might be diffused across the samples of data. The frequency of thoughts in Figure 4.9 represents the number of quotes associated with each category. The human rule referenced the largest amount of thought, and the main category empathy referenced the highest number of quotes, namely 25 quotes.

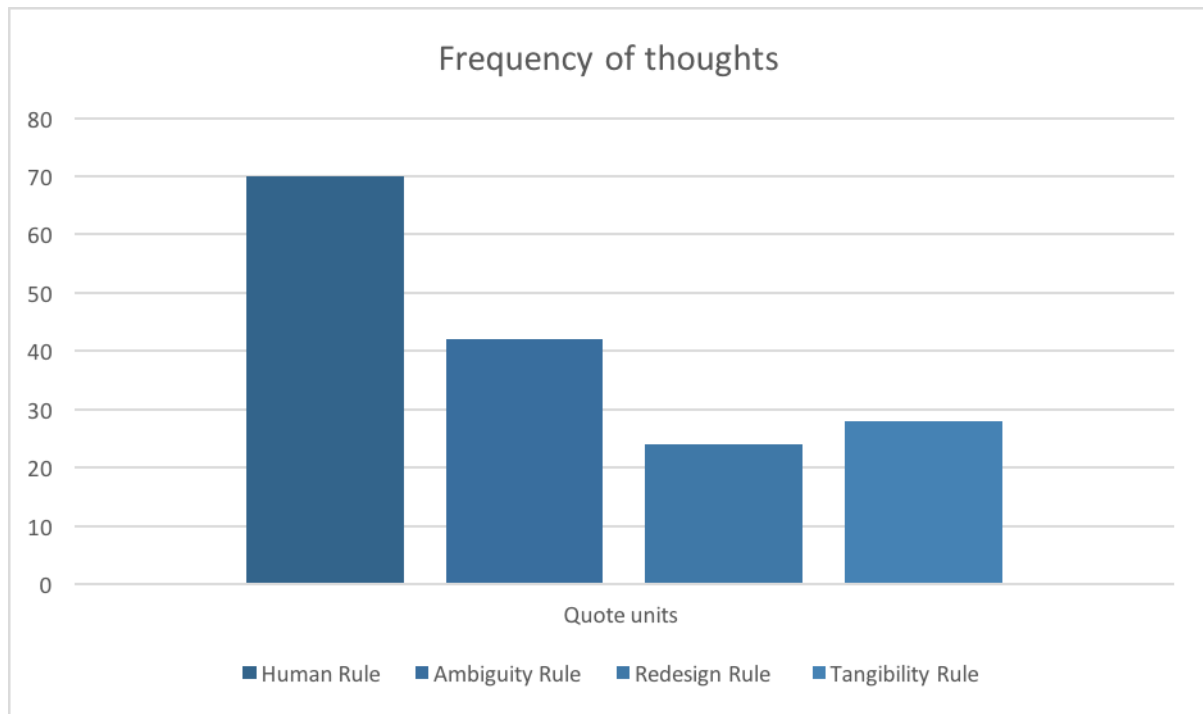


Figure 4.9: Frequency of content for each Design Thinking category from interviews

4.4.3 Application of the Design Thinking rules

4.4.3.1 How are industrial design business's interpreting the human rule

During the process of coding the relevant data, the descriptive sub-categories in Table 4.9 emerged from the content analysis process. To recall, the human rule generated the most relevant quotations in terms of the semi-structured questions asked during the interviews. It appears that the respondents could link instances of applying aspects of the human rule to various examples of their projects.

What emerged from the data is that the human rule casts an important role if framed within the problem solving process. The process starts by finding out what the customer wants and how best to serve him/her. An interesting insight gained from the human rule is that the customer is not the only person who contributes to the quality of the delivery, but the internal team and human resources are as important to the outcome of the project. Therefore, the internal business functions are an aspect of the human centric category. The respondents felt that Design Thinking requires the 'right people to get the job done'; therefore, multi-disciplinary is relevant, depending on the needs of the job. Moreover, this teamwork also builds internal company relationships from which the project at hand can benefit. The coding

schemes human centric and empathy have some similarities in their descriptions: what transpired was that human centric has a broader scope if linked to satisfying people’s needs; empathy is more concerned with establishing people values and un-met needs. However, both will have an influence on the new product and service development, and will, at the same time, influence the outcomes resulting from collaboration and knowledge transfer.

Table 4.9: Emerging sub-categories from applying the human rule

Rule	Main Category	Descriptive sub-categories (emergent)
Human	Human centric	<ul style="list-style-type: none"> - Customer relationship management - Employee relationship management - Customer feedback management
	Empathy	<ul style="list-style-type: none"> - Customer relationship management - Understanding the customer - Methods for gaining Insight - Value to the customer - Employee relationship management
	Multi-disciplinary	<ul style="list-style-type: none"> - Knowledge management - Knowledge transfer
	Team work	<ul style="list-style-type: none"> - Capacity building - Employee relationships

4.4.3.1.1 The discussion of each category under the human rule

Human centric

A purpose of being human centric is to serve the needs of the customers, but also the needs of those within the organisation who work together to make sure that the customer’s needs are served. Monadjem, in the following statement, describes human centric as a process of gaining knowledge regarding the customer or user’s needs and then serving them, ultimately satisfying what they want. The ‘customer relationship management’ and ‘customer feedback management’ sub-categories identified are an activity between the company and the customer that embraces human centric values. Monadjem explains:

‘Ultimately, our end-user is a merchant and we need to know what they want, what they feel, what they worry about, what

they are excited about and what makes them happy, how we can serve their need.'

Another sub-category that emerged refers to internal human capital; namely, empowering those with whom you work with, so that they can support the company in serving and satisfying the needs of the customer. The sub-category 'employee relationship management' applies to the empowerment of employee's or co-workers within the company, to nurture their values. This empowerment leads to a greater care for the company, according to Nicolson. Which would appear to influence the performance of the company. Nicolson justifies this in the following quote:

'I do think that a large part of us having a business and justifying why we are employing the people - in that way it is more about the team of thinking and not just myself and Lyall. We try very hard to empower people and as much as possible in the way we have set it up.'

The above statement describes the company's approach in general, the way the business model is governed, and what the underlying company values may be. The application of embedding human centric is either to serve the customer or empower the internal employees of the company. These values come with the actions identified, such as aspiring to what they like, interacting with them to solve the problem, caring about what they like. This responsiveness also shares a role with what it takes to be empathetic as a designer.

Empathy

Even though it has been made clear that there are similarities between empathy and human centric, the Design Thinking category empathy appears to require a slightly more personal relationship with the customer: researching the un-met needs of the customer and gaining an understanding of the customer to create 'value to the customer'. The emerging sub-category 'customer relationship management' is also became apparent in the human centric category. This comes before the serving and satisfying of the needs; it is the point at which the designer establishes the clients' needs and identifies what they want through activities such as research which may involve listening to, touching, and interacting with the client. These activities are described under the sub-category 'understanding the customer'. Monadjem describes this in the following statement:

'It's also having that mind-set of, wearing the hat of the user, how does this work for you, when you use a service, in a place that we didn't expect, is our reaction, this wasn't designed to work train or high voltage power lines, oh shoot we have to accommodate for this. I think it very much goes back to the mind-set of tell or listen.'

The insight that is gained from the customer appears vital to any further development of the products/services and to understand what the requirements may be. This will lead to more desirable experiences for the customer, and the motivation grounded in the internal company relationships will also ultimately drive the quality of the product, service or even the activity which the company does in-house. In the following statement, Monadjem further explains how one needs to establish an understanding of the customer:

'Ultimately our end-user is a merchant and we need to know what they want, what they feel, what they worry about, what they are excited about and what makes them happy and how we can serve their need.'

Again, it also seems that empathy is about gaining personal insights, and it relates to the thoughts of the customer and the ability to sympathise with these. Design Thinking is therefore known for its 'methods for gaining insight' a sub category that emerged. The insight is driven by social values rather than the technical/physical properties that also play an important role in design. Another sub-category that emerged in a different frame, but related to empathy is the description 'employee relationship management', this was what Nicolson described as fostering responsibility in the employees of the company. A healthy relationship among employees, as well as the resulting benefits, create employee satisfaction and Nicolson describes this as the employees' commitment to their work.

Multi-disciplinary

The interpretive lead that was derived from the multi-disciplinary category is that it broadens the set of skills that can be brought to a task and that will solve a problem. At the same time, it broadens the scope of projects, which means a more diverse set of problems can be

tackled, rather than the specialised skills being kept in a silo. These fall into the emerging sub-category of 'knowledge management'. Monadjem, elaborates in the following:

'If we look at the broader network that we work with, industrial designers, manufacturing engineers, it's quite a bit broader, the core specialisation is one of software from electronics development and even our approach to that, it's very cross functional. We have an intention that the focus is the problem and not "siloing" in on specialisation.'

According to Monadjem, the advantages of a multi-disciplinary approach during new product development is that it allows for cross-functional work to happen. This cross-functional approach means that the project on which they are working will benefit from greater resourcefulness, with diverse inputs that can ultimately drive the newness of the outcomes. What also becomes clear is that multi-disciplinary broadens the scope of the projects they can work on; therefore, increasing their capabilities and 'knowledge transfer' that contributes to these projects.

Teamwork

A concept very much related to and just as important as multi-disciplinary work, is the idea of working as a team. The main category teamwork differs from multi-disciplinary, one may have similar disciplines working together. In a way, Teamwork is a less descriptive concept than multi-disciplinary and resonates with the conception of co-creation discussed in Section 4.3. Teamwork takes customer values further than one would have imagined because of the various perspectives that can contribute to a task, which thus leads to satisfying the needs of the customer. Experience from different sources can take the project further than one would have imagined, in this way resulting in the sub-category 'capacity building'. In addition, it builds internal 'employee relationships' (another emerging theme) through collaboration, forming a stronger whole through different inputs and refinement during concept and technical developments. Interesting developments happen when a company involves its partners to receive feedback and gain the right input for certain outcomes to be achieved, also a form of co-creation. Peterson explains this in the following statement:

'The Germans which were also our customers initially....then they became investors and partners, opening a store on our

behalf, they also gave a lot of input on the design, details and stuff.'

Unique and unexpected solutions can be created through teamwork in the Design Thinking context. It appears that the generalist and specialised skills of team members complement each other in the design management. The generalist, working with the specialist to oversee the scope of the project and help manage the team, makes sure that the broader needs are addressed.

4.4.3.2 How are industrial design businesses interpreting the ambiguous rule

Five sub-categories were associated with the code groups of the ambiguous rule. The emergent categories are summarised in Table 4.10.

There are 42 accounts of the ambiguity rule that are referenced in the data from all three cases. The coding scheme included the main categories uncertainty, managing uncertainty and failure. During the analysis it became clear that ambiguity is a trait that every business experiences. However, there was also the view that ambiguity can produce radical ideas if it is managed well. Incrementally managed, it will pivot the process of any development in the right direction from the lessons learnt.

The ambiguity rule gave an insightful picture of what Design Thinking processes encounter and embrace. It accompanies the start of the NPD process, the start-up of the business; it is present in any context where there is managing change. Mitigation requires leading with some control and applying iteration and testing to make sure that one knows one's customer well enough to overcome these challenges. On the other hand, ambiguity also nurtures innovations through giving leeway to team members to utilise ambiguity beyond its normal boundaries.

Of interest were the two different approaches to uncertainty and managing uncertainty during the coding scheme. The verbs attached to managing uncertainty came with different descriptions of 'uncertainty' as a noun. Uncertainty, on its own, gave a description of the context; managing uncertainty came with applications of the term.

Table 4.10: Emerging sub-categories from applying the ambiguity rule

Rule	Main Category	Descriptive sub-categories (emergent)
Ambiguity	Uncertainty	<ul style="list-style-type: none"> - Context of ambiguity - Innovation management
	Managing uncertainty	<ul style="list-style-type: none"> - Managing change - Gaining insight
	Failure	<ul style="list-style-type: none"> - Learning from failure

4.4.3.3 The discussion of each category under the ambiguous rule

Uncertainty

What appears from a broader overview of the application of ambiguity, and this will probably apply to any business, is that uncertainty can be found everywhere in business. Especially during complex situations. Complexity becomes apparent because of the nature of Design Thinking, withholding a problem to solution process. The ‘fuzzy front end’ of the design process is when problem solving seems to involve the most complexity. Therefore, there are ‘contexts of ambiguity’, an emerging sub-category in Table 4.10. Monadjem elaborates on his experience of managing the business in the following comment:

‘So in the start-up stages you quite often find yourself back in those positions. We are working on a second generation of our terminal, with some kind of new-fangled tech and kind of design learnings, of durability and design for reparability, and all those things that we are cooking in and then you find yourself back in the ‘fuzzy front end’ of the design process.’

Uncertainty is also associated with the application of novel design concepts: the respondents referred to using ambiguity to manage Innovation (newness) by generating through mistakes and by giving leeway to the people on the team, hence the ‘innovation management’ sub-category. Innovation and newness processes tend to go hand in hand, because they are usually at the front end of any creation. Peterson, describes how ambiguity can nurture newness in the following quote:

‘Someone got the dimension’s wrong and made it a bit longer and then I thought actually that’s quite cool. I would wear that. And now it became a male product that’s doing very well, and I would never have thought of that if they hadn’t made mistakes. So it seems there is a lot of value in the mistake.’

Changing target markets also brings uncertainty to the design process, and the values that can come with this change is that new paths can bring new products and generating through mistakes can take these developments beyond what the company might have imagined they would be. These come in the context of either complex, new or fuzzy stages of projects.

Managing uncertainty

Ambiguity can be managed; the code managing uncertainty came with nine applications that were identified from the input of all the respondents. These all contribute to factors that mitigate and/or improve the product or the organisational processes. The emerging sub-category ‘managing change’ captures the broad description. An important factor that comes with mitigation is to be led by hypothesis and then to test the hypothesis, which means that the management felt there needed to be some level of control when managing this uncertainty. The concept of being hypothesis-led could also be described as deducing objects, to be able to mitigate these stages. The conception of iteration discussed in section 4.3 is related to managing uncertainty as it helps mitigate through various cycles of improvement. The process requires applications of research, testing and then absorbing lessons. Monadjem explains aspects of these applications in the following quote:

‘Yes, I think I am very comfortable on the design side, just because I am a generalist who knows enough to imagine what can be done, without getting too worried about the problems encountered (laugh), which is useful I think. There is also: having run this course with different products, being comfortable with the fact that you will get some things wrong and there will be remedial action, axes and crunches and that’s just part of the process.’

The emergent sub-category ‘gaining insight’ is another aspect that emerged under the main category of managing uncertainty. By being empathetic and knowing one’s customer, one

can control the uncertainty in the market. This description is related to the human rule. These routines of knowledge exploitation can be managed so that, for the sake of quality management and continuous improvement, the company always knows what its customers are feeling and wanting.

Failure

Failures appear to be unavoidable during the NPD process. But, much like managing uncertainty, a failure can pivot the insight towards a solution. It is about learning from these mistakes to be able to manage the complexity and, therefore, 'learning from failure'. Monadjem explains this in the following statement:

'Unless you are doing something simple and predictable, you are likely to experience failure. I think it's about organisation resilience to recover from that and to absorb that as a lesson that turns from a failure to pivoting'

Failure usually happens when one is doing something for the first time or new ground/ innovating, according to Monadjem. Ways to learn from these lessons is to test and use the information gained from the failure to make informed decisions.

'We always test out something before we put it out, whether it's testing for 5 days or a month, depending on the complexity of the product.'

According to the respondents, innovations are also a consequence of the lessons learnt from failure - because of the new elements that are learnt during the process. As discussed above, Failure can take the designer in a direction that s/he would have never thought of before. If the designer is able to manage this ambiguity and see it as a learning curve, it can become a beneficial factor to the outcome.

4.4.3.4 How are industrial design businesses interpreting the re-design rule

Nine descriptive sub-categories were associated with the re-design code group. The emergent categories are summarised in Table 4.11.

The re-design rule appears to reside with the traditional understanding of design, whereby taking us back to Simon’s (1996) description that explains design by “improving on existing situations, to preferred one’s”. Foresight appears apparent when it involves something new and the situations are complex. Therefore, this change involves the transformation of what already exists and projects a new solution to the initial problem. During this process, iteration helps mitigate the risk during times when something is not clear. Testing then constructs measures and feedback that direct the next phase of development. Reflection is the more personal development of the process, where the designers reflect on previous experiences or to put yourself in context where it nurtures reflection and this may very well differ depending on the person.

Table 4.11: Emergent sub-categories from applying the re-design rule

Rule	Main Category	Descriptive sub-categories (emergent)
Re-design	Foresight	<ul style="list-style-type: none"> - Contexts of re-design - Managing transformation - Approach change
	Iteration	<ul style="list-style-type: none"> - Cycles of improvement - Managing uncertainty
	Testing	<ul style="list-style-type: none"> - Mitigation of failure - Managing transformation
	Reflection	<ul style="list-style-type: none"> - Divergent context - Reproduction - Re-active

4.4.3.4.1 The discussion of each category under the re-design rule

Foresight

Foresight is necessary when there are no precedents to use as point of departure, and the designer wants to arrive at a solution. The data showed at least nine applications employed to manage this. Primary applications involved reviewing and updating projections, which is captured by sub-category ‘managing transformation’. In addition, the respondents spoke about being agile and nimble to navigate complex situations, and when things are changing rapidly. It also became apparent from the descriptive sub-category that there are ‘contexts of

re-design', as when the challenge is to create the new. In the following quote Peterson speaks about controlling the 'how':

'Things are changing and you have to be nimble and quick on your feet and to be able to navigate. For us it's good to control the 'how'. No one can control the level of intricacy of our products'

A way to think ahead of the game is to bring people together because one envisions what can be done and identifies the strengths in people. Another perspective of foresight comes through in the leadership role; namely, to see the value in the firm's employees and to manage this. In the following quote, Peterson calls such leaders visionaries and 'blue sky thinkers'.

'The creative part is essential. I don't think you can get anywhere.... Some don't classify them as designers, but it's the visionaries, the blue sky thinkers. They are not good at anything really, but they were good at getting people together.'

Discussion also plays an important role in foresight, and this is where foresight is associated with empathy: by identifying the needs and creating a hypothesis that will lead to a solution based on different people's interpretations from a discussion, there is an 'approach to change'.

Iteration

Iterative is the set of cycles of development that aim to improve the product. Each cycle was explained as being the activities of revisiting what can be improved for the next cycle. The move to the next cycle is conceptualised by forming new combinations of what was formed in the previous iteration. A decisive improvement would be if iterative development takes a solution beyond what you may have imagined in the first place. In essence, the aim of iteration is about 'cycles of improvement', an sub-category in Table 4.12. Peterson speaks about iterations of improvement in the following statement:

'At the end of the day we are happy if we are happy with the product. Then we will put it out. And if we are not happy with the product, we'll put time back into design and refining it.'

But, most importantly, the respondents maintained that iteration is just part of the design process; it improves the product and lowers or mitigates the risk. Iterative improvement also has an affinity with the main category of 'managing uncertainty', a component of the ambiguous rule.

Testing

Testing, like the empathy category, involves the process of responding to the customer's unmet needs. It appears that empathy plays an integral role in the identification of needs and values. Testing is also linked to managing uncertainty and failure. It is a method of 'mitigation of failure' for a project through customer testing during the design process and testing the market before a launch. Monadjem speaks about this sequence of testing in the following statement:

'For us, it's more the process around coming to solutions, to hypotheses that you can test, and then deciding on how to test them.'

Testing can require a more hypothesis-led approach in the new product development process. It involves testing the prototype that has been constructed based on the needs established. This process is aligned with the sub-category of 'managing transformation' and involves exposing the product to the user and obtaining feedback and responses regarding where changes can be made to address an improved form.

Reflecting

Reflecting seems to define itself as a situation or phenomenon in the real world, or an experience, that designers can reflect upon. It also means reflecting on the customers' perceptions and how they would feel about the product or services rendered. The respondents tended to see reflection as most prominent when one takes oneself out of the normal context and does things that are unusual on a day-to-day basis, therefore reflecting has a 'divergent context', an emerging sub-category. Peterson remarked that, in his case, most of the creative conceptualising happens at home.

'Most of the creative stuff actually happens at home.'

Another activity that appears to support reflecting is visual presentation. Monadjem sees this technique as a way of inviting critique, discussion and improvement – a process of ‘reproduction’ - a means of reflecting on the current situation to see how it can be improved. Nicolson explains how he and Sprong are constantly perceiving and reflecting on the way they are working in the following statement:

‘So a lot of the stuff we do on a day-to-day basis is a little bit hard, but we do spend a lot of time considering...and how people on a business level are perceiving the way we are doing things.’

Reflection is the category that is based on the concept of reacting with the knowledge gained from previous experiences. Therefore, the emergent sub-category was ‘re-active’, to reflect upon and react to, based on input from the previous experience. It can also be described as a means of projecting, of analysing what may or may not work, a process that resonates with the concept of prototyping and testing.

4.4.3.5 How are industrial design business’s interpreting the tangibility rule

Four sub-categories were associated with the Re-design code category. The emergent sub-categories are summarised in Table 4.12.

The main categories communication, visualisation and prototyping are all, to a degree, related to each other under the tangibility rule. Communication is used to facilitate information between the human resources and to be able to work collaboratively. Communication is ultimately a form of sense making between stakeholders. Visualisation, on the other hand, is also a form of communication. However, it has been used by designers to secure buy-in for their products or business ideas. The prototype is also used in this manner to receive feedback and measure what improvements need to be made. Prototyping is very important because it is also a form of mitigation to test and avoid the rejection of a solution.

Table 4.12: Emerging sub-categories from applying the tangibility rule

Rule	Main Category	Descriptive sub-categories (emergent)
Tangibility	Communication	<ul style="list-style-type: none"> - Information retention - Method for feedback
	Visualisation	<ul style="list-style-type: none"> - Process of retention - Form of measure
	Prototyping	<ul style="list-style-type: none"> - Method of measurement - Mitigation of risk - Resource and time management

4.4.3.5.1 The discussion of each category under the tangibility rule

Communication

It appears that communication is important in many fields. Communication in design involves how designers communicate in team activities, how they use their spatial skills to communicate. However, on an organisational level it also refers to the facilitation of bringing people together. On a customer level, with reference to a product or service, it means either to expose or create some kind of mutual understanding about the product. These are aspects of ‘information retention’, an emerging sub-category. Peterson, in the following quote, speaks about connecting with people through the exposure of their thinking:

‘There is a percentage of us that design what we want; luckily our thinking is in line with our customers. Whatever we make, it connects with someone that’s out there. We expose our stuff to enough people to get the same kind of thinking people on our side, spending their money.’

Communication was also associated with techniques that designers use to gain feedback and solve a problem, hence the sub-category ‘method for feedback’. Nicolson explains the use of these techniques when they are working with their customer:

‘I’ll be sitting in a meeting and we sketch up, almost come to a design. So in terms of sketching and stuff, it’s not a skill that I

would say I am very skilled at, but it is often better than my clients'. It's a very basic isometric 3D or like drawing.'

Visualisation

Visualisation serves a very similar function to that of the communication category. From the visualisation category it became very clear that this presents itself as an advantage to designers. Consequently, they are taught sketching and rendering skills at a foundation level. Their visual and presentation skills enable them to gain rapid feedback. This feedback can be in the form of measures that they can use to build better products, offer better services or even in the way an organisation is spatially connected.

This physicality relates to 'process of retention', an emerging sub-category. Monadjem refers to improvement through inviting critique and discussion in the following statement:

'Post-it notes, post-it notes and visual representation of what we do. We'll walk through and we'll see that our six-month plan isn't in an excel sheet; it's actually on a big white board and post-it notes that people can look at and that's to invite critique and discussion and improvement (VM, p1).

Visual rendering in the spatial context is also taught to industrial design entrepreneurs to assist them in prototyping, sketching and 3D visualisation, such as CAD programmes that facilitate communication of the product, which act as 'form of measure', a sub-category.

Prototyping

Prototyping is an important design method because it aims to solve certain aspects of design, and it can lower the financial risk or give the investors' confidence regarding the design going forward into production.

The prototype functions as a 'method of measurement', another sub-category. The evidence shows that prototyping serves both the interest of the business and the customer. From a business perspective, it can save the company costs with respect to work that does need to be done. Therefore, prototyping happens before larger investments are considered/made, and the sub-category describes this 'mitigation of risk'. Monadjem elaborates:

‘That we will do quite intentionally...is we will have a tech team produce one or two prototypes. Before we put the full effort into production-running tech, and we will see if commercial gains can get any interest on those. And whether it’s terminals or back-end tools, any of that stuff. It’s all very... the cost of doing something wrong, especially a start-up, when you measure your bank balance in time, how much money you have, everything second is precious, you don’t want to get too much work done that isn’t used.’

In the product design context, prototyping is also done at low profile, and this enables one to create a product rapidly, at a low cost; it facilitates communication regarding the usability or efficiency of the product, for example, without investing too much time. Peterson recalls doing low profile prototyping at home to materialise new ideas and this associates with the broad description in sub-category ‘resource and time management’.

The next section will look at the relationships between the Design Thinking rules and the business model building blocks.

4.4.4 How Design Thinking shapes industrial design business models

The previous section describes how Design Thinking is being applied across the three cases: Thingking, Research Unit and Nomanini. In this section, the cases are analysed in a comparative case study design, each case representing a particular aspect of Design Thinking and the business model building blocks. The business model building blocks, for which there is a non-existent relationship, will not be listed or there will be an open space in the tables.

In order to manage the descriptions based on Osterwalder and Pigneur’s (2005) concept, the three pillars (such as in section 4.3) of the business model building blocks are used to present all the components of the business model. These include the product/service pillar (value proposition), the customer interface pillar (customer relationships, channels, customer segment) and the infrastructure management pillar (partners, resources, activities).

The following section will discuss at a greater length to facilitate the understanding of how Design Thinking is shaping the value proposition.

4.4.4.1 How Design Thinking shapes the product/service pillar (Value Proposition)

As discussed in the literature review, the value proposition is the bundle of products and services that the company creates for its customers (Osterwalder & Pigneur, 2005). Across the business model cases, each case had more than two value propositions that described the bundle of products or services that create value for the customer segment. The proposed categories were selected based on the business model exercise in section 4.4 of this chapter.

Thingking has three descriptive value propositions: newness, customisation and cost reduction. Research Unit has design and brand status, and Nomanini offers convenience and usability and cost reduction. What became apparent in Thingking's business model, is that Newness is the main value proposition. Nomanini on the other hand had attributes of Newness during the 'fuzzy front end' of the NPD process, but not as a primary value proposition for the instance of their current business model. This insight shows that Design Thinking was thoroughly applied to create the product/service that supports their value proposition.

Table 4.13 below presents a summary of the value propositions across the different business model cases and their relationships with Design Thinking.

Table 4.13: Relationship between Design Thinking and the product/service pillar of the business model

	CASE: Thingking	CASE: Research Unit	CASE: Nomanini
Value Proposition	<p>Newness</p> <ul style="list-style-type: none"> • Newness through the structure of the multidisciplinary input • Newness through uncertainty and teamwork • Newness through applying foresight tools <p>Customisation</p> <ul style="list-style-type: none"> • Empathy supports customisation • Customisation supported through multi-disciplinary and teamwork 	<p>Design</p> <ul style="list-style-type: none"> • Design through understanding and researching the needs of customer- a requiring empathy <p>Brand status</p> <ul style="list-style-type: none"> • Brand status through empathy 	<p>Newness</p> <ul style="list-style-type: none"> • At the start-up stages of the company and there is uncertainty <p>Convenience and usability</p> <ul style="list-style-type: none"> • Convenience and usability built by empathy <p>Cost Reduction</p>

What is interesting about Thingking’s value proposition is that the internal structure, that includes a multi-disciplinary team, appears to have an effect on the value proposition, and this allows them to create newness. The following statement from Nicolson describes how multi-disciplinary activities produce innovative ideas, but also how the management aim to keep an open structure:

‘We are. We’ve structured it in such a way that the specialist is able to come in a way with a lot of innovative ideas; so it’s very open.’

Another capability that supports newness is the manager’s ability to apply foresight. Because the projects vary greatly, and because not much has been done in the field, they have to stretch themselves, using foresight, to come up with new ideas, as explained by Nicolson:

‘It doesn’t happen that regularly that we really have to stretch ourselves in that way. Because quite often the field that we are playing in - not that much has been done.’

A different aspect of Thingking’s value proposition is customisation. In association with the human rule, employing a multi-disciplinary structure. It allows the specialist to do many

different things that satisfy the specific needs of the brief. Nicolson explains in the following quote:

‘The one skill that one of our employees that we would never be able to do is Nick, and he does lots of different things, regarding software and hardware things.’

Nicolson also speaks about how the specialised multi-disciplinary teamwork can inform and broaden the scope, allowing the directors to take generalist roles.

‘In that way we have a team, and we all have different skills to contribute. Myself and Lyall have a broad understanding of everything that goes on, because of the specialties that it forms a lot of.’

The evidence from the case of Thingking is supported by various Design Thinking rules. The rules that were referred to in relationship to newness and customisation include the human rule and re-design rule. Figure 4.10 presents a schematic of the causal relationship that Design Thinking has with its value proposition.

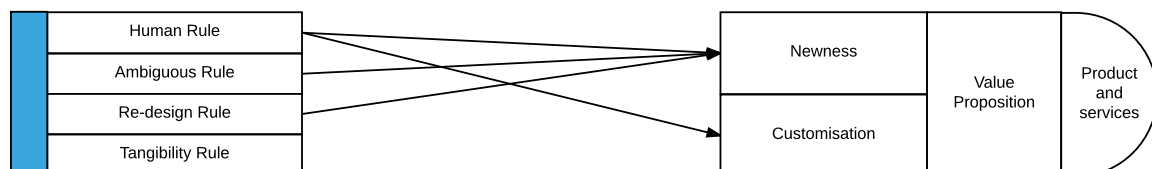


Figure 4.10: Thingking’s value proposition shaped by Design Thinking (Author’s construct)

Research Unit’s core value proposition is the sub-category design of key activities. Some of the design activities include research and iterative development, which has a key relationship with the re-design rule. This involves researching what has been done before and improving on it. Peterson elaborates:

‘We really spend a lot of time researching and doing things properly, as proper as what we can do. At the end of the day we are happy if we are happy with the product. Then we will put

it out, and if we're not happy with the product, we'll put time back into design and refining it.'

Another value proposition that Research Unit provides, is the company's affinity for creating a strong brand that is aligned with the customer's cultural associations (discussed in Section 4.3) – the ability to design something that is invaluable to the customer. This brand/status is the primary reason why the customer in this niche market will buy the company's products. Peterson explains the value that the brand can bring to the cost of their products in the following quote:

'The only way that you can get away with a big mark-up is if you really put a lot of thought into the design, understand what it means, be empathetic and know what the customer wants, and work on those things and make something that is really valuable to them, but taking something that is invaluable before it is being constructed, to make it more valuable to the customer.'

The evidence presented by the case Research Unit describes a relationship between the human rule and the sub-category brand/status, the re-design rule and the design sub-category. The re-design also influences the value proposition sub-category newness. Therefore, because Research Unit is a design-driven company, design represents a significant offering in its value proposition. Figure 4.11 describes the causal effects between the two concepts of Design Thinking and the business model building blocks. These linkages are based on the evidence in the data, even though we might assume that the human rule will also have a linkage with sub-categories newness and design.

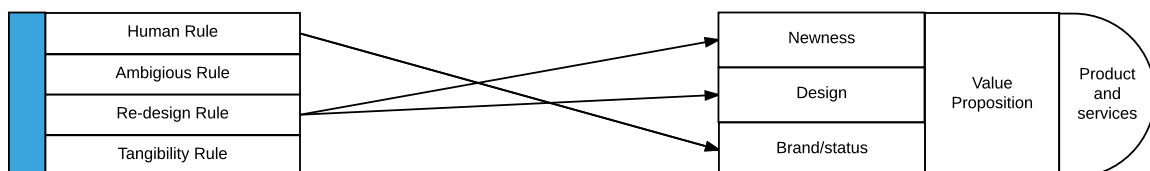


Figure 4.11: Research Unit's value proposition shaped by Design Thinking (Author's construct)

Nomanini's value proposition also emphasises newness in the products and services which the company offers its customers through a design process. Monadjem explains that this

generally comes at the ‘fuzzy front end’ and start-up stages of the NPD process. Monadjem speaks about this in the following quote:

‘So in the start-up stages quite often you find yourself back in those positions. We are working on a second generation of our terminal, with some kind of new-fangled tech and kind of design learnings, of durability and design for reparability, and all those things that we are cooking in and then you find yourself back in the ‘fuzzy front end’ of the design process.’

Nomanini will build new cases by using hypothesis-led techniques, and then test them as a way of managing uncertainty (Ambiguity Rule). Nomanini has direct relationships with the business model building blocks, as presented in Figure 4.12.

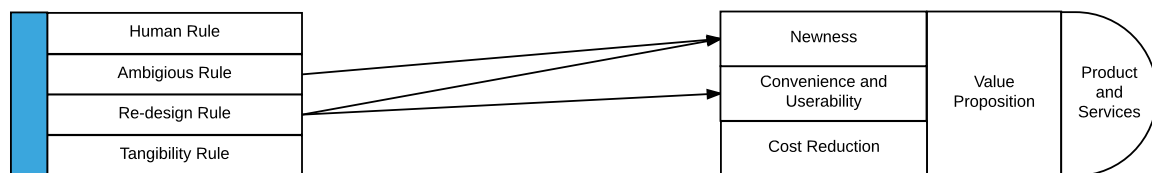


Figure 4.12: Nomanini’s value proposition shaped by Design Thinking (Author’s construct)

4.4.4.2 How Design Thinking shapes the customer interface pillar

Customer segments, as described in the relevant literature are those different groups of people or organisations which the enterprise aims to meet (Osterwalder & Pigneur, 2010).

Table 4.14 below presents a summary of the customer interface pillar across the different business model cases and their relationships with the Design Thinking categories.

Table 4.14: Relationship between Design Thinking and customer interface pillar of the business model

	Thinking	Research Unit	Nomanini
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Customer Segments	<p>Niche market</p> <ul style="list-style-type: none"> Niche market comes with the unknown needs of the customer, which requires empathy 	<p>Niche market</p> <ul style="list-style-type: none"> Niche market by focusing on empathy 	<p>Mass Market</p> <ul style="list-style-type: none"> Mass market managed through knowing what can be done - managing uncertainty
Customer Relationships	<p>Co-creation</p> <ul style="list-style-type: none"> Co-creation through communication 	<p>Co-creation</p> <ul style="list-style-type: none"> Co-creation through communication <p>Personal assistance</p> <ul style="list-style-type: none"> Personal assistance through human centric values 	<p>Self-service</p>
Channels	<p>Awareness</p> <ul style="list-style-type: none"> Awareness through empathy 	<p>Retail</p> <ul style="list-style-type: none"> Empathy through a direct service to the customer 	

Both the cases of Thingking and Research Unit share a similar customer segment description, which is a niche market segment. However, Thingking’s customer segment is its clients, which are companies; whereas Research Unit’s customers are individuals. The niche market with which Thingking works (e.g. advertisers) has specific needs. Thingking, therefore, embeds an empathy approach in its dealings with both the clients and the users of the service/product they produce for their users. The causal relationships are presented in Figure 4.13.

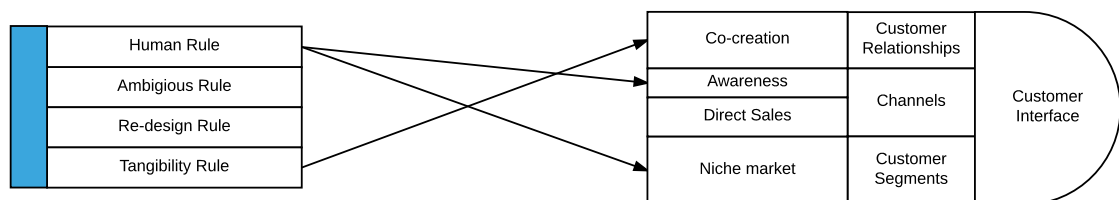


Figure 4.12: Thingking’s customer interface shaped by Design Thinking (Author’s construct)

Nicolson emphasised that they reflect deeply on their work and their customers’ perceptions of them as a company. Therefore, this consideration for the customer carries value that is associated with the category empathy, a main category belonging to the human rule. Nicolson explains this in the following quote.

‘We do spend a lot of time considering and how people on a business level are perceiving the way we are doing things.’

With regard to the sub-category channels, we need to recall that this describes the manner in which the company reaches and communicates with its customer segments. The main channel through which Thingking connects with its customers is through creating awareness. Retail is the direct channel type that Research Unit has with its customers. Peterson believes that one needs to have personal contact with one's customer via one's own personnel. He explains this in the following quote:

'So the best people that can give an experience of a product are the people who own the store. So we try not to dilute our product by giving it to any store out there, because they don't offer the same service, and it's all about service and the experience of the product.'

Research Unit's causal relationship between the human rule and customer relationships becomes clear. The personal assistance is supported by the human rule which the company values. Figure 4.14 represents the causal relationships that the Design Thinking rules have on the Research Units customer interface.

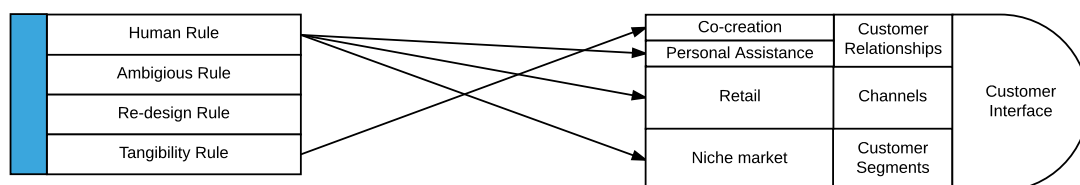


Figure 4.13: Research Units customer interface shaped by Design Thinking (Author's construct)

Nomanini, on the other hand, has a mass market customer segment. The broad group of customers includes the merchants in informal markets, who have similar needs and problems. However, Nomanini has shifting target markets. Initially, when they were considering a payment system for taxi drivers, they found opportunity in the informal payment space. Now, due to the size of the company and its expansion into other countries, they have to deal with different consumer needs in each country.

'I think we've pretty consistently every 9ish months pivoted as a business, whether it's our target market changing, our role in the

value chain, the way we bite technology, then broadening that out....”

Monadjem explains that their target market has changed, and being able to manage this uncertainty is the way in which the company has pivoted to mitigate and problem solve the possible new needs of the customer.

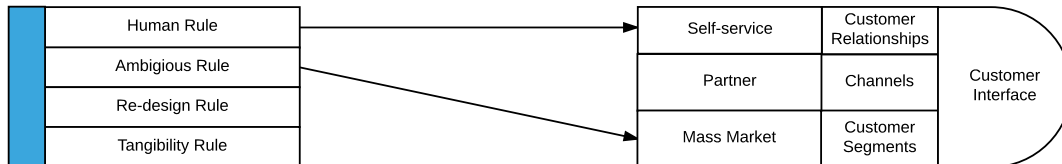


Figure 4.14: Nomanini’s customer interface shaped by Design Thinking (Author’s construct)

However, customer relationships are also important to the company, because it deals with UX software development that supports the platform and the interface with the customer interact with. To provide the service, it still needs to listen to and understand, through empathy, what its customer needs are.

‘It’s also having that mind-set of - wearing the hat of the user: How does this work for you, when you use a service in a place that we didn’t expect, is our reaction, this wasn’t designed to work train or high voltage power lines. Oh shoot! We have to accommodate for this. I think it very much goes back to the mind-set of, tell or listen.’

Figure 4.15 shows the causal relationships that the Design Thinking rules have on the Nomanini’s customer interface.

From analysing the categories within the customer interface pillar, it becomes clear that the human rule plays a role in shaping how the company interacts with its customers. In all three cases, the tangibility rule and the ambiguous rule were referenced in relation to the customer interface.

4.4.4.3 How Design Thinking shapes the infrastructure management pillar

The infrastructure management pillar consists of the key activities, key resources and key partners. These are the factors behind the scenes which influence what needs to be done to deliver the company's value proposition to its customer. Table 4.14 presents a matrix between Design thinking and the infrastructure management pillar.

Table 4.15: Relationship between Design Thinking and the infrastructure management pillar of the business model

	Thingking	Research Unit	Nomanini
Key Activities	<p>Problem solving</p> <ul style="list-style-type: none"> Problem solving by responding to the brief, to serve the human centric needs of the project <p>Production</p> <ul style="list-style-type: none"> Production is controlled by managing uncertainty 	<p>Design</p> <ul style="list-style-type: none"> Using design as a Foresight method to navigate and control the product quality Creating value through empathy in design <p>Production</p> <ul style="list-style-type: none"> Managing uncertainty by understanding production 	<p>Problem solving</p> <ul style="list-style-type: none"> Multi-disciplinary and specialised Managing problem solving and design through knowing what can be done - managing uncertainty Comfortable with uncertainty Failure pivot in the right direction
Key Resources	<p>Human</p> <ul style="list-style-type: none"> Empowering human resources by being human Centric 	<p>Human</p> <ul style="list-style-type: none"> Empathy within teamwork Empathy through giving leeway and empowering internal employees 	<p>Human</p> <ul style="list-style-type: none"> Human centric - working with people who care Empathy through the identification of design in everyone Empathy through giving the employees responsibility
Key Partners	<p>Suppliers</p> <ul style="list-style-type: none"> Communication through control drawings 	<p>Investors</p> <ul style="list-style-type: none"> Visualisation- attracting attention or buy-in 	

It became clear that problem solving is an indispensable activity in all the cases if they wish to satisfy their customers and support their value proposition. Research Unit is more focused on the design as a value proposition. However, design activities has strong attributes which link it to problem solving. The two cases, Thingking and Nomanini, have different associations with the human rule. To Thingking, it is about responding to the brief to serve its human centric roles. Therefore, Thingking's problem solving is directed by a human centric approach to this activity, and this shapes the key activities in order to achieve the outcomes. Figure 4.16 represents the causal relationships that the Design Thinking rules have on the Thingkings Infrastructure management.

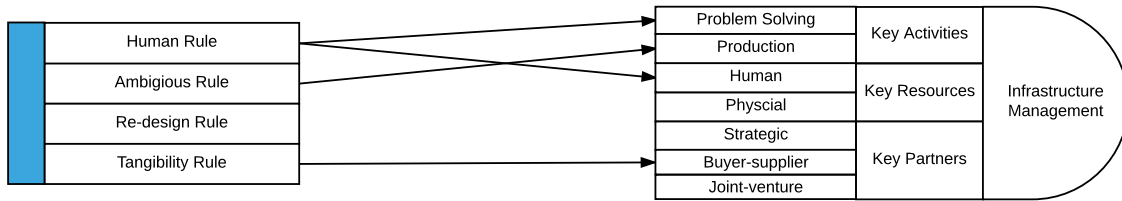


Figure 4.16: Thinking's infrastructure management shaped by Design Thinking (Author's construct)

Nomanini has direct associations with the human rule and ambiguity rule, as the multi-disciplinary teams are shaping the key activities in order to solve the problem. At the same time the competences of the company are equipped to manage uncertainty, a trait of the ambiguity rule. This means that the activities involve a process of knowing what can be done. Monadjem further discusses this in the following statement:

'It's very much the IT lean start-up approach; it's very much the business management consultancy approach. So getting out of the 'fuzzy front end' and by leading with hypotheses and having the confidence, having an opinion and acknowledging that it's not yet fact; but also having the resilience to go "We were wrong about this. Let's pull together and fix it.'

Even though it can be assumed that the multi-disciplinary structure would be a key resource, in the case of Nomanini, human resources are influenced by the employees' motivation to work effectively and the relationships which management has with its employees. Figure 4.17 represents the causal relationships that the Design Thinking rules have on the Nomanini's Infrastructure management.

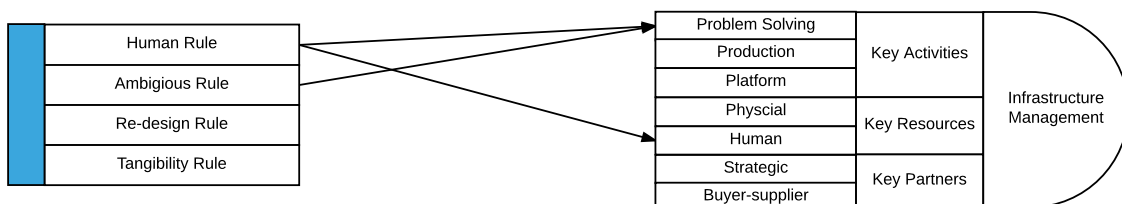


Figure 4.17: Nomanini's infrastructure management shaped by Design Thinking (Author's construct)

A member of staff who cares for the company contributes much more towards the outcome of projects than somebody who does not. Nomanini retains the Design Thinking principle related to the human rule to give their employees responsibility. This applies to Research Unit as well, as the management is applying design principles to the way they manage their employees, and this is shaping the type of human resources they have available to

implement projects. Research Unit also uses foresight attributes of the re-design rule which shape their activities. Also, attributes of tangibility rule, such as the category visualization influenced the buy-in from the financial resources Research Unit received as an initial investment to get their startup business off the ground. Research Unit also takes an hypothesis approach in the level of control hold, explaining this in the statement below, a trait of the ambiguity rule in relation to how production is managed.

‘but now things are changing and you have to be nimbler and quick on your feet and be able to navigate. For us it’s good to control the how. No one can control the level of intricacy of our products anywhere else in Cape Town.’

On the other hand, Research Unit also creates value through the key activities it manages. This value is gained by having an understanding of the customer. Peterson explains:

‘The only way that you can get away with a big mark-up is if you really put a lot of thought into the design, understand, be empathetic and know what the customer wants and work on those things and make something that is really valuable to them, but taking something that is invaluable before it is being constructed, to make it more valuable to the customer. If you get that right, if you know, it trickles down to other parts of the business, making the business more efficient.’

In terms of the key partners, the tangibility rule has an influence on the main Design Thinking category communication, such as in Figure 4.18.

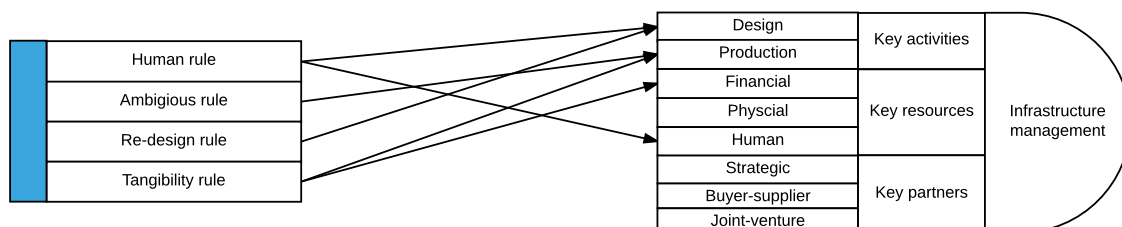


Figure 4.18: Research Units infrastructure management shaped by Design Thinking (Author’s construct)

This main Design Thinking category communication falls in line with the emerging sub-category of ‘knowledge retention’. Both the cases of Thingking and Research Unit use this to

their advantage. Thingking uses drawing and sketches as means to communicate with their suppliers. Nicolson explains:

'Definitely. I usually - at every meeting - am sketching something, and I use it as a means of conveying that we are on the right page, for them to try to understand what I am talking about.'

Research Unit, on the other hand, uses its communication competences to purvey something innovative to retain the attention of their clients. In their case the start-up funding invested by SAB was in part a consequence of these communication competences. Peterson explains:

'Yes. The reason why we won the competition was because of the that, because you can mention facts that blow you in the face; you can have graphs that bore you. What allowed us, at the end of the day, is that you just have to stand up. Whether you shout out or whatever you do... What I did was, I demonstrated a graph. When our sales started increasing I said, "I left my job! Yay!" - and sales went up. Those kind of small things allowed me to be more creative. People want to be entertained.'

The evidence from the cases indicates that Design Thinking rules has a relationship with the key partners. In the case of Nomanini, however, there were no direct quotes that could be interpreted to have this causal relationship (see Table 4.17).

4.4.5 Discussion

This section was split into two analysis phases. The one phase analysed how Design Thinking is being applied within the frame of categories operationalised, and the second phase of analysis considered the relationships with the business model building blocks. The evidence from the data depicted that there are numerous interrelationships between Design Thinking and the business model building blocks, evidently designing the business.

According to the present literature review, Fraser (2009) maintains that the biggest pay-out at the start is the design of the business model itself and suggests that Design Thinking should be expanded across all aspects of an organisation. Judging by the evidence of the present case studies, Design Thinking has been interpreted for its application framed within the three business model building block pillars, product/service, customer interface and infrastructure management. Such an application means that these cases have expanded Design Thinking across the organisation and have not limited it to only the product itself. Fraser's (2010) three gears of business design positions the concept 'empathy and deep user understanding' at the core of these gears. In order to provide a value proposition (product/service) that the user or customer will want to purchase, the company needs to take a 'deep dive' into what the needs of the customer may be – so as to address these needs. This concept has similarities with the emergent categories of 'methods for gaining insight' and 'customer relationship management'.

In relation, the human rule acts as a source of information to creating the value proposition/s. Therefore, these insights are then combined with design activities to create the value proposition. Evidently, this steers the value proposition sub-categories such as newness or customisation, for example. The themes developed by Zott and Amit (2010) from the business model design concept, such as 'novelty', have a causal relationship with the Frasers (2010) gear 'empathy and deep user understanding'; therefore, novelty is an effect of this particular concept. Both Thingking and Research Unit have a niche customer segment (customers with specific needs) which is interpreted as causality of the 'novelty' theme, also based on Zott and Amit's concept. Whereby these specific needs are addressed by the value proposition in a novel form.

Furthermore, Fraser's (2010) second gear, namely, 'concept visualization', is described as ideation, prototyping and user evaluation. Ideation is an important method related to the ambiguous rule and is associated with 'contexts of ambiguity', when something new needs to be ideated about, or at the 'fuzzy front end', when not much else has been done before. Prototyping and user evaluation are directed by the need of gaining insight through customer testing. The key activities of the business model will, therefore, be problem-solving in order to serve the human centric needs addressed by the product/ service that is being developed. The last conceptual gear, 'strategic business design', considers the commercial viability of the idea. The idea in this case would refer to the value proposition which is the primary focus for the interrelated activities that will be employed. There were no direct relationships with this concept. However, what became apparent was that the infrastructure management and customer Interface all focus on the value proposition at the core. The 'strategic business

design' of these pillars would lead to a business strategy and the competitive advantage that supports the value which the business model creates.

It also becomes apparent that the 'strategic business design' concept is whereby Design Thinking is influencing or shaping the infrastructure management pillar of business model, such as the resources, partners and activities. In addition, the customer engagement under the customer interface pillar also appears to play a large role in the broader business strategy to understand the needs of the customer.

5 CHAPTER 5: CONCLUSION

5.1 INTRODUCTION

This final chapter provides a conclusion to the findings obtained within the scope of this study. It will present an overview of the research aims and questions, methodology and results, followed by the discussion of its contribution to knowledge. It will then reflect upon the limitations and anomalies, make recommendations and, lastly, outline the scope for further research. The chapter will close with final words regarding the body of work that this study has covered.

5.2 OVERVIEW OF THE RESEARCH AIMS, METHODS AND FINDINGS

5.2.1 Introduction

The primary purpose of the thesis is to explore and describe how Design Thinking is shaping business models within the context of industrial design. To revisit the conceptual framework in chapter two: it proposed a relationship between two conceptual models, the Design Thinking rules and business model building blocks. In essence the body of study sought to explore the interrelationships between these two concepts captured in the conceptual framework in Figure 5.1.

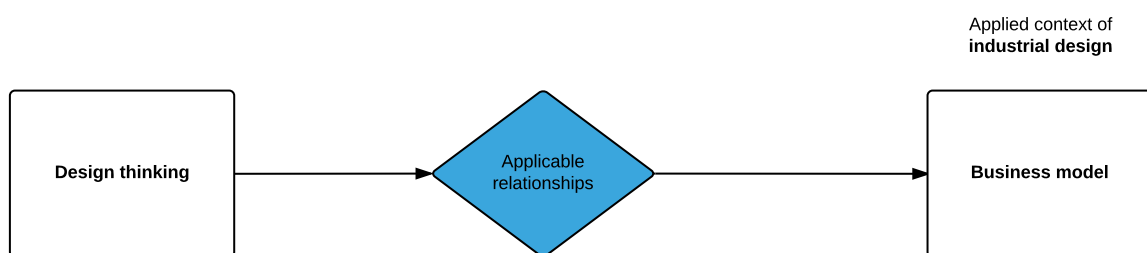


Figure 5.1: Conceptual framework revisited (Author's Construct)

5.2.2 Revisiting the research aims and questions

The two main aims that create a lens for this research are the following:

- undertake research that will contribute to the understanding of how Design Thinking can be applied outside normal (disciplined) boundaries, and in addition acknowledge the changing role of industrial design through this lens
- to understand the best practices (application) of Design Thinking in the context of industrial design entrepreneurship

The above aims are guided by a backdrop in which Design Thinking has widened in its scope. In the last few decades, it has evolved considerably as a concept outside the boundaries of the product domain, known as industrial design. The reason why the potential research in this area has grown is that the Design Thinking concept is assumed to drive innovation and competitive advantage in any type of business. It is now more evident that Design Thinking can be applied to 'new business model and go-to-market strategies' or even 'improving own internal business processes and organizational structures' (Schmiedgen et al., 2015).

Because design is now seen more and more as tool for unlocking innovation (CCDI, 2012), the need for research on best practices of Design Thinking has gained more attention. Design Thinking can be used to solve problems in various domains, but it is in the business discourse that this methodology has gained the greatest attention - a finding made in the analysis of sub-question 1. This is especially so because it has been acknowledged as a process for solving contemporary business challenges.

As this interest in Design Thinking continues, it appears from the literature that the challenge still continues to demonstrate how Design Thinking is being applied in the organisational domain. However, the business model building blocks were effective in describing on a meta-level where Design Thinking is located in the organisation.

The research questions guided the methodology used, resulting in findings that generated a number of descriptions and emergent categories based on either an inductive process or by the conceptual frameworks applied to the data. We revisit these research questions in Table 5.1.

Table 5.1: Research questions addressed in the study

Overarching research question:	
How does Design Thinking create, deliver and capture value for industrial design related business models in South Africa?	
Sub-questions:	
1	What are the different perspectives and conceptions of Design Thinking which practitioners in Cape Town embrace?
2	What are the features of business models in an applied context of industrial design?
3	How does Design Thinking give shape (applicable relationships) to industrial design related business models?

5.2.3 Research methodology

The literature review led to a better understanding of both the phenomenon of Design Thinking and that of the business model. However, the literature review resulted in Design Thinking being portrayed idealistically and nebulous from a theoretical perspective. This means that there is no theory for Design Thinking with a defined terminology. However, the concept of Design Thinking rules was selected for higher order principles. On the other hand, the business model building blocks have been discussed by a body of contemporary literature which covers the realm of business in a common and descriptive language. Hence, why this concept was chosen as one of the conceptual frameworks.

The case study methodology allowed for practical insight to be gained, which provided the breadth and depth of the businesses analysed in their context. The main categories which directed the coding allowed for emerging sub-categories to be identified. Design Thinking rules and the business model building blocks served as good starting points to analyse and interpret the business phenomena studied in a more structured way, and also to test these categories for their applicable reference.

The inductive approach taken in sub-question 1 was intentional, not only because the knowledge with respect to Design Thinking has been open-ended, but rather it aimed to formulate conceptions that are not contrived, but context induced. These conceptions were

then derived from the data in an inductive content analysis method. Therefore, this inductive approach meant that I, the researcher, came to a decision through interpretation. These results were not used to test relationships that informed the results in sub-question 3. Rather, it aimed to inquire about the respondents personal understanding of the phenomena in order to get an idea of what Design Thinking might mean to them and also serve as form of credibility backing the findings that emerged through the Design Thinking rules.

The business model building blocks in sub-question 2, were broken down into main categories and sub-categories. The sub-categories served as descriptive categories under the main business model building block categories. Furthermore, the comparative method between the three cases outlines shared features of each case.

Sub-question 3 aimed to establish this conceptual grounding, namely, the Design Thinking rules and the business model building blocks. The approach to developing a direction from the start, using a prior framework, meant that data could be captured under these main categories without having to justify the initial conceptual grounding. This approach made sense because there is some conceptual basis for Design Thinking and the business model in the literature, and the aim in sub-question 3 was to apply what exists to explore further phenomena. It also made sense in terms of what was manageable within the parameters of the entire study. Focusing on theory building as frame of reference for sub-question 3 could demand more time and resources than feasible for an M.Tech thesis and the objectives that could be realised within the scope of such a study.

Therefore, the approach used addressing sub-question 3, which was deductive in its application, started with the Design Thinking rules as a structure for analysis, with main categories that were operationalised. This framing allowed for sub-categories to emerge in a descriptive interpretation. Furthermore, the results from sub-question 3, were used to present the relationships with results from sub-question 2. The relationships were positioned between the main categories Design Thinking rules and the business model building blocks.

5.2.4 Interpretation of the research results

The results of this study demonstrate that Design Thinking in practice is complex - in effect reliant on various interdependent factors. Furthermore, the findings demonstrated that Design Thinking is, in fact, shaping industrial design related business models. To understand this, we revisit the findings based on each sub-question and place the findings within the

context of previous findings from literature. A summary of each question is presented in the following:

5.2.4.1 Sub-question 1

What are the different perspectives and conceptions of Design Thinking which practitioners embrace?

Two discourses emerged, with practitioners having different interpretations of the concept of Design Thinking. These discourses include the perspectives from a 'design' stance and a 'business' stance. The responses to this question re-define the meanings of Design Thinking and justify the notion that it encompasses problem-solving in any domain, rather than an approach that is limited to design specific disciplines, such as the product design domain. This finding supports one aim of the study, namely, to illustrate that Design Thinking is being applied outside the normalised or common (disciplined) domains. This confirms our understanding of how industrial designers are adapting to the socio-economic conditions (an assumption we proposed in Chapter 1.9) which demand movement, therefore addressing the changing role of the industrial design concept.

We can now say that Design Thinking is a process that is driven by the objective to satisfy a need. If the domain of activity should be product development, then there would be needs addressed to user of the product. What this means is that the problem (the need) and the solution (the value) are contingents of each other. The conceptions that support and give quality to the outcome of the design are the emerging conceptions, such as 'design ability', 'user and customer led', 'cultural associations', 'generative', 'prototyping', 'testing', 'co-creation'. These are all conceptions that constitute what good design is, or represent the inter-dependencies of the best practices of design.

When positioning these conceptions and giving them a logical inference based on the Dubberly (2008) logic model, it became clear that these conceptions are interdependent. Other conceptions, such as 'co-creation', are advantageous as an input, but are interchangeable in terms of developing the appropriate forms. These conceptions are part of the Design Thinking process and all form part of the problem solving process and methods used in this process. An additional key finding was that co-creation was not mentioned by all respondents in the sample.

Because these conceptions were extracted from the data presented by a varied sample that included entrepreneurs, consultants and education practitioners, some outside the dedicated product development context, Design Thinking was presented as a process that involves the sequence of activities, nevertheless this sequence is not in any way linear. The findings allow us to reflect on what Design Thinking offers us in terms of the perceptions and conceptions involved in thinking through this design process. Furthermore, the findings lead one to conclude that the application of Design Thinking rules in sub-question 3, may well facilitate the problem solving process in any domain.

5.2.4.2 Sub-question 2

What are the features of an industrial design business model?

In Chapter 4, each business model building block of each individual case was described using a structured analysis matrix (i.e., business model canvas), also known as template. The data gathered demonstrate the complexity of the business model and also depict an instance of the business model of each case. Using this business model canvas framework, developed by Osterwalder and Pigneur (2010), it became clear that there are similarities in the features across the business models of the three case studies. These features include, for example the pre-determined sub-categories problem-solving activities or human resource deliberations which are important organisational aspects if these companies wish to deliver the value proposition. A summary of the features identified in the results follows below.

Industrial design related business models:

- create value propositions that are categorised as either newness, customisation or cost reduction,
- apply problem-solving and production as key activities,
- rely both on human and physical resources,
- have niche or mass customer segments, depending on their market size/economy,
- have both buyer-supplier relationships and strategic partnerships.

It has also become apparent that there are no specific business types that describe the features of an industrial design business model, which means it is influenced by the context. However, there are patterns across the cases and business models. Given that Monadjem did not have a background in design, there were still conceptual relations interpreted

between Design Thinking and the business model building blocks. The CEO of Nomanini, Monadjem, still interpreted Design Thinking in the business model (for example, convenience and usability as a value proposition) as a trait of the design activities. In this case it is evident that Nomanini would use industrial design in-house to design the convenience and usability of their terminals.

The book 'Business Model Generation', by Osterwalder and Pigneur (2010), states that companies are guided by three different economic, competitive and cultural imperatives. These types of companies include 'customer relationship businesses', 'product/service innovation businesses' and 'infrastructure businesses'. Even though the scope of this question did not include classifying the business model cases and justifying this theory, we did start to see categories emerging in the third analysis phase (sub-question 3) that associate with these business types which identified themselves in the results.

5.2.4.3 Sub-question 3

How does Design Thinking give shape (applicable relationships) to industrial design related business models?

The sub-question 3 above applied a qualitative content method of analysis which also allowed for additional sub-categories to emerge. For every business model building block, the Design Thinking rules had some causal effect that was shaping the business model, whether it be the value proposition or the way the company managed its human resource. To reaffirm: the main categories revenue and cost structure of the business model was discarded from the relational analysis

This question was split into two sections of interpretation in Chapter 4.4. The first section discussed how Design Thinking is being applied within the frame of the Design Thinking rules. The second section looked at how Design Thinking is shaping the business model. Therefore, is Design Thinking and the business model related? And what observations of these categories reveal to us conceptual interlinkages?

The three cases have also uncovered a variety of values of Design Thinking derived from the application of these Design Thinking rules. Because these three cases have similarities in terms of the industrial design industry, it should not be assumed that their features are universal. The reason for the literature review in chapter one was to explore and paint a

picture of the industry in South Africa and how the size of the industry may influence the business model.

5.2.4.3.1 The human rule: All design activity is ultimately social in nature

What shapes the business model?

There were several descriptive categories that emerged from the main categories under the human rule. This was no surprise when we revisited the statement that the 'human centric point of view' is imperative to solving technical problems (Meinel and Leifer, 2012:xv). The reason is that this statement coincides with the interrelated emergent sub-category of 'value to the customer', seeing that Design Thinking with respect to the human rule is about creating or providing value in the form of a product and/or service to the customer. It also became apparent that, to establish the needs and provide this value, customer relationships need to be managed, and there need to be ways to gain this insight. These considerations fall under the 'customer relationship management' sub-category and 'methods of gaining insight' from the user or customer. The human rule is not limited to the customer or the user; it also involves 'employee relationship management'. Therefore it is applied internally and externally to the organisation. Also, according to a statement by Cross (2012), teamwork has become of particular importance in normal professional design activity, particularly as integrated activity involving collaboration among different professions, such as in multi-disciplinary design activities. Therefore, the internal organisational values, the way in which employees work together and the motivations are vitally important. Design Thinking under the human rule enables empowerment in the organisation. The human rule is, in essence, the ability to see the value in co-workers and nurture their talents and values when working together, which requires empathy both internally and externally to the organisation.

What business model building blocks are being shaped?

With respect to the business model, the human rule is shaping the value proposition. What this means is that the 'customer relationships management' and 'methods of gaining insight' would inform the design decisions that would form the value propositions which the company creates, such as newness, customisation, convenience and usability and/or cost reduction. The design activities that are required to deliver these value propositions are reliant on both the infrastructure management and the customer interface pillars. Both internal and external designs of the business model. For example, Research Unit reaches its customers through its stores (channels). Through this personal customer relationship, it would understand its

customer/user needs and satisfy this through the brand/status that it creates. Therefore, the human rule emerges as playing a role in shaping the company's interactions with its customers and users, which refers back to the emergent customer relationship management category. Another finding related to the human rule is that these personal relationships (considered to be empathy) shape the niche customer segment. Nomanini, however, does not have a niche market and rather develops technology that supports a multi-platform for a mass market customer segment. The human rule at Nomanini plays a role in the NPD process and the management of the human resource internally, which involves the employee management that transfers and complements the skills needed to deliver the value proposition. Resulting in the 'Knowledge transfer' category, falling under the infrastructure management pillar.

5.2.4.3.2 The ambiguous rule: design thinkers must preserve ambiguity.

What shapes the business model?

Ambiguity is found in various contexts, coinciding with the emergent sub-category of 'context of uncertainty'. It is present in complex, new, NPD or at the 'fuzzy front end' of any development. Ambiguous contexts can help manage innovation by gathering different forms of interpretations, a trait of managing change. Cross (2012:23) describes ambiguity as being 'essential to the design process, allowing participants to manoeuvre independently within object worlds and providing room for the recasting of meaning in the negotiations with others', this activity involves 'designing as a reflective conversation'. The way in which the directors of the cases manage this change and recasting is specific to Design Thinking, because the process involves this ambiguity when faced with complexity while insights are gained and formed. This also coincides with the human rule according to the emerging category 'methods of gaining insight' and 'capacity building' through teamwork and reflective conversations that may also involve the role of 'customer relationship management'. This means absorbing lessons and gaining insights from the user/customer that will make the development less ambiguous. Design Thinking involves the phases of uncertainty and failure, traits of ambiguity to improve any aspect of the early stages of the development phase. An approach to controlling such uncertainty means that the designer might make a prototype to measure the improvement (or even faults) in the prototype. All of the above is experienced under the emergent sub-category 'managing change'. Furthermore, another tactic to manage this change is through iterative development, cycles of improvement that are encountered in 'contexts of ambiguity'.

What business model building blocks are being shaped?

It was evident that ambiguity is shaping the value proposition when the proposition involves newness, which involves 'contexts of ambiguity', an emergent sub-category. In the customer interface pillar, ambiguity is also present when dealing with both a niche or mass market under the customer segments, such as in the case of Nomanini, whereby in the case that they are entering new markets. The infrastructure and management pillar has a strong correlation with the ambiguity rule. Another relationship exists between the key activities such as production and managing uncertainty. This is an interesting finding because it means that designers are managing change through their approach to control in the production design and implementation. There is a differentiation here to ambiguity used at the 'fuzzy front end' to encourage innovation, rather it is at the stage in development after there is ambiguity where the design activities involve prototyping and testing to mitigate risk of failure.

5.2.4.3.3 The re-design rule: all design is re-design

What shapes the business model?

Referring to the literature, the re-design rule is imperative to how the needs have been addressed in the past (Meinel and Leifer, 2012:xv) and the process of envisioning possibilities based on new insights (Cross, 2012). In essence, re-design is the process of 'managing transformation' - an emerging sub-category. Moreover, the re-design rule has a context, as when innovation or something new is required; hence the emerging sub-category of 'contexts of re-design'. When it involves a strategy to designing something new, there needs to be an approach to 'managing uncertainty' to achieve the objective. This strategy can involve having a hypothesis-led approach, whereby the existing frameworks are applied within the design process. Hypotheses may be applied at the start or through the iteration and testing of a prototype. Iteration is important because it induces a selection and a potential combinations that will guide a new direction or decision.

What business model building blocks are being shaped?

As we have discussed, re-design is appropriate when not much has been done before. This means that a business model may have a value proposition that involves addressing a completely new set of needs. It will be shaped by key activities that involve the re-design rule, such as foresight, iteration, testing and reflection. These activities of re-design are part

of the key activities of the business model. Therefore, the re-design rule is being applied in the form of problem solving as an element of key activities. The re-design rule is also shaping customer relationships, whereby 'methods for gaining insights' are captured to inform the key activities.

5.2.4.3.4 The tangibility rule: making ideas tangible always facilitates communication

What shapes the business model?

Tangibility, as discussed in the literature review, is a form of media for communication (Meinel & Leifer., 2012:xiv). A prototype is a physical object or mock-up, that can be useful tool in suggesting new possibilities (Cross, 2012). Prototypes are used as central activity and is key working method for the design process. Cross (2012) believes that the actually making of things, will speed up the process of understanding the fundamental strengths and weaknesses. Therefore this communication and visualisation serves in its purpose of the design process for the 'knowledge retention' gained, an emerging sub-category. It also invites critique and external buy-in. The strength and weakness's signify a 'method of measurement'. The benefits of using a prototype are the 'mitigation of risk' by creating objects that can be tested hands-on before any large investment is made.

What business model building blocks are being shaped?

We need to refer back to the common understanding that the design process attempts to start with the abstract and moves towards the concrete, visualisation having the greatest effect on this development (Lyons, 2005). In the NPD context, we can refer to the prototype as visual tool. Therefore, the key activities are being shaped the ability to visualise and communicate, main categories under the tangibility rule. In the case of Research Unit, the tangibility rule played a role in the 'knowledge retention' for the investment and traction which the company received. The outcome is a key resource for the business model. The mitigation of risk sub-category, under the tangibility rule shapes the Key Activities, which is part of the the design process. The tangibility rule is also recognisable in Research Unit's channels in the customer interface pillar, where they also use their store to test products. This has relationships with the secondary sub-category 'mitigation of risk'.

5.2.4.4 Addressing the overarching question

How does Design Thinking create, deliver and capture value for industrial design related business models in South Africa?

According to the literature reviewed, the definition of a business model states that 'a business model describes the rationale of how an organization creates, delivers and captures value' (Osterwalder & Pigneur, 2010:14). Therefore, the overarching question is derived from this conceptual understanding. If an industrial design business has design skills and capabilities, or a grounding in design, then the assumption was that this would present itself as an organisational resource and would become apparent as an agent that would influence the values that shape the business model described in Figure 5.2.

The results build a descriptive interpretation of where the value derived from Design Thinking is located in the business model. Now that the three case studies have revealed some detailed information about the relationship between Design Thinking and the business model, we can address this question broadly and give a qualitative interpretation of where this value lies. The following insights are proposed to address the overarching research question.

a) Design Thinking is creating value through its infrastructure management

- creating value through the knowledge management, transfer and the empowerment of the key resources which the business needs to operate,
- creating value through capacity building (seeking complimentary skills and capabilities)
- creating value through the ability to transform insights captured and managing the change in the activities performed,

b) Design Thinking is delivering value through its products and services

- delivering new, novel and customised forms of value,
- delivering value by satisfying the needs of its customers,
- delivering value by means of customer retention

c) Design Thinking is capturing value by means of the customer interface

- capturing value by developing customer relationships, such as encouraging co-creation and personalisation
- capturing value through the awareness and the empathy for the customer,
- capturing value through applying design methods to gain niche customer insights

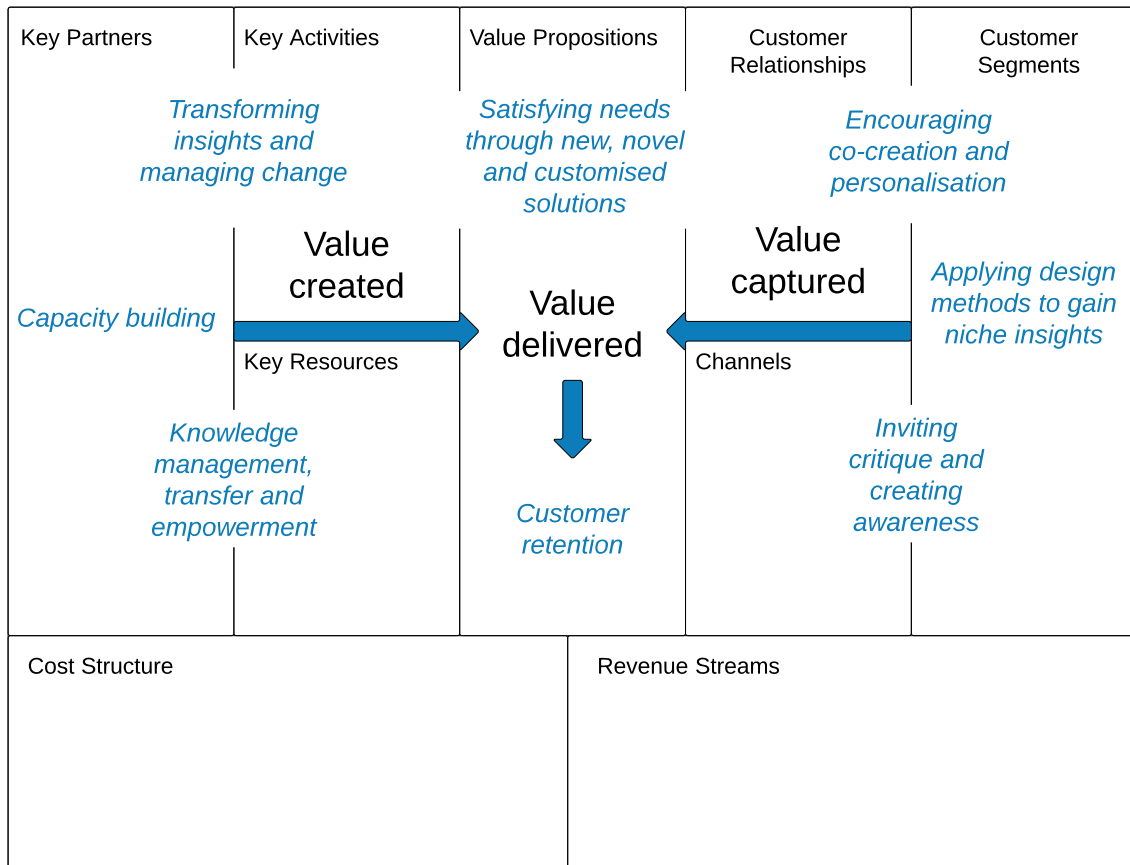


Figure 5.2: Design Thinking value for the business model (Author’s construct adapted from Osterwalder & Pigneur, 2010)

This summary of the interpretations of where Design Thinking creates, captures and delivers value is not limited to these domains. For example, the Design Thinking through empathy approach aims to empower talent within the company. Therefore, this is a form of capturing the value of the employees, an integrated and internal resource. Another example is the co-creation category which refers to value being created with the customer. However, co-creation a sub-category of customer relationships would also be a key activity that refers to the infrastructure management.

5.2.5 Key insights from the study

Furthermore, seven key insights are identified across all the results from the analysis addressing the questions:

- Design Thinking is a method for differentiating products and services or even the business model itself
- Design Thinking is both user and customer-centered, therefore it is not always the case that the user is the customer
- Design Thinking does not only involve the customer, but also the employee, to manage the integrated activity of collaboration and personal motivational values
- Design Thinking in the business model context requires collaboration, a trait that is not as important in the product design domain but does provide value for the latter, too
- Design Thinking requires a process and sequence of activities, but this is not linear and certain activities may be repeated through iterations
- Design Thinking is mandatory when the value proposition requires something new or customised.
- The business model itself is, in fact, an object of Design Thinking

5.3 CONTRIBUTION TO KNOWLEDGE

This section aims to communicate the contribution to knowledge resulting from the research findings within this thesis. A driving motivation for conducting this research was that there is limited literature available which focuses on the Design Thinking practice being applied within industrial design entrepreneurship. Also, the existing knowledge of business model design is broad, and there are few contextual and descriptive research projects on the topic.

The overarching aim of this study is concerned with understanding the application of Design Thinking in practice, and drawing attention to the interrelationship between two concepts to induce context derived results. The desire was to understand what designers really think and do when they create products, services and enterprises. The research questions evolved as the scope of the study became more defined.

5.3.1 Contribution to academic research

The Design Thinking rules are an overarching consensus of a concept. In the 'Design Thinking' research book published by Meinel & Leifer (2012) there was no evidence-based understanding of these rules being applied in a particular context by practitioners of design. Rather it provided the opportunity to use this concept to direct the application of Design Thinking. In essence, it created the space for testing the application of the concept 'on the ground'. The emergent Design Thinking categories (sub-question 3) in the analysis of the data gave rich description of what designers and engineers are really doing when they are designing. These findings contribute to the very little primary research that has been done here in South Africa.

Furthermore, the research identified limited academic work which focused on Design Thinking being applied outside its normal boundaries. Work that shares some similarities with the South African context is the work written by Viljoen & Zyl (2009), called Design Thinking - Crossing Disciplinary Borders. It looks at 'moving the concept of design beyond the design discipline itself, creating new and exciting opportunities, not only for the various other disciplines involved, but also for design education' (Viljoen & Zyl, 2009:66). This study, therefore, contributes to the body of research on Design Thinking being applied across borders.

The results of this research justify Plattner's (2012:v) statement that:

'the method of Design Thinking melds an end-user focus with multidisciplinary collaboration and iterative improvement and is a powerful tool for achieving desirable, user-friendly, and economically viable design solutions and innovative products and services'.

This statement provides a picture of the core aim behind Design Thinking and that is developing product and services, but also it describes attributes of Design Thinking that make up a business model, such as multidisciplinary collaboration for example addressing the key resources and the structure of the business model.

In a recent study, "Parts Without a Whole" by the d.school that looks at the current state of Design Thinking practice in organisations, Schmiedgen et al. (2015) seek to understand how Design Thinking is diffused across organisation, as well as which organisational functions

can be developed optimally by employing Design Thinking. Similarly, in the paper “Design in the Organisation: Parts and Wholes” (Junginger, 2009), she develops an archetypical to be able to assess the role of design in an organisation. Because this study looks at how designers enact Design Thinking in the business model, it contributes to this branch of research, namely, understanding the role of design in an organisation.

Lastly, addressing the scope of business model design, key authors such as Zot and Amot, Fraser and Osterwalder, and Pigneur and Lockwood look at a business model as an object of design. Moreover, authors, such as Lockwood and Fraser, see Design Thinking as a methodology to develop business strategy.

The outcomes of the present research illustrate how design logic may be used in order to optimise business model design, especially with respect to those business which wish to become more design orientated organisations. The resultant focus areas which have been described are the categories that related the context, application and the benefits of Design Thinking.

5.3.2 Contribution to design education

Revisiting the initial problem in design education at CPUT in the FID, this study addresses aspects as stated in the report Panel Evaluation Report for FID ‘the institution’s mission and planning, needs for students and other stakeholders, intellectual credibility, coherence, articulation, characteristics and needs for professional and vocational education’ (CPUT, 2013). To date, it is not clear what development has taken place since the evaluation of the National Diploma and B. Tech. in 2013 which claimed that the ‘curriculum and assessment procedures do not adequately address the integration of Design Thinking in the business domain’ (CPUT, 2013:13-14). However, this research can serve as a reference for courses, providing useful tools, such as the business model canvas. The study may also assist with the integration of Design Thinking in this business domain, as reference guide to identifying key attributes for the Industrial design praxis.

5.3.3 Greater significance of the results

On a broader level, CCDI is implementing a Western Cape Design Strategy to create an enabling environment for design, by assuming that ‘Design is a key for unlocking value of innovation, innovation is a driver of competitive advantage and innovation drives economic growth’ (CCDI, 2012). Therefore, the results of this research contribute not only to an

educational movement and need, but also suggest strategies for promoting design throughout a diverse set of sectors outside of the creative industries and encourage the use of design, or the methodologies used by industrial design in particular, to develop the South African economy, as way of solving problems and stimulating the economy through products and services.

5.4 LIMITATIONS AND ANOMALIES

5.4.1 Substantive reflection

Previously discussed in the literature review, Design Thinking in practice is complex and, in effect, is reliant on many interdependent factors. Therefore, during the operationalisation of the human rule, for example, each main category, such as empathy, could be broken down into many variables in order to understand the psychological nature of what is happening when Design Thinking is being applied. Consequently, this study focused on the meta-level concepts of Design Thinking and the business model. The reasons for this are because of limited research in this field, and that a meta-level study is important before any micro-level research should be done. For example, a more focused study could ask: How does empathy influence the type of value proposition in a business? This meta-view meant that only a certain number of variables could be operationalised or obtained. It also meant that generic emergent categories were presented to give a description at this meta-level.

An anomaly that became apparent in the results is that Design Thinking is a process of thinking. This had implications during the interpretation of Design Thinking in relation to the business model building blocks, because a business model is an outcome of design. At the same time, when it is a design orientated organisation, design is a key activity applied to the product/service. Therefore, a complexity arises from the fact that the business model itself is, in effect, a result of Design Thinking and the product and services are, too. Thus, a narrative account needed to differentiate clearly between instances of Design Thinking guiding the business model design versus those influencing the product and service design.

5.4.2 Methodological reflection

The application of Design Thinking involves complex context specific situations. Therefore, the reader should bear in mind that there are many ways in which the logic of design could be presented, as well as ways to describe how we design. The first part of this study elaborates on the issue of Design Thinking being interpreted in different ways and still not

having emerged as a carefully defined concept with its own distinct terms that describe the concept, such as in sub-question 1. The perceptions of Design Thinking in the problem-solution space may differ greatly, depending on the process adopted and the context. Consequently, it is almost impossible to establish a common definition that could be verified using the same methodology, but in a different set of businesses from a similar sample.

The case study methodology worked well to gather the relevant data that would answer the research questions. The research design, looked at three case studies. Two with directors with an Industrial design background (Thingking and Research Unit) and the other with knowledge of industrial design (Nomanini). During the case study process, it became clear that Nomanini is archetyped differently to the other industrial design cases, because the director Monadjem does not have a background in industrial design, but had worked for an industrial design consultancy firm and had experience in NPD.

The Nomanini case was a good example of NPD rather than being industrial design specific. It also posed the sub-question 'What are the features of business models in an applied context of industrial design?', a comparison of each case gave description of how these cases present themselves within the framework of the business model building blocks. Furthermore, the results in sub-question 3 show that Design Thinking has influenced aspects of all the three business models, including Nomanini. However, possible implications of the results are subject to the fact that Nomanini was directed by a professional with an academic background in engineering and business management.

An alternative case study research design, would mean the directors of business model would be from a completely different professional background or industry and the results would then propose a comparative analysis, on how Design Thinking influences a business model without any relation to former design.

To establish the validity of quantitative content analysis of this research question a larger sample group would have been required in order to see how many responses would touch upon the various categories in sub-questions 1 and 3 and the density between these categories would need to be controlled according to the sample. Rather, the qualitative content analysis approach shows where the relationships lie among the categories, especially as it became clear that the categories are interdependent. This may well be why literature has neither arrived at a consensus regarding the concept of Design Thinking.

5.5 RECOMMENDATIONS AND SCOPE FOR FURTHER RESEARCH

5.5.1 Policy recommendations

Three primary policy recommendations are proposed.

Firstly, the outcomes of this study support the call for industrial design education in Cape Town to be more geared towards business and management competencies. The purpose would be to prepare industrial design graduates who wish to take the path of entrepreneurship, and a fair majority of graduates do venture into establishing their own businesses. Even though the industrial design curriculum offers a business component, it is important that there should be other mechanisms that support this development after graduation; that the curriculum should also be geared towards including design entrepreneurship in post-graduate courses.

The second recommendation addresses the need to create awareness around the 'value of design' and the contribution which industrial design, or design in general, makes towards economic growth and solving 'real world' problems. Also, the idea that design can be applied outside its traditional borders should be seriously promoted.

Thirdly, it is vitally important that a design competencies strategy be developed for the future of industrial design businesses in South Africa. Such a strategy should look at the cognitive, interpersonal, business and strategic skills that will develop SMEs in this sector.

5.5.2 Academic research

Because of the limited academic research done in the field of Design Thinking, new knowledge is needed to clarify Design Thinking and deepen an understanding of this concept, as well as adapt its processes to the evolving socio-technical context of our education and business. The following research streams are proposed as opportunities, or further scope, for research:

- understanding business model innovation, in the context of industrial design
- classifying industrial design-driven business models,

- understanding the Design Thinking competences of industrial design and its relationship with the problem solving traits of entrepreneurship,
- business and economic opportunities for the changing role of industrial design,
- understanding how Design Thinking operates in teamwork scenarios and this influences the value proposition of the business model,
- Classifying new design related business models emerging in the South African context

understanding the 'true value' which design holds for entrepreneurship.

5.6 CLOSING WORDS

There are multiple drivers that are making an intersection between the inter-disciplinary fields of design and business. While industrial design is expanding its boundaries to include systems, service design and entrepreneurship, the methodology of Design Thinking is being sought after in the fields of business. The design processes are being celebrated for their value and for delivering innovation, in particular to solve business problems which entrepreneurs constantly encounter in our rapidly growing complex world. Designers are subconsciously applying their skill to the business context, while business people are trying to understand how designers think - a very interesting phenomenon, which was the motivation driving this study.

Finally, the business landscape is being revolutionised by tools, such as the business model canvas with its ability to articulate a 'blueprint for strategy' that depicts the logic of how a company creates, delivers and captures value. This suggests that there is vast scope for better understanding the logic of business and how it is being shaped by design in various contexts to benefit the generations to come.

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7 APPENDICES

7.1 Appendix A: Copy of research Ethics Checklist form

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Faculty of Informatics and Design

Research Ethics Review Checklist

All post-graduate students and researchers are required to complete this form before commencing with research. Post-graduate students are requested to please submit this form together with HDC 1.2 (proposal submission) to the Faculty Research Committee (FRC).

(Where applicable mark relevant boxes with an X)

Project Title: _____

Applicant / Researcher:	Title, name & surname:				Under-graduate		Post-graduate		Staff	
	Office Telephone:	Cell:	eMail:							

Supervisor (if applicable):	Title, name & surname:				Under-graduate		Post-graduate		Staff	
	Office Telephone:	Cell:	eMail:							

Research Checklist:		Yes	No
1:	Does the study involve participants who are unable to give informed consent? Examples include children, people with learning disabilities, or your own students.		
2:	Will the study require the co-operation of a gatekeeper for access to the research participants. Examples include students at school, members of self-help groups, residents of nursing homes — anyone who is under the legal care of another.		
3:	Will it be necessary for participants to take part in the study without their knowledge and consent at the time? — e.g. covert observation of people in non-public places?		
4:	Will the study with the research subject involve discussion of sensitive topics? Examples would include questions on sexual activity or drug use.		
5:	Will the study involve invasive, intrusive, or potentially harmful procedures of any kind (e.g. drugs, placebos or other substances to be administered to the study participants)?		
6:	Will the study involve testing on sentient subjects?		
7:	Will financial inducements (other than reasonable expenses and compensation for time) be offered to participants?		
8:	Will your research involve materials or processes that could damage the environment?		

If you have answered '**No**' to all questions, submit the completed and signed form to the FRC together with the research proposal.

If you have answered 'Yes'...

If you have answered 'Yes' to one or more questions, kindly attach a report describing how you plan to deal with the ethical issues raised by your research. This does not mean that you cannot do the research, only that your proposal will need to be approved by the Research Ethics Committee. You will need to submit your plans for addressing the ethical issues raised by your proposal to the FID Research Ethics Committee.

Declaration

As Researcher / Applicant I acknowledge that:

- It is my responsibility to follow the CPUT Code of Practice on Ethical Standards (which is currently being drafted) and any relevant academic or professional guidelines in the conduct of my study; and
- that this includes providing appropriate information sheets and consent forms and ensuring confidentiality in the storage and use of data.
- Furthermore that in the event that there are any significant changes in the design, or conduct over the course of the research, that I will notify my supervisor (where relevant) and inform the FID Research Ethics Committee if new ethics approval is needed.

By my signature below I declare that I am not aware of any potential conflicts of interest, other than those declared on THIS form, which may influence the ethical conduct of this study.

Signatures:

Researcher:
Date:

Supervisor:
Date:

FID Research Ethics Committee comments:

Approved	Referred back	Ethics Committee Member	Date:

7.2 Appendix B: Vahid Monadjems consent



Cape Peninsula
University of Technology

FID/REC/ICv0.4

FACULTY OF INFORMATICS AND DESIGN

Individual Consent for Research Participation

Proposed title of the study: The roles that design thinking can play in developing competitive Industrial Design driven business models

Name of researcher: Oriole Mphumelelo Bolus

Contact details: email: oriole@eduspace.co.za
084 457 1153

Name of supervisor: Prof Mugendi M'Rithaa,

Contact details: email: mugendim@cput.ac.za
072 655 8727

Name of co-supervisor: Byron Quality

Contact details: email: i-am@byronquality.com
082 555 1909

Purpose of the Study:

The Industrial Design profession is advancing with an even broader inter-disciplinary competency by definition, those with entrepreneurial traits are strategically aligning both design and business attributes concurrently by exploiting the mind-set, methods and tools now better known as 'Design Thinking'. Thus creating value and representing a significant impact if employed during the business model design stages. The research aims to find out how the methods and mind-sets of design thinking creates value to ensure Industrial Design entrepreneurs know how to take advantage of their design skill by also employing it in their business strategy, rather than a product alone. Hereby, shifting with the economic context, whereby it is important that there are continuous enablers being developed for graduates to be self-employed and self-reliant in the Industrial Design business practice. This is all working towards developing a business model design conceptual framework for Industrial Design thinkers to employ at the front end of a business venture.

In order to achieve the above objective a variety of models, processes and cases within the interdisciplinary field of the business and Industrial design will be explored. The research design follows a qualitative approach on the basis of Design Science Research.

Participation: My participation will essentially consist as an interviewee.

Confidentiality: I have received assurance from the researcher that the information I will share will remain strictly confidential unless noted below. I understand that the contents will be used only for the M Tech Thesis and that my confidentiality will be protected by the use of pseudonyms (or as specified below). Explicit consent must be obtained before any publication of the data findings (unless otherwise noted).

Anonymity will be protected in visual data (unless noted below) through the non-disclosure of my identity or any intellectual property thereof. Photographs will only be taken with my consent.

I am aware that the longevity of the visual and other data can remain in publication for many years and could raise the risk in the long term as circumstances change.

Conservation of data: The data collected will be kept in a secure manner. These will be digitally recorded data that will be encrypted and kept in a password-controlled environment. Original or copied information needs to be stored for auditing purposes.

Voluntary Participation: I am under no obligation to participate and if I choose to participate, I can withdraw from the study at any time and/or refuse to answer any questions, without suffering any negative consequences. If I choose to withdraw, all data gathered until the time of withdrawal will be returned or destroyed.

Additional consent: I make the following stipulations (please tick as appropriate):

	In thesis	In research publications	Both	Neither
My image may be used:			✓	
My name may be used:			✓	
My exact words may be used:			✓	
Any other data that I provide (stipulate):	✓			

Anything else you would like to add?

Acceptance: I, Vahid Monadjem
(print name)

I agree to participate in the above research study conducted by Oriole Bolus of the Faculty of Informatics and Design department of Industrial Design at the Cape Peninsula University of Technology, which research is under the supervision of Professor Mugendi M'Rithaa.

If I have any questions about the study, I may contact the researcher or the supervisor. If I have any questions regarding the ethical conduct of this study, I may contact the secretary of the Faculty Research Ethics Committee at 021 469 1012, or email naidoove@cput.ac.za.

Participant's signature:  Date: _____

Researcher's signature:  Date: 15 July 2015

7.3 Appendix C: An example of the interview

Interviewer: Oriole Bolus

Interviewee: Vahid Monadjem

Transcript from the interview with Vahid Monadjem

Date: 21 July 2015

Location: 42 Hans Strijdom Avenue

SECTION ONE: Interviewee Profile

OB: Okay let's start. So I am having an interview with Vahid Monadjem on 21 July. Is that correct?

VM: More or less

OB: To start with: Can you give me a few details, such as your age, education, job title and the time since you founded Nomanini?

VM: Okay. So I'm 33. I did a B.Sc. in Electro-Mechanical Engineering and also a second Honours in Financial Analysis and Business Management. I am now the CEO of Nomanini. Nomanini was founded four years ago. When it was realised... was January 2011.

OB: Tell me a bit about your background before you started the business. This could just be your work experience and how this steered you in this direction?

Background

VM: So, after graduating from the University of Cape Town I started a company with two friends. All of us were electrical and mechanical engineers and we ended up doing electrical engineering consulting. So we worked on various projects from baby toys, to farm weather sensors, machines to machine communication equipment. I did that for two years, and then I moved into industrial design at XYZ where I was the mechanical engineer, effectively being

the technical liaison with designers. We loved that space - the interface between tech and people. I did that for two or three years. Then I moved into business management consulting. I worked with McKinsey (a company in Johannesburg, Indonesia, United States and Germany) during the first two years doing various generalist consulting, mobile operating, utilities, industrials, all sorts, and the last six months I got a fellowship in emerging markets development and launch. During the entire period I would quite often get involved with one or two mobile operators here in South Africa. And that experience is the context that helped me create Nomanini. Then in December 2010, I resigned from McKinsey to start Nomanini.

OB: That's great. Now that you have given me some of your background, tell me a bit about the industry and your role as the CEO?

VM: So our industry - we work at the very front edge of mobile, where mobile is moving more into the payment space. To be more specific, the reason mobile became so pervasive is the scratch card and that prepaid mechanism that enables the service to buy in very small increments. It was highly affordable; it's affordable at a single dollar at a time and that's what leads to the mobile revolution, where there's now over 700million mobile phones in Africa that nobody would have expected 10 years ago. I think within that - it really highlighted the issue of payments and collections as the key enabler - to service providers - providing more. So now, as you look at the electricity utilities are trying to provide a suite for seeing that the way for them to serve the under-served are the prepaid, micro-payment mechanisms? So in that space - that's where we look at it. We say that the next step, for micro-payments and prepayments, is to make them electronic. The physical is effectively what amounts to receipts and tokens which make it expensive, and we believe that mobile electronic will provide that wonderful channel has been created by the mobile, to provide payments for a lot of other industries. The role of a CEO in a start-up is a very broad one. The normal CEO roles of strategy, I guess, is what generally is a management oversight. In the start-up context you are a gap filler, where you don't have a CFO or COO, product management; you are all of those things. So the start-up space carries a lot of other roles.

SECTION TWO: Perspectives of Design Thinking

OB: Mentioning before the core to this - the core to this research is looking at what roles Design Thinking can play in competitive industrial design business models. But what I was saying - I am also looking at other business models that might be product-development orientated. So the main question is: How can the methods and mind-

sets of Design Thinking facilitate the development of competitive business models? So that kind of brings in the next set of questions that will be more around design. So tell me: Do you feel you use design approaches in your work practice? What is your association with design?

(6:33) VM: My association with design is non-academic. It was the few years that I spent at XYZ. I was exposed to industrial design and in some projects playing that role. It never formalised. Which brings up the question of 'What is your definition of your design approach?' Just to be sure when I answer this question that I answer it truthfully.

OB: I guess that follows certain principles, and they have certain features or characteristics that they employ. It could either be Design Thinking approaches, like brainstorming, or it could be empathy mapping, or these are just some of the methods that they would use. Or they would employ kind of Design Thinking processes, where they would kind of try to discover and maybe emphasise, to try find a problem, identify things that they would want to work with. Um.... and then they ideate; then they move into that space, and there might be a lot uncertainty in that space, but they are happy with that - to deal with that uncertainty and then prototyping. So there is a bridge between engineering and design.

VM: It does definitely seem that especially the modern process software being very agile, and how that's spilling over into other technical fields - of this idea of iterative development, user methods development - of kind of rapid feedback cycles. It's very design-like; so the lines are very blurry for me. Whether our approach to iteration and prototyping and testing are one of design or one of extreme software. So maybe we want to talk about how we did it and then you can decide whether that is design. So we had this idea in 2010, and before my prototype - to give me the confidence to design - was too facilitate a workshop with target users who have actually used something with proof of concept type service. So we did proof of concept before we even started the company. So it was very.... think tools that were very much linked to engineering design. But we did a 6-week pilot in Soweto with taxi drivers who, at the time, were our target market, and at the end of the six weeks we had a workshop. We had sticker voting and tried to use tools to bring out the feature set that we had to develop in the production version after the proof of concept. That worked very well. I had the confidence to leave a corporate role. Even within the way our business developed - it was - we were - it wasn't just the product that was consumer-led. It was the business that was somewhat market-led. So we started with this idea of selling airtime in minibus taxis, and what we kind of, in January..... we incorporated in being and doing. We had a lot of

work to do, creating a transaction terminal that would work in this environment and a backend system that could accommodate this kind of transaction. Midway through twenty-eleven, we got an alfa prototype that we could use and test and all that. Um.... ran up and down Cape Town, getting field notes and one of the things we realised: people that were most interested by this were retailers. That gave our company a nudge towards - to think of your target market more broadly. So then we potentially did a beta with taxi drivers and retailers and security guards and schools kids to try getting a broad mix of reactions. Um..... there were multiple cycles like this that we refined and target market. We refined our role in the value chain, whether we are the core wallets in the payment space. Finding a niche, it was very - I want to still use the word 'design-led'. It was led with the needs of the end-user, and it was a very iterative approach.

OB: Building up from that quickly: What does Design Thinking mean to you? Some of the words you used, iteration based, user-led...

VM: Sometimes when a term is over-used, it loses its meaning.

OB: Haha, yes - I see....

(12:09) VM: For me, it's listening to your end-user and being able to test the hypothesis and the change. You could say that is Design Thinking. You could say that is good business. You could say that's lean start-up stuff. You could say that it's a scientific method, finding a business.

OB: So breaking it down into common sense, like you were saying. Where people can see it as this common sense, thinking in a particular way.

VM: I mean I suppose it's one of the things that are a little more emphasised in design ... over the years I have absorbed: there's the very hard- core rationalist approach, and then there's the approach that emphasises more of the emotional aspects, based on one's experiences. But, I think that's the distinction between the design method, the scientific method and lean-start tools is that - is acknowledging that a person, a series of things, in addition to being a consumer, mother or father or - they worry about different things. I think that the only distinction I would.... but I ...again... I am not an academic that would know too much about these things.

SECTION THREE: The application of Design Thinking in business

Human rule

OB: Good. I will go into more detail of Design Thinking, looking at some of the principles. These will be more target questions in that sense, not so much open-end questions. Still, with the aim to get your opinion on your experience with design. Are your motives in the company human-driven, and does this play an important part in the product development process? (I think you may have mentioned a bit of that).

(14:09) VM: It's actually sometimes that we are very cognitive about - we've moved in our role of the value chain. We've actually started very much providing these tools for market merchants – well, first taxi drivers, and then moved to the retail sector. As we have moved in the value chain, we have actually moved up - we've moved further away, not actually having direct contact with the merchants ourselves ... although our technology is used by them, and that's something which, as a company, we have been very mindful of. It's very easy to get swayed by what MTN or VODACOM want. Ultimately, our end-user is a merchant, and we need to know what they want, what they feel, what they worry about, what they are excited about and what makes ... how we can serve their needs. So I think, as a company, we are very much led by that. I don't think it starts with product development, to be honest. I think it starts from hiring; it starts from the kind of people you get to work on a problem - need to be people who care - I think it starts there.

OB: And they maybe employ an empathetic approach in their ways

VM: Have you worked with developers!

OB: I guess you also have people working externally.

VM: No, no! Design is not just putting something around something that is developed. The role of design is the responsibility of design in every person. Just like in our company: when we have the responsibility, everyone has a lot more autonomy and scope to question and challenge, and try new things. It's also having that mindset of - wearing the hat of the user: How does this work for you, when you use a service, in a place that we didn't expect - is our reaction. This wasn't designed to work in a train or high voltage power lines ... oh shoot! We have to accommodate for this! I think it very much goes back to the mindset of: tell or listen. I think that the period when stretched companies find themselves getting to tell mode and they say 'This is too hard to change'. Tell the user to use it differently. I think it's just about having

a listening approach.

OB: I see. Describe some of the most influential specialisations or disciplines you have in your company or organisation, in terms of the human resource side of things. Do you think the way you have organised your company - do these skills complement each other? And how do you see these skills complementing each other?

(17:03) VM: At our core we are very much a technology company. A technology company with a lot design and room in the air, in the way in which we approach a problem, but, by and large, the specialised skills that we have are, by and large, developers, and this is in-house. If we look at the broader network that we work with, industrial designers, manufacturing engineers, it's quite a bit broader. The core specialisation is one of software from electronics development, and even our approach to that is - it's very cross-functional. We have an intention that the focus is problem and not siloing in on specialisation. Only till about a year and a half ago did we start to roll out; we started to form up a formal commercial side to our business. Until then it was myself - we were more doing direct sales to merchants. Then we switched over from a local model to an international model. We started a commercial function, which is its own kind of specialisation, doing international business across Africa.

Ambiguity rule

OB: The next question I am going to ask is aimed at your approach. In a managing position, do you find yourself comfortable with uncertainty or ambiguity, in certain cases, especially now that you have been in the start-up stages?

19:03 VM: So, in the start-up stages, quite often, you find yourself back in those positions. We are working on a second generation of our terminal, with some kind of new-fangled tech and kind of design leanings of durability and design for reparability, and all those things that we are cooking in - and then you find yourself back in the 'fuzzy front end' of the design process. Yes, I think I am very comfortable in the design side, just because I am a generalist who knows enough to imagine what can be done without getting too worried about the problems encountered (laugh)... which is useful I think. There is also - having run this course with different products, being comfortable with the fact that you will get some things wrong and there will be remedial action, axes and crunches and that's just part of the process. I think one of the biggest things is getting through those cycles; that period is being hypothesis led. In the thinking to make sure that this thing this is our best answer, here's how we are going to test it.... Okay, and let's try turn as many of these hypotheses into facts

as we can - and that approach - and that's what I find very interesting very like a design approach, which I experience as I did with XYZ. Very much the IT lean start-up approach. It's very much business management consultancy approach. So getting out of the 'fuzzy front end' and by leading with hypotheses and having the confidence, having an opinion and acknowledging that it's not yet fact, but also having the resilience to go: 'We were wrong about this. Let's pull together and fix it.'

OB: So, do you believe that failure is part of the process in that sense in certain cases.

VH: Oh yeah.

OB: Have you had any cases where you may have developed a strategy but may have failed, but in the long run it's actually brought up something more interesting.

VH: So, I think: Unless you're doing something that has been done before.... ahh... you going to fail (laugh). Unless you are doing something simple and predictable, you are likely to experience failure. I think it's organisation resilience to recover that and to absorb that as a lesson that turns from a failure to pivoting. I think we've pretty consistently every 9ish months pivoted as a business, whether it's our target market changing, our role in the value chain, the way we bite technology, then broadening that out..... You could argue that to that point: Well, that was a failure point - but that just became, broadly defined, a pivot. Well, I think that became part of the experience when you are innovating. When you are trotting on a new path.

Redesign rule

OB: What kind of foresight methods and tools does your company use. Let's say you are kind of tackling a problem and you want to move to the next stage. Are there any kind of methods that you would use to help get through that.

VM: Just give the kind of problem. Are we talking the strategic sense?

OB: Ja, more the strategic, more in the business model sense. Not so much the product design sense.

VM: I think we will employ different frameworks, we will do SWOT analysis, we will do

business modelling - and we will do all that. But I think the main thing is the process - the more important bit is the process. We have to build these business cases and we have to use.... I remember looking at the business canvas, you know. But for us, I mean, for many of the small fast moving companies. The discussion is the most important thing. For us it's more the process around coming to solutions, to hypotheses that you can test, and then deciding on how to test them. I would say that the most important kind of tools that we employ are very..... post-it notes.... post-it notes and visual representation in what we do. We'll walk through and we'll see that our six-month plan isn't in an excel sheet; it's actually on a big white board and post-it notes that people can look at and that's to invite critique and discussion and improvement. That's one of the big things that characterises Nomanini, and we do the same thing with even.... Umm.... the technical work that is done. It gets done through a very visual can-ban board or on a wall. It's definitely visual tools that are always there - they are a big feature. I think the frequency of discussions - but limiting them.... So, say, every morning I would have a stand-up discussion, what the problems are, the executive teams. Every week we sit down and see whether... we unblock discussions. Every month we update our - we review our financials and we update our projections. Every quarter we do the same thing with our board of directors. I think it's those discussion points that are the most important.

Tangibility rule

25:31 OB: That's good insight. Do you think - also related to that - do you think prototyping is important? Even in the case of a new strategy that you would like to prototype. Maybe give an example of how you would prototype.

25:50 VM: So, one of the things that we think is going to be important, going forward, is vendor financing - on a very large scale! The little boxes that we sell by the thousands that add up to millions - to millions! - of dollars of hardware that our clients are importing in work - and being able to offer that in financing could be a very powerful way to expedite the application of this tech. So... you know... Yes, we want to go talk to a big Pan-African bank. The process starts with a prototype where we can prove our case. We can, on our own balance sheet, test vendor financing, see whether there is a default issue - any of that stuff. The prototype in a business sense, whether it's on the financial side or...umm.... it's funny. If you look at our office layout, you will notice all our desks are on wheels. Every configuration is a prototype. Is this how the co-ordination should work together? So there's that self re-configuration that happens, through the relationship of prototyping between technology and commercial. What we will do quite intentionally is - we will have a tech team produce one or

two prototypes. Before we put the full effort into production running tech, and we will see if commercial gains can get any interest on those. And whether it's terminals or backend tools, any of that stuff. It's all very.... the cost of doing something wrong, especially a start-up.... when you measure your bank balance in time - how much money you have - every second is precious. You don't want to get too much work done that isn't used. I am quite dogmatic about establishing some kind of prototype before we invest full action into something.

7.4 Appendix D: An example of the structure of post interview comment sheet

Interviewer	Oriole Bolus
Interviewee/organisation	Vahid Monadjem
Unit of analysis	Nomanini
Date:	21 July August 2015
Length of interview:	One hour
Location	42 Hans Strijdom Avenue

1. How would you describe the interviewee's overall attitude to participating in the interview?
2. How would you rate the overall quality of the interview?

Little interesting detail	Some interesting detail	Lots of interesting detail
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3. Did the interviewee say something noteworthy/ interesting in response to one or more of the interview questions? Which questions did/he or she provide interesting detail, if any?

Question number and or question topic	Jot down three or 4 words what he said

4. Items that came up in the interview that would be worth following up on in the next interview:

7.5 Appendix E: An example of a category in the code book directed under the human rule

Human centric:						
RES	L.THEME	A.QUOTE	CODE	CONTEXT	EMERGENT SUB-CATEGORY (categorised description)	RELATIONAL L. THEME
CP_2	Human centric	People are quite understanding, because we had stitches come loose before, but because you are quite open with your business, where it is an artisan kind of craft business, product people don't say ah my thing broke, they say.... ah don't worry if you only send me a little rivet to NY I'll be happy and then you just send one, it's easy like that.	Human-centric by having a personal contact with customers	Customer Products/services	Customer relationship management Interaction with customer post design Personal contact satisfying needs through relationships Open-ness	Customer Relationships Personal services
CP_2	Human centric	We took the harder route, not by choice, because we had to. We took the manufacturing under our roof, design everything, so PR, literally everything, except making the actual fabric to make the leather, is done in house, but it does give us complete control over our product, we know how to, because we own our stores, we have one in the biscuit mill and the watershed store and we have a store in Berlin opening up. So the best people that can give an experience of a product is the people that own the store	Human centric-personal contact with work colleges	Company/ Internal Products/experience	Employee relationship management Under one roof-working closing together Customer relationship management Best people to give experience of product	Key Resources Human Resource (experience of product) Customer relationships Customer retention Channels Own stores
VM_3	Human centric	So I think as a company we are very much led by that, I don't think its starts with product development to be honest, I think it starts form hiring, its starts from the kind of people you get to work on a problem, need to be people who care, I think it starts there.	Human centric through working well with employees	Company/ Internal	Employee relationship management (Establishing needs through the right people and selecting those who care	Key resources Human

CP_2	Human centric	The product really shines once you used it for a couple of months or years and when people come back to us we document it	Human centric through the engagement with customers	Customer Products/services	Customer relationship Management Methods for gaining Insight Interacting with the use of product	Channels Awareness of product/services through stores
CP_2	Human centric	We use our social media quite a bit, like twitter, if you like our product put it on twitter and if you don't like it put it on Twitter as well, so we know what is going on.	Human centric using social media to get feedback	Customer Product/service	Customer feedback management Feedback through social media	Channels Awareness
CP_2	Human centric	It's really important to know when you go into the business why you go into the business, it only hit us afterwards, my wife and I. You have to make sure that every day you are having fun. If not every day is going to be fun, then it going to be workdays. But to make it fun, the interaction with the people is key	Human centric through interaction with people	Customer Company/ Internal	Customer relationship management Employee relationship management Interaction with people is key to keeping motivation	Key resources Human Customer relationships Customer retention
MN_1	Human centric	What emerged is that everyone is really dedicated to the business ThingKing, I'll purely thought they were just there to do their jobs, which they probably are, but I mean I do think that a large part of us having a business and justifying why we are employing the people, in that way it is more about the team of thinking and not just myself and Lyall. and we try very hard to empower people and much as possible in the way we have set it up	Human centric through empowering employees	Company/internal Empowering in-house human resource	Employee relationship management Team of thinking Empowering employees	Key resources Human

CP_2	Human centric	Yes, our business is very much human centered, especially in Cape Town and SA to a degree as well, it's the customer service that we very much focused on our products are something that people; we aspire to our products, and people aspire to our products and something that people want to use for a very long time	Human centric by aspiring to what you do	Customer Products/services	Employee relationship management Emotional bond Aspire(emotional bond) to products by being Useful	Value proposition Design Emotional bond to superior quality
VM_3	Human centric	Ultimately our end-user is a merchant and we need to know what they want, what they feel, what they worry about, what they are excited about and what makes, how we can serve their need	Human centric as serving the user needs	Customer	Customer relationship management	Key activities Problem solving (new solutions to serve individual needs)
CP_2	Human centric	At the moment, are not a big corporate or company where you can't really know all the customers. We are still small enough to know most of our customers, and knowing our customers and having a list of our customers. We really look after all of them.	Human centric by looking after customers	Customer	Customer relationship management Customer Care	Customer Relationships Personal contact Customer Segment Niche
VM_3	Human centric	It's actually sometimes that we are very cognitive about, we've moved in our role of the value chain. We've actually started very much providing these tools for market merchants, well first taxi drivers and then moved to the retail sector. As we have moved in the value chain we have actually moved up, we've moved further away, not actually having direct contact with the merchants ourselves, although our technology is used by them and that's something as a company we have been very mindful of	Human centric as responding to roles in the value chain	Customer	Customer Relationships Customer awareness Change in roles of customer engagement	Key Partners Strategic