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Product design challenges of Small to Medium Enterprises in the Western Cape: A Design Thinking approach

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Declaration

I, Matthew Craig Greeff, declare that the contents of this thesis represent my own unaided work, and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

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Abstract

The study aimed to investigate how product design SMEs in the Western Cape could be supported. The study's research questions illustrated how important SMEs are in the South African economy, brought to light the key challenges product design SMEs face and provided support criteria to promote growth within the sector. Small to Medium Enterprises (SMEs) are seen as a vital driving force for South African economy, employment rate as well as innovation making it an important sector to support sustainable development. However South Africa SME failure rate is ranked one of the highest in the world with majority of SMEs failing to make it past their second year of operation. In illustrating and understanding the challenges product design SMEs face in Cape Town the study provided support measures to develop sustainable product design businesses. Previous literature has failed to investigate product design SMEs and the value they provide within South Africa, additionally not a lot is known about the challenges these business face. A Design Thinking (DT) approach was used within the study alongside blended research methods. These methods included; online surveys, semi-structured interviews and a design workshop. The study utilised 'Lewin's Change Management Model' as a conceptual framework as well as 'The Braun and Clarke 6 step method to Thematic Analysis' for Data analysis. The research found that, through the enterprise demographic, product design SME in Cape Town diverse into multiple fields, majority of the SMEs had been operation between 5-10 years, most generated an annual turnover of R500 000 – R 5 million and employed 1 – 20 employees as well as majority of the SMEs operated from the city bowl. The research additionally illustrated that majority of common business challenges consisted of financial resources, human resources as well as management. The research also uncovered a number of emerging themes in relation to product design SME challenges and through co-defining these challenges found that managing clients, project scope and design unknowns as the most important challenges. Ideation with participants in addressing these challenges formed possible solutions parameters such as good communication and transparency with clients, detailed definition and recognition process to manage project scope as well as systems for early identification of design unknowns within the creative process. The research also co-defined existing tool and systems currently in place within the product design SMEs sector that aid in building a sustainable business. These tools and systems consisted of; project forecasting programs, tools to streamline business workflow, project priority systems, financial forecasting tools and effective networking within the design industry.

Keywords

Design Thinking, Design Project Management, SMEs and Product design.

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Clarification of basic terms and concepts

Term	*Definition*
Design process management	Managerial undertakings involved in the product design process. I.e. Managing different ideas within the conceptual phase of a product development.
SME enterprise demographic	Demographic relates to human populations and the information collected about them. SME enterprise demographic, in the study, refers to the information about the SME sector population such as employee numbers, income, years of operation etc.
Product Design SME	Small to medium enterprise that specialises in the creation of new products that can be sold by a business to the consumer. Products can vary greatly, but some examples would be; furniture, automotive, consultancy services, appliances, lighting or retail to name a few.
Client input	The clients (consumer) participation during a products development, specifically relating to ownership and making important project decisions (such as direction change, funding, continuing or aborting, etc.).
Client expectation	The clients (consumer) expected outcome of the project. Usually discussed at the beginning of the project where classification of the project cost, timeline, the clients perceived idea of what to expect, etc.

Acronyms

Acronym	*Definition*
SME	Small to Medium Enterprise

1. Introduction

The study investigated product design SMEs within the city of Cape Town, Western Cape in order to establish challenges within the sector that affect the success of the business. Literature found that SMEs are a critical driving force for both South Africa's economy and employment rate. Specifically, SMEs utilising design have been found to build technology an innovation within the country improving general living conditions. South African SMEs have an extremely high failure rates with majority of SMEs unable to make it past two years of operation. It is evident through literature that there are SME business challenges, however, there is limited information on the specific challenges within product design. This gap of knowledge within the product design SME sector led the study to provide a detailed enterprise demographic of the sector, main challenges effecting growth as well as solutions parameters to address these challenges in order to support sustainable growth within the sector. The study aimed to establish how the growth of product design SMEs in the Western Cape be supported. Research questions yielded insights into the importance of SMEs in the health of the economy, the key challenges experienced by product design SMEs and the support they perceived as essential to growth.

The study used a Design Thinking approach to structure the research alongside blended research methods such as; an online survey, semi-structured interviews and design workshop. The Literature and online survey was used to provide an understanding and empathize within the industry while providing an enterprise demographic. The demographic found that product design SMEs specialise in many diverse fields, both developing and boosting innovation and technology. Most had been in operation between 5-10 years with an average annual turnover of R500 000 – R 5 million, on average employed 1 – 20 employees and most business operated from the city bowl. The research found that most common business challenges consisted of financial resources, human resources as well as management. Specifically challenges with project management were co-defined by participants which found that managing clients, project scope and design unknowns were the more important challenges needing support. The research found that co-ideation with participants in addressing these key project management challenges formed possible solutions parameters such as good communication and transparency with clients, definition and recognition within project scope management as well as processes for early identification of design unknowns. The research also co-defined existing tools and systems currently in place within the product design SMEs which consisted of project forecasting programs, tools to streamline business workflow, project priority systems, financial forecasting tools and effective networking within the design industry.

1.1. Background to research problem

SMEs have a very important role in the economy, especially within developing countries, such as South Africa, that are faced with both income and employment challenges (Cant & Wiid, 2013: 707). Not only do SMEs contribute to the economy, but also provide product innovation, and by doing so bring wealth and better living conditions to both rural and urban areas (SBP, 2014: 1). The SME sector in South Africa not only contributes almost 58% of the GDP but 60% of the employment as well (Barnard; Kritzinger & Krüger, 2011: 112). Yet the growth within this sector has been relatively low over the last few years, as the 60% of employment in 2010 was lower than the global average of 77% despite efforts from government (SBP, 2014: 1). The South African SME failure rate is one of the highest globally: with 75% of businesses unable to establish themselves and therefore unable to fulfil developmental roles in the country in 2010 (Olawale & Garwe, 2010: 730; Barnard et al, 2011: 112). In recent years this figure has reduced to 70% as depicted by the Minister of Trade and Industry, Rob Davies, in 2014 (SBP. 2014: 1). The survival rate of SMEs is less than 50%, with new businesses being able to survive beyond 5 years, this is not only seen in South Africa but is becoming a global trend (Brink & Cant, 2003: 2). It is important that the sustainability and development of SMEs within South Africa is addressed in order to prevent possible risk of economic stagnation (Cant & Wiid, 2013: 707; Olawale & Garwe, 2010: 729).

Design is a tool for innovation and it therefore drives unknown demands that can create new markets and expand possibilities (Design Skills Report, 2016: 13). The importance of design has been recognised in multiple fields (D'Ippolito, 2014: 3), alongside good design in products and services is how enterprises are able to create engaging brand experiences which enrich the relationships with consumers (Western Cape Design Strategy, 2012: 4). Design is able to boost a company's competitiveness and thus contribute to its success. SMEs that use innovation usually have higher profits, better credit, higher market value and stronger probability of surviving (Krause & Schutte, 2015: 164).

1.2. Statement of research problem

South Africa, like many other countries, has multiple avenues that contribute to the economy, one of these is the Small to Medium Enterprise sector (SMES). SMEs, within South Africa, account for 91% of the formal business entities and contribute up to 58% of the GDP as well as 60% of the employment (Barnard et al, 2011: 112).). However, many battle to get past their second year of trading, with a failure rate of up to 63% (Cant & Wiid, 2013: 707). There are millions of Rands being lost on business undertakings due to avoidable mistakes and problems (Brink & Cant, 2003: 1). The product design sector of South African SMEs is no different, even though there is limited literature on the challenges faced by product design SMEs in the Western Cape, as these enterprises also struggle with day-to-day challenges that render their businesses less profitable or successful. Design offers a possible solution. Design is a direct link between creativity and innovation which can build ideas into reality (TBR, 2015. 4), in short, it has the ability to solve a need. Design as an innovator is

understood as a way to bring forward new value in goods and services (Krause & Schutte, 2015: 164). This is achieved by the inherent innovative nature of design which creates unknown demands which form new markets and possibilities (Design Skills Report, 2016: 13). Global trends show that design innovation has had a major role in development of new products or service delivery, whether it be for the private, public or civil sectors (Western Cape Design Strategy, 2012: 4).

1.3. Research question & sub-questions

When considering the research problem, the following main question, and supporting sub questions, were framed to inform the study.

1.3.1. Main research question

How can sustainable growth of product design SMEs in the Western Cape be supported?

1.3.2. Research sub-questions

1.3.2.1. How do product design SMEs impact the local economy within South Africa?

1.3.2.2. What are the challenges facing product design SMEs operating within the Western Cape South Africa?

1.3.2.3. What do product design companies perceive as the support criteria required to facilitate sustainable growth within the sector?

1.4. Position of the researcher

The researcher is a product designer and working within the industry for three years, and thus had an emic ethnography approach to the research. An emic ethnographic research approach allowed for the immersion within the design industry. Enabling more 'insider' perspectives. This provided for more in-depth research to be discovered. The researcher being a qualified product designer and having three years of experience benefitted the study, as data findings collected were easily understood allowing for more detailed investigation. However, this could have also influenced the research due to bias to favourable results. To prevent this. The researcher utilised the Design Thinking research approach to methodology, to focus purely on the user inputs. Additionally, the use of the design workshop to co-define challenges as well as tools and systems prevented any bias in the research. Understanding that product design is often an industry filled with conflict of interest the researcher ensured that all participants within the research were coded. Possible limitations of the researcher consisted of access to more product design SMEs within Cape Town and possibly participants not wanting to share vital information that might have caused conflict of interest within their business (such as business IP). The researcher could be limited by the fact of being a product designer for three year and having formed certain relationships with participants that took part in vital sections of the research. However, it is not clear if this would negatively or positively influence the research findings. Finally, researcher being a product designer and understanding the complex nature of the industry was believed to

be a vital contribution to the study, this was because of a deep shared interest in addressing challenges in product development management.

Personal motivation for research;

It was the personal interest of the researcher to gain better insight of the product design SME industry in order to become a successful business owner as well as provided support to fellow product design business. Additionally, the researcher was interested in using DT as a methodology/toolkit to investigate challenges in businesses to provide support as a possible career direction.

1.5. Ethical Considerations

Before any data was collected participants were made aware of the study and what it entailed, outlining that it was a Masters in Design investigating product design SMEs within Cape Town and had been approved by the Cape Peninsula University of Technology. Participants who fitted the criteria were contacted and asked to complete the online survey, where, in the first page of the survey they were informed about the study and illustrated their rights, this can be found in Appendix B: Survey Monkey Online Survey template. The survey was also used to establish participants that were willing to be involved in further research, these participants were approached in the semi-structures interviews and design workshop. Participants involved in the semi-structured interviews and design workshop were asked to sign consent forms, found in Appendix A, indicating their rights within the study. No participant was offered any inducement encouraging their involvement and in no way was persuaded to be part of the study when ask to sign the Consent of Principle Form. All participants were asked for permission to use data collected in the study, as well as were made aware that they can stop taking part at any time. Coding was used to protect participant's identities and all activities were completed anonymously. Ethical considerations regarding organisations that partake in the study were very important as any IP or certain business workings of each organisation as this may cause serious conflict of interests as well as was not the focus of the study. Communication to the participants was vital in order to assure that in no way would their business structure or organisation ever be at risk. The purpose of the study was not to gain insight into the knowledge or business processes but rather the challenges and how can they be supported. Any data collected during the project was stored and backed up online. Access to this information is strictly limited to the researcher as well as supervisors. All information collected is password protected to ensure security of participant's information. Data is stored online via password protected google drive account if ever needed for auditing.

1.6. Delineation of the Study

The research report focused on product design SMEs based in the Western Cape South Africa specifically the city of Cape Town. Secondary research was conducted to gain a better understanding of the South African SMEs as well as challenges faced by these businesses. This formed the foundation of primary research that

was compiled through online surveys, semi-structured interviews and design workshop. The primary research only focused on small to medium enterprises that have less than 200 employees and make less than R30 million. The research did not focus on consumer input but rather on participants who were in senior or managerial positions within the company, working as designers. The study's focused on a designer perspective and not the client perspective. It also only looked at SMEs within the product design sector of Cape Town. Lastly, it only explored the internal business environmental challenges faced by these SMEs as external business environmental challenges (such as political instability and natural disasters) which cannot be controlled.

1.7. Objectives and Significance of the research

The study aimed to provide support to product design SMEs in Cape Town to build sustainable businesses. An investigation aimed to both understand the current South Africa SME industry and challenges faced, as well as provide an enterprise demographic to describe the Cape Town product design SME sector. More importantly the study aimed to explore key challenges that hinder the success of these SMEs in order to ideate possible solution parameters. By co-defining these challenges, the study aimed to contribute insights into these challenges to better understand why they occur. By understanding these key challenges, the study aimed to provide detailed solution parameters to be implemented within the industry in order to test the level of support they provide to product design SMEs in Cape Town. It was the intension of the study to contribute a body of knowledge supporting the management and business administration of Product Design SMEs.

Study's key Objectives and Aims;

- The impact of SMEs in the local South African economy
- Demographic of Western Cape Product Design SMEs.
- Key challenges that Cape Town Product Design SME experience.
- Provide support parameters in relation to the key challenges that Product Design SMEs face.
- Promote and support sustainable growth in the Product Design SME sector.

1.8. The contributions, outcomes and results of the research

Contribution of the research

The research provided a body of knowledge for the Western Cape creative industry of South Africa which included;

- A demographical layout of Product Design SMEs.
- The key challenges faced that effected the sustainability of these businesses.
- As well as the support criteria to promote growth within the sector.

Outcomes and results of research

The study contributed to a greater description of enterprise demographic of South African product design SMEs to better define the industry. Common business challenges within product design SMEs in Cape Town consists of management of financial resources, human resources and general management. The study provided deeper insights into management of product development where managing clients, project scope and design unknowns were found to be the most important challenges needing to be addressed. Additional challenges found included; utilising effective design reviews, designer inefficiency, comparing the project progress against the brief and managing suppliers. The study provides possible solution parameters that could be implemented within the industry to provide the necessary support structure to build sustainable businesses. The study also contributes to co-defined existing tools and systems currently in place within the product design SMEs sector. The research found that majority of the Western Cape product design SMEs had been operation between 5-10 years, generating an annual turnover of R500 000 – R 5 million while employing 1 – 20 employees. Common business challenges consisted of financial resources, human resources as well as management. The research co-defined key challenges and found that managing clients, project scope and design unknowns were the most important challenges needing to be addressed. The research co-defined solutions parameters to address these challenges which consisted of; good communication and transparency with clients, detailed definition and recognition process to manage project scope as well as systems for early identification of design unknowns within the creative process. The research also co-defined existing tool and systems currently in place within the product design SMEs sector and consisted of; project forecasting programs, tools to streamline business workflow, project priority systems, financial forecasting tools and effective networking within the design industry

1.9. Brief outline of chapters

The following is a brief outline as to what to expect within the following chapters. Chapter 1 provides an introduction into the study illustrating the background of the research, the main research and sub-questions, the position of the researcher within the study, an overview of the methodology, ethical considerations, delineation of the study as well as the study's objectives and outcomes. This is followed by Chapter 2 where literature investigates the South African SME industry as well as the value of design within building innovation. Chapter 3 detailed the study's methodology, specifically the use of Design Thinking process as a research structure detailing the research and data analysing methods. This is followed by Chapter 4 which presents the study's findings from research methods such as online surveys, semi structured interviews and design workshop. Chapter 5 discusses the study's emerging themes in the findings, specifically detailing the product design SME enterprise demographic within Cape Town, the key challenges effecting these SMEs and finally the solution parameters needed to address these challenges. Finally, Chapter 6 presents the study's conclusions as well as recommendations for future research.

2. Literature

2.1 Introduction

South African SMEs account for a large section of the formal business entities as well as the GDP and therefor play a very important role in the economy both for income and employment. SMEs not only contribute to the economy but to innovation and, by doing so, improved living conditions for both rural and urban areas (SBP, 2014: 1). However the growth within the sector has been relatively low with employment rate dropping despite efforts by government. South African SMEs failure rate is ranked one of the highest in the world with 75% or businesses unable to establish themselves and therefore unable to fulfil developmental roles in the country (Olawale & Garwe, 2010: 730). Design offers the potential to address this issue. Design is innovative and able to turn ideas into reality (TBR, 2015: 4), in short, it has the ability to meet a need. Design is able to bring value to goods, services and even business models. Design acts as a tool for innovation and in doing so is able to create new unknown demands creating new markets, it is able enhance a business's competitiveness and ultimately its success. SMEs that incorporate innovation have a stronger probability of surviving (Krause & Schutte, 2015: 164).

2.2 South African small to medium enterprises

2.2.1 SMEs and how to they build the economy

The National Small Business Act of South Africa of 1996, as amended in 2003, states a SMEs as:

> *"…a separate distinct entity including cooperative enterprises and non-governmental organisations managed by one owner or more, including branches or subsidiaries if any is predominately carried out in any sector or subsector of the economy mentioned in the schedule of size standards and can be classified as SME by satisfying the criteria mentioned in the schedule of size standards"* (Cant & Wiid, 2013: 708).

The term SME covers a wide variety of firms, which can include informal or formal registered companies as well as non-VAT registered organisations. They can range between medium sized firms, which may have up to 100 employees, to micro-enterprises such as self-employed. It also varies between the lowest income brackets of the population to the upper end which can be compared to SME segments in developed countries (SEDA, 2016: 4). South African firms are classified as 'small' if they have less than 50 employees and 'medium' if they have less than 200 employees (Krause & Schutte, 2015: 166).

Type of firm	Small	Medium
Employees	1-49	51-200
Turnover	Maximum R13m	Maximum R51m
Balance sheet	Maximum R5m	Maximum R19m

Table 1: Size Classification of SMEs in South Africa, Source: Olawale & Garwe, 2010: 730

Within the South African context, the majority of SMEs operate within the lowest end of the income bracket known as the survivalist bracket. These SMEs are commonly seen as street trading enterprises, home-based evening jobs or backyard manufacturing, this informal sector is almost entirely made up of SMEs who are indicated to have very little growth potential and less likely to hire employees (SEDA, 2016: 4). A study conducted by Krause and Schutte (2015: 167) found that SMEs within South Africa were predominantly found either in Gauteng or Western Cape, with 53 % located in the Gauteng Province and 36% in the Western Cape Province. The study also found the majority of the SMEs employed between 1 and 10 employees with 77% of respondents identifying themselves as 'owners', 78 % of the SMEs were in operation for 3 years and 28 % for 10 years. In accordance to the GEM report in 2013, only 10% of South Africa's adult population are involved with starting up SMEs and only 2.9% having operated as a SME for more than 3 years. Putting South Africa fourth last in the study (SBP, 2014: 1-2).

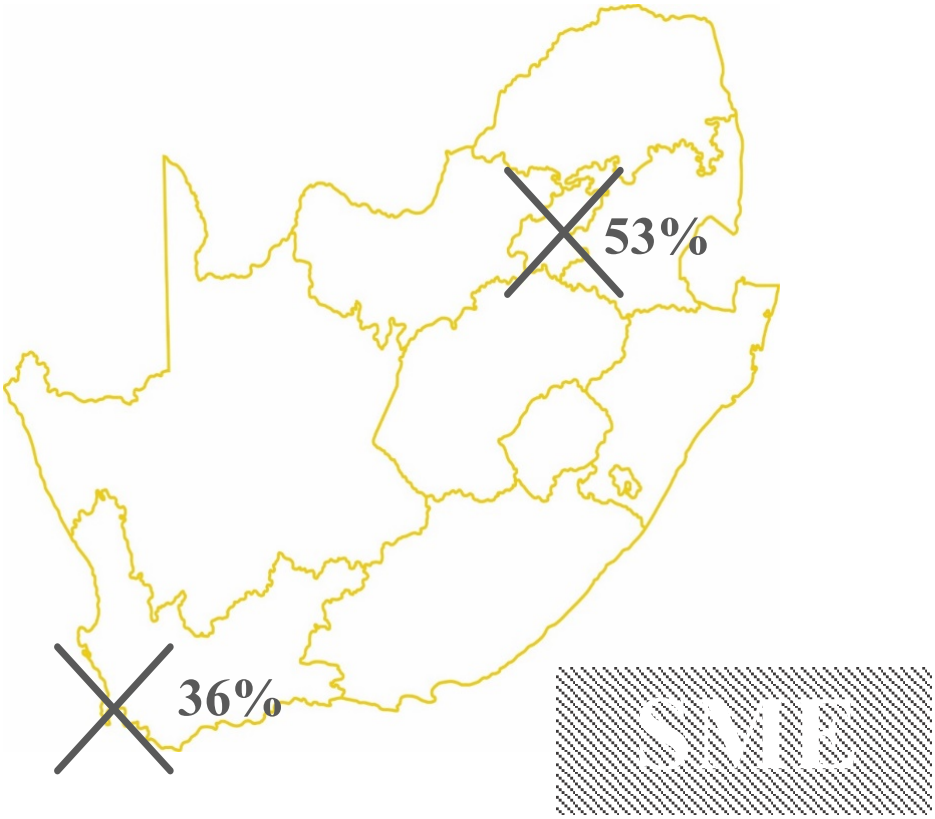


Figure 1: South African SMEs geographic location demographic, Source: NSBC, 2016:1

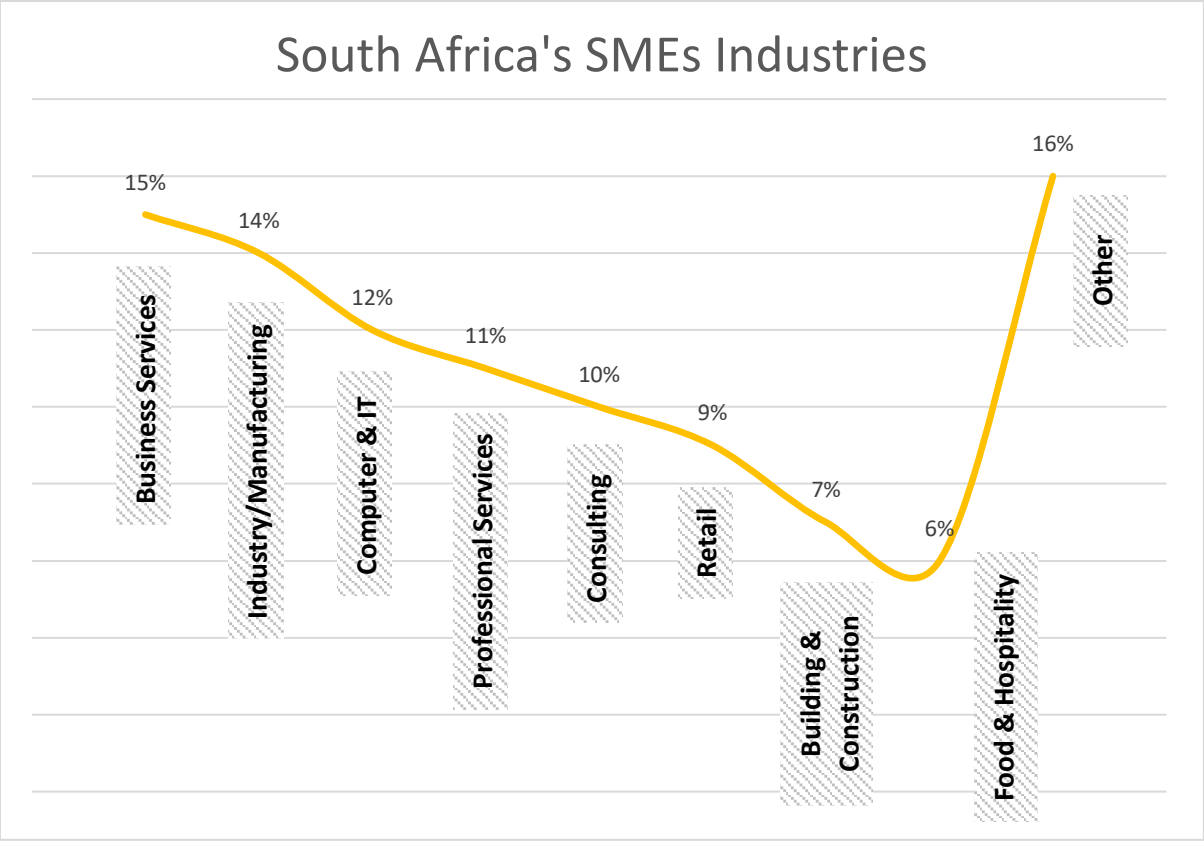


Figure 2: South African SMEs industry demographic, Source: NSBC, 2016:1

The SME Industry is a critical driving force for the economy as well job creation, both in developing and developed countries. The contribution that SMEs provide to employment and income generation is recognised globally and especially in South Africa (Brink & Cant, 2003: 2; Olawale & Garwe, 2010: 729). SMEs, within South Africa, account for 91% of the formal business entities and contribute up to 57% of the GDP as well as 60% of the employment (Barnard; Kritzinger & Krüger, 2011: 112). SMEs are widely recognised by many large global institutions, such as the World Bank. Within South Africa, SMEs do not only have an important role in the economy, but product innovation as well and in doing so provides a means for wealth in both rural and urban areas (SBP, 2014: 1). As illustrated by a study conducted by Barnard; Kritzinger & Krüger (2011: 111) these enterprises are vital to the economy and growth of job opportunities, as the high labour absorption of SMEs suggests that they are able to generate income at a faster rate in comparison to larger businesses.

An issue within South African Economy is the high percentage of unemployment, with almost 25% of active population being without jobs, a potential avenue for addressing this issue is the promotion and development of SMEs (Olawale & Garwe, 2010: 729). South Africa also has a precarious state of youth unemployment, with 36% of youth not able to get employment, however, the South African National Development Plan (NDP) realises that SMEs are leading sectors for employment change, with the SBP study

indicating that these SMEs are more likely to employ not only the youth but the older populations, both forming a large percentile on the unemployment population (SBP, 2014: 2). A study conducted in 2012 by Adcorp indicated that 68% of all South African workers were employed by small businesses that employed less than 50 people (Krause & Schutte, 2015: 166). However, the growth in this sector has been relatively slow over the past years with government efforts to support having undesired results. These SMEs accounted for only 60% of employment in 2010 in comparison to a global average of 77% (SBP, 2014: 1).

South African SMEs failure rate is ranked one of the highest in the world, with about 75% of companies failing in becoming an established firm and even when established, the probability of the SME making it past 42 months is less likely in South Africa than in any other GEM (Global Enterprise Monitor) surveyed country, indicating that new SMEs are not able to fulfil developmental roles in the country (Olawale & Garwe, 2010: 730). As in most developing countries, South Africa is faced with challenges in development of SMEs caused by a high failure rate because these SMEs are unable to turn the business into sustainable ventures (Tshepo, 2017: 3). Within South Africa small enterprises have a failure rate, with 57 of businesses unable to operate further than a year, with 70% of these new businesses failing within the first five years (Barnard et al, 2011: 112). Minister of Trade and Industry, Rob Davies, in 2014 illustrated as much as 70% of the SMEs in failed within their first year pushing South Africa to one of the highest failure rates in the world (SBP, 2014: 1). The South African Government recognises the importance of SMEs and established a new Ministry of Small Business Development in 2014 with the goal of promoting and developing SMEs (SEDA, 2016: 4). The sustainability as well as establishment of new SMEs in South Africa is critical to the economic value of the country, and without it there is risk of economic stagnation (Cant & Wiid, 2013: 707; Olawale & Garwe, 2010: 729).

2.2.2 South African SMEs business environmental challenges

South African SMEs are exposed to a moderate amount of macro environmental factors, however the more common challenges faced include: management, marketing, social resources, human resources and financial resources (Cant & Wiid, 2013: 707). The following table illustrates the following key challenges faced by SMEs in South Africa, it is mentioned that that it is vital to realise that not all domestic small business face the exact same set of challenges and these challenges can tend to be location specific (SEDA, 2016: 7).

Table 2: Challenges Faced by SMEs, Source: SEDA, 2016: 7-10

1. Access to finance and credit
2. Poor infrastructure
3. Low levels of research and development (R&D)
4. Onerous labour laws
5. An inadequately educated workforce
6. Inefficient government bureaucracy
7. High levels of crime
8. Lack of access to markets

Every SME is part of the business environment, as the majority of enterprises cannot function in isolation (Surnhi, 2015). The business environment has a strong influence on the success and growth of SME. It is vital for SMEs growth that support is provided to the business environments, as the variables have either a negative or positive effect on the growth or failure of these organisations. The Business environment is generally split into two categories; the internal (micro) business environment and the external (macro) business environment. The internal environment affects the working of a business where the external effects the function of all business entities operating the business (Surnhi, 2015; Olawale & Garwe, 2010: 731). The research conducted by Cant & Wiid (2013: 714) found that unemployment, inflation and interest rates, crime and legislation were the key challenges faced by South African SMEs within the external environment. Within the internal environment the study found the key challenges to be incorrect pricing, low demand for product and services, location of SME, as well as a varied amount of marketing variables. Many external and internal business factors largely effect businesses innovation and business process innovation (Jovanović, Stamatović & Zakić, 2008: 18).

2.2.2.1 External business environment

The external business environment in the economy directly influences the working, decision making, strategy and performance of a business, it is dynamic in nature and is ever-changing (Surnhi, 2015). Management within these SMEs have absolutely no control over these exogenous challenges (Olawale & Garwe, 2010: 732; Brink & Cant, 2003: 3). These factors are found outside the business, regardless of the industry the external factors effect SMEs growth and survival (Pakkanen, 2012: 12). It is important that SMEs are aware of changes that may occur in the external environment as these factors may have influences in the success of the business. Being aware of these variables within the macro environment will not only help reduce any negative outcomes but will also help take advantage of possible opportunities (Cant & Wiid, 2013: 708). Being aware of the external business factors in order to identify and understand threats or opportunities which can influence a business (Pakkanen, 2012: 12). In addition to knowing and understanding the macro environment, a SME must also have a knowledge base of the market environment. It is vital for a SME to know their

customers such as; what they are interested in, how they are buying, when they are buying and so forth in order to better meet their needs or demands, allowing for the business to survive (Cant & Wiid, 2013: 709). External Business environmental factors consist of political, demographical, global, sociological, customers, related industry factors and technology amongst many others. These factors are usually divided into three categories and are; general, industry or competitor environments (Pakkanen, 2012: 12). The most noticeable challenges faced by South African SMEs success in the economy are crime and corruption, compliance with legislation, resource scarcity, HIV/AIDS and ever-changing technology (Brink & Cant, 2003: 3).

2.2.2.2 Internal business environment

The internal business environment relates to the environment that has direct interaction with the business as it effects routine activities of the business immediately. It is often associated with a small part of the enterprise in which it functions (Surnhi, 2015). Knowing and managing the internal environment is connected to the performance achievement of the business, yet, studies that explore the impact of the internal environment as a whole on strategy and performance are rarely seen (Dragnic, 2014: 124). The internal environment comprises of factors that have an influence on the businesses resources, these resources are the foundations for the capabilities which in turn lead to development of competitive advantage (Pakkanen, 2012: 14). The factors with the internal environment is largely managed by the business itself, these can consist of finance (such as owner's equity or collateral) management, location, investment in technology as well as infrastructure, production cost and networking (Olawale & Garwe, 2010: 731). The external business environment consists of suppliers (providing input into the business such as raw material or equipment), competitors (rivals within the industry who compete for similar resources or consumers), marketing (create a link to customer such as wholesalers, retailers or distributors), consumers (consumption of goods or services provided by business) and lastly the business itself (consisting of employees, stakeholders, investors etc.) (Surnhi, 2015). It is important for the internal and external environment, however, to convene together so that to create strategies to overcome treats or take advantage of opportunities. Even though the external environment creates both threats and opportunities it is the internal environment (Table 3) that exploits these in order for the business to succeed (Pakkanen, 2012: 14).

Table 3: Summarised internal business environmental challenges faced by South African SMEs

Main Challenges	Description
Access to finance	One of the major concerns to South African SMEs is finance, it is the second most reported challenge after education that causes an enterprise to fail. This Finance gap is a major challenge as only 2% of new SMEs are able to access bank loans with 75% of applicants being rejected, indicating that without structured supported finance many SMEs are unable to survive and grow (Olawale & Garwe, 2010: 731). A study conducted by Clarkson & Wynn (2009: 11) found that it is vital for the success of a business to deliver a project on time and within budget, management who are able to schedule projects effectively can cause serious financial challenges for the business.
Management skills	Management skills can be listed as the knowledge or skills, behaviours and attitudes that have a contribution to personal effectiveness within a business (Hellriegel et al., 2008). South African SMEs lack in sufficient management skills, the lack of expertise in areas such as marketing, human resources and financial knowledge causes some SMEs to fail (Cant & Wiid, 2013: 709). Within South Africa the shortage of education and training has reduced the capacity of management within new SMEs. This is one of the leading causes of low levels of entrepreneurial creation, and the high failure rate of SMEs (Olawale & Garwe. 2010: 731). These insufficient management skills in accordance to Brink & Cant (2003: 4) consist of lack of expertise in areas such as human resources, financial knowledge and marketing. A study conducted by Van Zyl & Walker (1999: 1) found that it is often difficult for managers to deliver exactly what was expected by the client especially in product innovation and development.
Marketing	According to Cant & Wiid (2013: 709) the one of the main issues that SMEs are faced with is marketing. This is an essential but difficult concept for a vast majority of SMEs as they struggle to use it effectively. Factors that fall under marketing can include low demand for products, competition, lack of product variety and branding, missing customer's needs, incorrect pricing, lack of knowledge and poor location all have an impact on SMEs. The owners of SMEs perception of the challenges related to marketing is that they often lack the time or financial support to invest in research on potential target markets, trends and marketing in general (Cant & Wiid, 2013: 709)
Location and networking	The SMEs location is crucial as it has an impact on market potential as well as growth opportunities for the enterprise. The correct location enables enterprises to easily identify and exploit opportunities within the market (Olawale & Garwe, 2010: 713). The location is very important, as it is found that within South Africa the low demand for products can be linked to the inconvenience for consumers to purchase from the enterprise business (Cant & Wiid, 2013: 713). Networking is also a challenge faced by SMEs, and both new or established enterprises can be positively impacted with the correct networking, the formation of networks with South African SMEs help business owners to tap into local resources in the external environment (Olawale & Garwe, 2010: 713).
Investment in information technology and cost of production	Investment within technology, as well as keeping up with the ever-changing information technology, is increasingly important to enterprises. Newly established SMEs that have limited access to capital struggle with purchasing the relevant and up to date necessary technology. Rising costs of inputs within South Africa, such as cost of electricity or petroleum, constrains the growth of SMEs as close monitoring of production costs is necessary to reduce waste and determines the more effective means of production (Olawale & Garwe, 2010: 713).

2.2.3 Innovation in SMEs

Firms that use innovation usually have higher profits, better credit, higher market value and stronger probability of surviving. Innovation has seen to be a positive enforcer of competitive advantage within firms (Krause & Schutte, 2015: 164). New businesses are a fundamental force behind the progression of capitalism, the innovation that SMEs produce feed creative disturbances in the economic system which in turn form new opportunities. It is these new products or services that create new technologies and therefore play a vital role in innovation creating competitive pressure on already established companies (Olawale & Garwe, 2010: 729). Within South Africa, achieving a global contribution in the innovation process through the collaboration of open innovation can be beneficial for competitive advantage. An open innovation mind-set can be beneficial for SMEs to access information and technology, which would not usually be available, to improve performance (Krause & Schutte, 2015: 164).

2.3 Design

Design is innovative and is understood as a way to bring new value in the form of goods, services, processes or business models. It has the ability to solve a problem (Krause & Schutte, 2015: 164). Design is a broad term, which can be difficult to define. Evaluating and managing the process of design can also be a challenge (Rae, 2014: 1). Design can be described as a process that is used to plan and develop ideas into products and services by harnessing consumer's perceptions, technology viability and business's practicality. It is seen to be more than just aesthetics but is directly linked to functionality, manufacturing, sustainability, quality, productivity and reliability (Western Cape Design Strategy, 2012: 4). However, design isn't only about the relations of internal components, weight, size, and aesthetics such as colour, shape, texture and sound. It has become more about the importance of the transformation that products and services have on consumers' desires, which is triggered by emotional responses. These emotional relationships can convince consumers to purchase these artefacts which has important impact on purchase decisions for a company (D'Ippolito, 2014: 7). Design can be considered as a direct link between creativity and innovation that is able to build ideas into practical and attractive propositions. All design is inherently creative, but it is the fact that each element has the ability to differentiate from designer to designer and company to company (TBR, 2015: 4). Design can range from artistic elements to a more problem-solving engineering-based reasoning. Which indicates how design relies on different types of knowledge bases; from the more rational-formalised knowledge of engineers to the more expressive-subjective knowledge of graphic designers. As a result, design as driving force of innovation, has a large spectrum of meanings. In its simplest form design is better understood as a tool used for problem-solving, starting with an opportunity and leading into a plan for production of that new product or service (D'Ippolito, 2014: 3). As the Western Cape Design Strategy (2012:3) defines it;

"Good Design is an activity that uses creative and iterative processes to take account of a range of factors and needs in the development of innovative products, services, environments and communication, in response to the human condition and society's needs"

- *Best practise in design*

Best Practice models are readily available to SMEs and often provide adequate measures insuring business sustainability. The ABAC have provided a handbook, 'Supporting APEC SME service exporters, a handbook of best practices', that summarises survey results and highlights the best practices found within Small to Medium Enterprises. Additionally a 'Guide for Training in SMEs', provided by ORSEU and the EU DG Employment, Social Affairs and Equal Opportunities Department, illustrates best forms of practices for traditional SMEs addressing key issues and presenting solutions. It is evident that there are a multitude of best practices knowledge base of traditional SMEs that promote growth of businesses, however, there is a general lack on best practice solutions specialised for product design SMEs.

2.3.1 Design Economy

It is important to grow the economy and improve the social conditions that people experience every day. Global trends show that design innovation has had a major role in development of new products or service delivery, whether it be for the private, public or civil sectors (Western Cape Design Strategy, 2012: 4). The 2016 Design Skills Report (2016: 38) found that workers with skills in design contributed an estimated £209 billion in gross value added to the UK economy in 2015. The design industry in the Western Cape also indicated great signs of growth, it was estimated that almost 80 000 people work in design related jobs within the Western Cape and contributed up to R14 billion per year the South African GDP (Western Cape Design Strategy, 2012: 6). Design skills are invaluable to innovation as the Design Skills Report (2016: 8) illustrated that 43% of workers that use design skills are most likely be employed by companies that generate innovation, these jobs often required workers to execute activities using creative thought processes to solve problems in order to develop new products and services.

Western Cape Design SMEs sectors	
Design consultancy	Interaction design
Furniture design	Toy design
Point of sale design	Exhibition design
Retail design	Appliance design
Storage design	Automotive design
Film set design	
Lighting design	

Table 4 Design enterprises sectors in the Western Cape

The design industry in the Western Cape has encouraging signs of growth and to build on this innovation value design capabilities and competencies need to be met. An enabling environment needs to be built which is perfect for the use of design to grow the economy and improve the quality of life within the Western Cape (Western Cape Design Strategy, 2012: 4). Similarly, in the UK Economy the Design Skills Report (2016: 11) has proven that design skills are a combination of creativity and technical ability that is vital for growth in economies and offer opportunities in technological and innovative advancements. However, with these opportunities comes significant challenges, as research has illustrated that skills gaps, shortages of design skills as well as decreasing numbers of new designers threaten the economy. Additionally, companies are not providing the necessary additional training required after formal education. The UK government is encouraged by the Design Council in this report to work with industry to prevent such challenges from affecting the valuable Design industry. Within the Western Cape there has been an initiative to provide the necessary support for the Design Industry to flourish.

Current support for Design SMEs in the Western Cape:

- Craft and Design Institute. The CDI is a non-profit company that develops and builds responsible creative enterprises that are able to trade in local and international markets. The CDI provides product, business and market support (The Craft and Design Institute, 2019). Recently the CDI launched a R12.8 million Growth Fund to boost SME growth and job creation in 2016 and is a five year disbursement period where SME and business owners are able to apply for funding and support.
- The City of Cape Town's (CCT) Arts, Culture and Creative Industries Policy (ACCIP).
- Western Cape Design Strategy.

Current support for Design SMEs nationally:

- The Department pf Trade and Industry (DTI).
- Department of Arts and Culture (DAC).
- Department of Economic Development and Tourism.

The Western Cape Design Strategy is aimed at motivating a demand for design services from the public as well as other sectors of industry, while also supplying a support system to the Design Industry (Western Cape Design Strategy, 2012: 10). The Design Strategy is driven by implementing design skills and thinking into business and organisational practices within the different sectors of the economy (Western Cape Design Strategy, 2012: 5). The Department of Economic Development and Tourism (DEDAT) identifies design as an important component to economic growth. The DEDAT is the first provincial government in South Africa, as well as the continent, to collectively create a design strategy that is aimed at implementing design into the economy as a tool to promote innovation and drive competitiveness (Western Cape Design Strategy, 2012: 4)

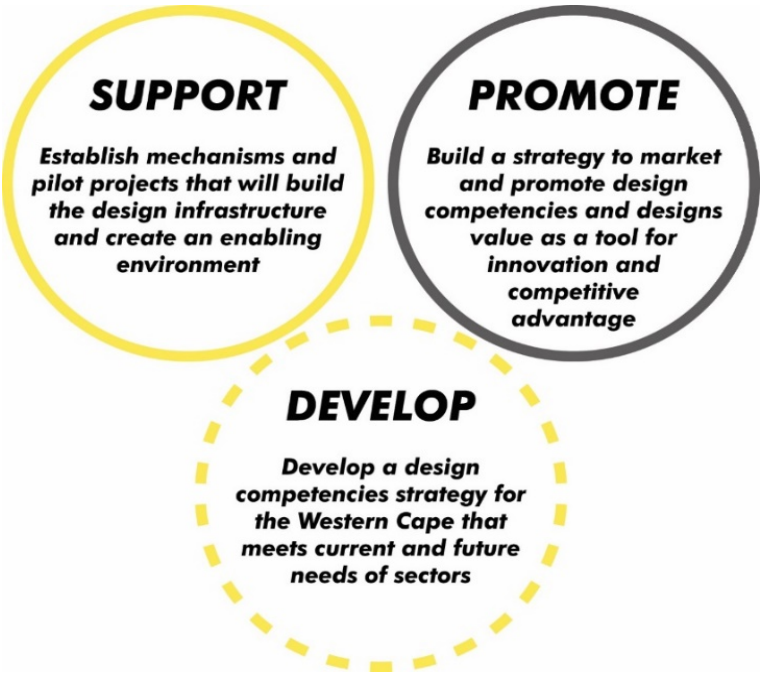


Figure 3: The Western Cape Design Strategy, Source: Western Cape Design Strategy, 2012: 18

The Western Cape Design Strategy (2012. 4-5) highlights the following potential points that design has to offer in economic development:

- Progressive-thinking in regional and local government
- Increase in wealth of natural resources
- Cape Town's infrastructure provides desirable locations for companies' R&D facilities
- Cape Town excellent university facilities to partner with industry in research
- Strong retail sector and associated point-of-sale design

2.3.2 Value of Design

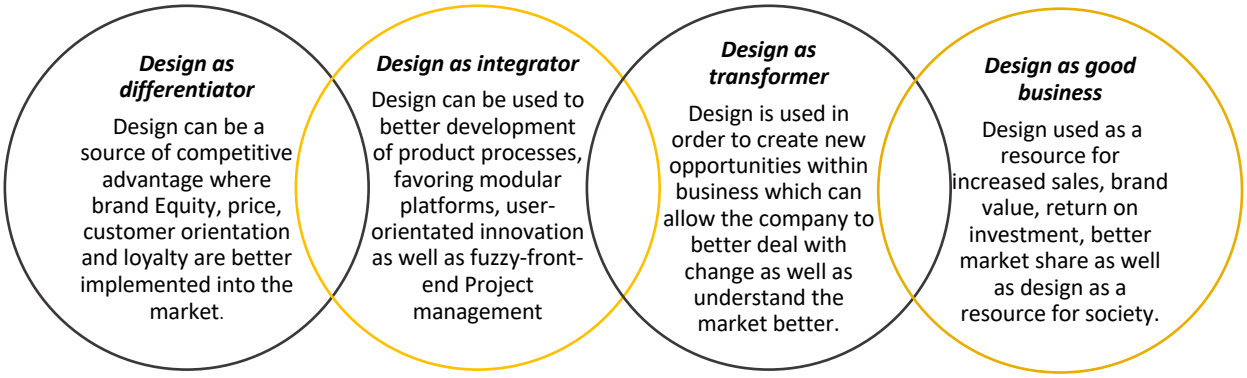


Figure 4: The four Powers of Design, Source: Mozola, B. 2006: 45

The importance of design has been identified in a vast range of fields such as engineering, innovation and aesthetics, management, and arts and creativity (D'Ippolito, 2014: 3). The Western Cape Design Strategy (2012: 4-5) illustrated that global trends show that design innovation has a vital role in development of products and services for private, public or civil sectors. Design drives innovation and, in doing so, fuels unknown demands that create new markets and expand possibilities (Design Skills Report, 2016: 13). It is for this reason that design and its values are evident is almost all industries, alongside good design in products, services, environments and communications, is how organisations are able to create engaging brand experiences which strengthen the relationships with consumers (Western Cape Design Strategy, 2012: 4). Client communication is also very important in design, the involvement of clients where knowing and understanding the client's needs is vital in any design SME (Brockhoff, 2003: 477). This also is said for the investment of the clients within a project which allows for understanding throughout the project Stone (2012:1) A study conducted by Brockhoff (2003: 477) and Andersson & Liedman (2013: ii) both found that the client (Consumer) satisfaction could be reached by elevating the customers perceived quality of past sefices against their expectation on future service, understanding this, management through design can offer improved product success by involving customers.

Design is a vital contributor to a company's success due to its ability to boost their competitiveness. Yet the role of design even has the ability to change people's perception of products, firms' understanding of strategy, or government policy design. It is therefore seen that designers not only have to provide products that aesthetically look good but also provide value which can be appreciated by the consumer (D'Ippolito, 2014: 2). Additionally the client's experience is able to shape the manner about how they speak of the business and in turn affects the businesses reputation and therefore their success (IPENZ, 2005: 1). Design is able to reduce cost, improve profitability and increase brand equity within organisations, thus becoming

vital value to corporate business strategies. And it is for this reason that companies are tapping into designers as a resource to create innovative business models, products and services that meet the actual needs of consumers (Western Cape Design Strategy, 2012: 4-5) Design can help organisations learn about consumers' emotional response to products and services to rethink user's needs (D'Ippolito, 2014: 3). Similarly the Design Skills Report (2016; 13) agrees that design is able to provide a greater understanding of the needs of people, as it is able to put people at the centre of a product, service or system as these technological developments that are created through design skills are more than none more likely to succeed in the market while improving people's lives. Design is therefore an enabler for improving day-to-day living environments by utilising both tangible and sustainable improvements that make our lives easier, safer and more enjoyable (Western Cape Design Strategy, 2012: 4-5).

VALUE OF DESIGN

1. THE WOW FACTOR	Good design is able to help products and services more visually pleasing, more compelling to use as well as more relevant in an ever changing environment. The 'wow factor' is able to draw in people to support companies over time.
2. BRAND EXPRESSION	Consumers of today feel as if they need to connect with brands as a form of an extension of themselves. It is because of this that we see, hear and interact with them in more ways than before. One of the more valuable work a designer is able to do is to perform lies in the interpretation of a company's brand and how to connect customers with them.
3. SOLVING UNMET USER NEEDS	Design is able to use empathy as an instrument and in doing so designers are able to create products, services or processes with the end users in mind. This allows for good products as well as reduces risk of failure. By studying what people do it provides an opportunity for' first-mover' advantage. It is this identification and capitalization on unmet user needs that leads to perception of the market.
4. DEVELOPING BETTER CUSTOMER EXPERIENCES	In every goods and services relation there is an end-to-end experience. It is when designers are involved that techniques involving empathy to discover and enhance both functional and emotional needs of the consumer. When different types of designers are involved in the various stages it is often that the process to build seamless, branded and differentiated experiences occur. It is a connection point for different parts of the company that do not always necessarily ever interact which makes it a key value-added method for practices within companies.
5. RETHINKING STRATEGY	Design and design thinking have become very popular in companies who face very complex issues that are difficult to solve using traditional business practices. By using design tools such as creativity, empathy and rationality these companies are able to rethinking problems in new ways and provide innovative solutions. Design do not just create solutions, they are driven to find the rooting issue and still even consider the entire range of possibilities to propose the best solution.
6. HARDWARE/SOFTWARE INTERACTION	Good design can be the difference between a complex and frustrating interaction and a pleasant effortless one. These well designed interactions can save consumers time, allow for more productivity, and provide emotive support to majority of things in our day-to-day lives.
7. MARKET EXPANSION THROUGH PERSONAL DEVELOPMENT AND USER UNDERSTANDING	Designer's ability to understand consumers' culture allows them to be well suited to aid companies to engage and catch new customers. Because designers are in touch with both the existing and the new potential consumers it allows for great success. If a company is able to have the confidence of knowing the consumer very well, there is less risks for management and therefore allow companies to take bigger and bolder innovations.
8. COST REDUCTION	Design is able to reduce costs within manufactured goods by rethinking and addressing ways or means it which the products come all together. Companies are able to use design to reduce cost and therefore increase designs financial impacts by managing the bottom line while growing the top line.

Figure 5: The Value of Design, Source: Rae, J. 2014: 2-8

2.3.3 Design Thinking

Design Thinking is an ideology that uses a hands-on, consumer-centred approach to solving problems that often leads to innovation, differentiation and competitive advantage (Gibbons, 2016). Design Thinking, according to Tim Brown, "is a hypothesis-driven process that is problem, as well as solution, focused. It relies on abduction and experimentation involving multiple alternative solutions that actively mediate a variety of tensions between possibilities and constraints and is best suited to decision contexts in which uncertainty and ambiguity are high. Iteration, based on learning through experimentation, is seen as a central task." (Mahmoud-Jouini, Midler, & Silberzahn, 2016: 148). Design thinking as a method allows for the understanding of the problem in order to produce solutions that are innovative and persuasive. Many of the design thinking tools are able to supply support that is effective in addressing the challenges (Thienen, J. P. A. von, Meinel, C. & Nicolai, C. 2014: 1). Throughout history great designers that have used a human-centred approach within the creative process have built meaningful and effective solutions (Gibbons, 2016). Design Thinking is more of a conceptual foundation opposed to a linear or analytical problem-solving approach that are less likely to solve problems filled with high uncertainty and ambiguity. It was these situations of uncertainty that need a reduction strategy which could be solved through a learning driven approach such as Design (Mahmoud-Jouini, Midler, & Silberzahn, 2016: 148). The true origins of Design thinking were established around the 1990's by Tim Brown and David Kelly of IDEA as well as Roger Martin, it captured methods and ideas that had been in the making for years for the creators into a single unified concept (Gibbons, 2016). Today, Design Thinking is an effective tool for any innovation process, able to join creative design approaches to traditional business management, that is based on rational problem solving and planning (Tschimmel, 2012: 2). Design Thinking uses a methodology that combines ideation and creative processes such as empathy for consumers, rapid prototyping and abductive thinking (Chasanidou, Gasparini & Lee, 2015: 12). Design thinking can provide a means to channel 'the problem-solving process' into a positive while allowing without preventinig any concrete decisions from being made or not going ahead (Thienen, J. P. A. von, Meinel, C. & Nicolai, C. 2014: 8).

Design Thinking, commonly referred to as DT, is able to, at the same time, address the desirability of a solution, its technical feasibility and finally its viability of transforming into customer value and market opportunity (Mahmoud-Jouini, Midler, & Silberzahn, 2016: 148). Design Thinking is a solution-based approach, and is suitable in addressing so called 'wicked' problems. These types of problems are often ill-defined or tricky and both the problem as well as the solution are unknown at the start pf the problem-solving process. Even if the direction of the problem may seem clear, there is a fir amount of effort and time that is allocated to in defining the requirements (Waloszek, 2012: 2).Design thinkers are required to be rational but emotional, analytical but empathic, intuitive but methodical, faced by planning and constraints but spontaneous. This kind of thinking can be referred to as a king of dualistic reasoning or known as 'abductive thinking', which is used to tell the difference between rational and inductive reasoning. This type

of thinking is therefore about future possibilities that often do not fit in existing models: in which feelings and emotion are just as vital as rationality (Tschimmel, 2012: 3). It is able to achieve the following advantages all at the same time; based on a user-centred process that creates products and services that address real needs, testing these products and services with real users, it unifies collective expertise to establish a shard language within multidisciplinary teams and finally it encourages innovation by exploring different options for the same problem (Gibbons, 2016).

DT is not only a way to build innovation but can offer new process models or toolkits that are able to help better, accelerate and conceptualize every creative process. These aren't only carried out by the designers, but by often large multidisciplinary teams in any organization (Tschimmel, 2012: 2). DT uses consumer insights as well as in depth and rapid prototyping to go beyond assumptions, which often block effective solutions, to deliver innovative and effective products, services and environments. Making it in recent years designers' preferred approach to deliver products and services (Brown & Wyatt, 2010: 32). DT as a way of thinking that leads to transformations, innovations and evolutions in new ways of living and business management (Tschimmel, 2012: 1). Design Thinking calls on the ability to recognize patterns, be intuitive, construct emotional ideas as well as be functional allowing designers and businesses to express themselves in media other than symbols or words (Brown & Wyatt, 2010: 33).

Design Thinking has had interest from both practitioners and scholarly literature, due to its design methods which are applicable across multiply fields such as business (Chasanidou, Gasparini & Lee, 2015: 12). DT has been highlighted by practitioners as well as academia as a novel methodology that is potentially valuable for improving innovative outcomes, whether they are products, services, or strategies (Mahmoud-Jouini, Midler & Silberzahn, 2016: 144). DT is usually constructive, experiential and optimistic which helps in addressing the needs of consumers. It is because of this that businesses are starting to embrace DT to better differentiate their brand, innovation and products and services to market a lot quicker (Brown & Wyatt, 2010: 32). The ability that Design Thinking has to solve multifaceted and complex problems, commonly known in DT terms as 'wicked problems', has exceled within the business environment (Chasanidou, Gasparini & Lee, 2015: 12). DT users are able to push forward ideas in the innovation process involving other role players such as the consumers as well as the stakeholders. This makes it achieve beyond the design of just artefacts but of organizations strategies as well and therefore creates this interest of business managers (Mahmoud-Jouini, Midler & Silberzahn, 2016: 148). It is because Design Thinking, as an approach, is able to look into areas that may have been overlooked by more traditional or conventional problem-solving practices. Not only does DT focus on creating products and services that are human-centred but the actual process is itself profoundly human (Brown & Wyatt, 2010: 33).

Design Thinking as an approach is very complex and there are many misconceptions surrounding Design Thinking. This has caused confusion and misunderstanding and as a result created criticism around the

method (Lourens, 2015: 97). There is often confusion associated with Design Thinking, especially with understanding the methodology, as it is often very vague (Vinsel, 2018: 1). To understand Design Thinking relies on the understanding of design itself and more specifically design's changing nature (Lourens, 2015: iv), yet designers have learned skills that allow for ways of thinking that embraces constraints as opportunities, to solve Design Thinking's 'wicked problems' (Lourens, 2015: 92). Design Thinking is sometimes referred to a repeatable, reusable or codified practice: often contradicting innovation, requiring uncomfortable work that challenges the status quo. Often business owners look for a tidy way to innovate, however, the fact is that there isn't a tidy way (Walters, 2011). Since Design Thinking can be so easily misunderstood, it is necessary to identify the key characteristics. This gives context to its methodology, and in doing so provides a starting framework. Without this framework, Design Thinking can become demanding to understand. The identification and discussion of Design Thinking characteristics allows for a clearer understanding of what it's true nature is (Lourens, 2015: 88).

2.3.3.1 Design Thinking success case studies

- Airbnb, a Design Thinking success story

The company has gone from making 200 Euro a week to revolutionizing tourism globally. In the late 2000's Airbnb was on the verge on the bankruptcy, after implementing Design Thinking within the company to investigate consumer tendencies. The designers put themselves in the shoes of the consumer and the company started to turnover twice as much a week. The team realised they were on the right track by following the Design Thinking rules of empathize, define, design, prototype and test. A small example of this was that a designer replaced the star rating system to that of hearts to make it less colder experience, by simply replacing the start with a heart business increased by 30%. Airbnb has now gone from making 200 Euros a week to being established in more than 1,500,000 ads in 192 countries and 34,000 cities with over 40 million users in 2015.

Read more: https://www.bbva.com/en/airbnb-design-thinking-success-story/

- Design Thinking case study: Innovation at Apple

Apple is one of the leading companies within the field of innovation which couldn't of happened without Design Thinking. After hard times during the early days of Apple, where Steve Jobs was fired in 1985 was the start of Apples chaotic era. Between 1985-1997 Apple struggled to achieve market success. Realising this Apple got Steve Jobs back in 1997, who started to implement Design Thinking within the company. Steve Jobs applied design thinking by focusing on; the consumers' needs and desires over the needs of the business, creating empathy to help consumers love Apple products, focus on the design over the engineering work where designers focused more on the form and function and finally by creating simple user-friendly products rather than complex hard-to-use products. This vision clearly can be identified in modern Apple products.

After the return of Steve Jobs the company the company went from having a net worth of $5 million up to $108 Million in 2016 with revenues of $233.7 billion.

Read more: https://www.designorate.com/design-thinking-case-study-innovation-at-apple/

- *Adding value to service expansion: Vlisco's innovation journey*

The Dutch company Vlisco is known to produce traditional Dutch wax fabric prints for the West African markets. However, lately the company had been faced with disrupted markets, competition and Chinese counterfeit. The company decided to implement Design Thinking to create new visions and secure the business future. In 2010 the company implemented a innovation team to use Design Thinking within the company. By focusing on a consumer-centric approach within consumer research, digital marketing, social media and content marketing as well as reaching out to colleagues running Design Thinking workshops to create enthusiasm in problem solving. By doing this the company is able to adapt to changing markets and embrace consumer desires.

Read more: https://thisisdesignthinking.net/2017/02/vlisco_dutch_textile_africa/

2.4 Conclusion

In conclusion it is evident that South African SMEs play a vital role not only in the economy but the employment rate as well. In response to research question 1.4.2.1. How do product design SMEs impact the local economy within South Africa, literature found that these SMEs are important to developing countries who are challenged by income and employment such as South Africa. Yet it is not only the GDP or employment rate that SMEs contribute to: SMEs have the ability to promote innovation and technology enabling improved living conditions. However, literature found that the growth within the SMEs sector is low with South Africa ranking one of the highest globally. More than half of SMEs are unable to establish themselves within the first 2 years failing to meet the demands of developmental roles within the country. Challenges such as; access to finance and credit, poor infrastructure, low levels of research and development (R&D), onerous labour laws, an inadequately educated workforce, inefficient government bureaucracy, high levels of crime and lack of access to markets cause SMEs within South Africa to fail.

Product design SMEs are no different, however, there is limited literature on these SMEs or the challenges faced on a day-to-day basis. It is important that these challenges are addressed in order to promote development and support within the sub-sector and is seen to be the main focus of this study. It is possible that design can offer a solution to this problem, design is able to innovatively turn ideas into reality and ultimately solve a problem or meet a need. Design as illustrated in literature is able to bring value to good and services and even business models. SMEs that use innovation have been proven to have better probability of surviving and therefore it is important that support measures be put in place to aid in developing successful and sustainable product design SMEs.

3. Methodology

3.1. Introduction

Design Thinking (DT) was used as the study's methodology with a blended research approach: including both qualitative and quantitative research methods. In doing so, the research explored both statistical quantifiable data, as well as qualitative investigations. Methods that were used included; online surveys, semi-structured interviews and a design workshop. The study utilized Lewin's Change Management Model (1951) (Kritsonis, 2005: 1) as a conceptual framework, in order to bridge the gap of knowledge of business/organisation structure, ensuring that data collected can be effectively analysed and implemented within the product design SMEs day-to-day business. The study also used the Braun & Clarke 6 Step Model (2006) of Thematic Analysis to analyse all data collected.

3.2. Design Thinking

Design Thinking was used as the studies core approach.

3.2.1.The Design Thinking Process

Design Thinking can be viewed as a system that has 3 intersecting spaces namely; desirability, viability and feasibility. It is within these 3 spaces that innovation excels. Viability refers to the business's perspective of Design Thinking, desirability refers to the perspective of the consumer, and feasibility refers to the perspective of technology or manufacturability (Chasanidou, Gasparini & Lee, 2015: 12).

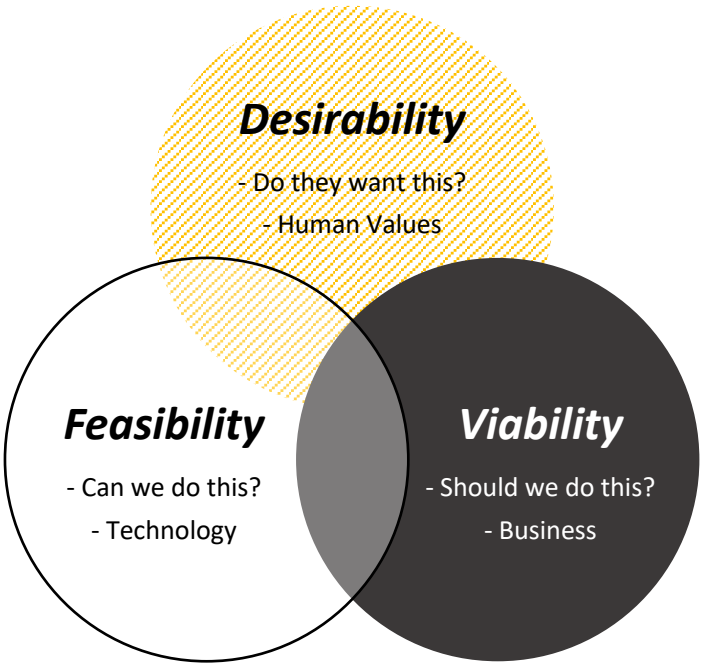
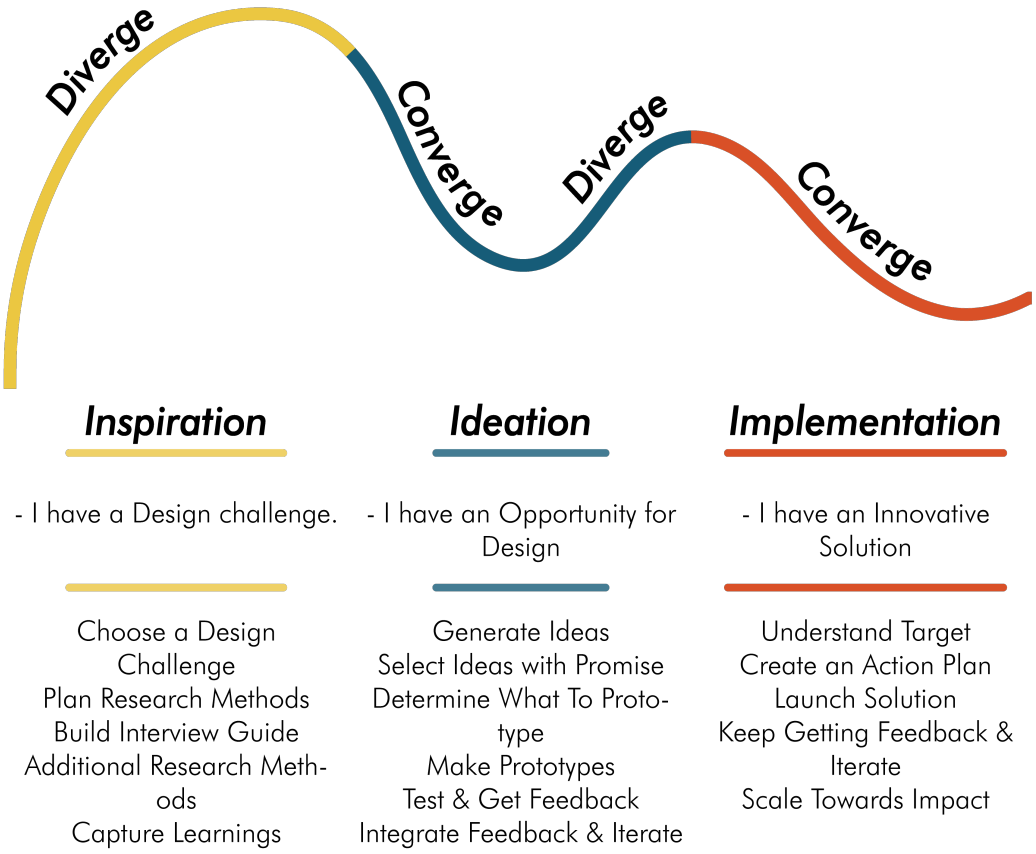


Figure 6: Three Spaces of Design Thinking, Source: Brook Stevens, 2018

The DT process can be viewed also as a system of overlapping spaces rather than linear based steps. These three spaces are known as: inspiration, ideation, and implementation (Mahmoud-Jouini, Midler, &



Silberzahn. 2016: 148). The reason for this is that instead of a linear motion through orderly steps, Design Thinking rather loops back and forth between these spaces; a project may loop between inspiration, ideation, and implementation multiple times until the design team refines the idea (Brown & Wyatt, 2010: 33).

Figure 7: Three Spaces of Design Thinking Process, Source: Design Kit, 2018

Within these three process spaces, there are six stages, these are: empathizing, defining, ideating, prototyping, testing and implementing. Empathizing conveys the relationship with the users, ideation uses brainstorming to generate solutions, the prototype phase consists of rapid prototype making, the testing phase is where prototypes are tested with users and finally the implementation phase is when the product is provided to the consumer (Chasanidou, Gasparini & Lee, 2015: 15) (Gibbons, 2016). Inspiration can be thought of as a problem or opportunity that will motivate a search for solutions, ideation as process in which to ideate, develop and test solutions. Lastly, implementation can be seen as the route to deliver these solutions into people's lives (Brown & Wyatt, 2010: 33).

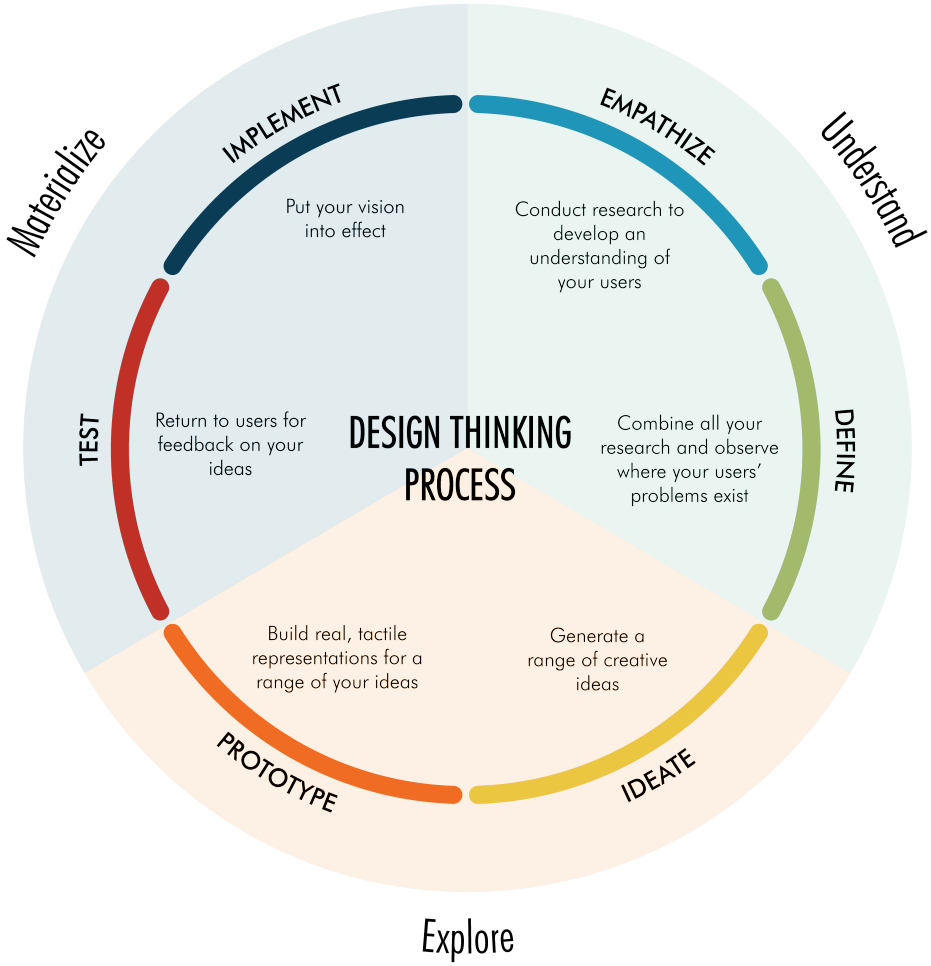


Figure 8: The Design Thinking Process, Source: Adapted from Severless, 2018

3.2.2.Application of Design Thinking within the research

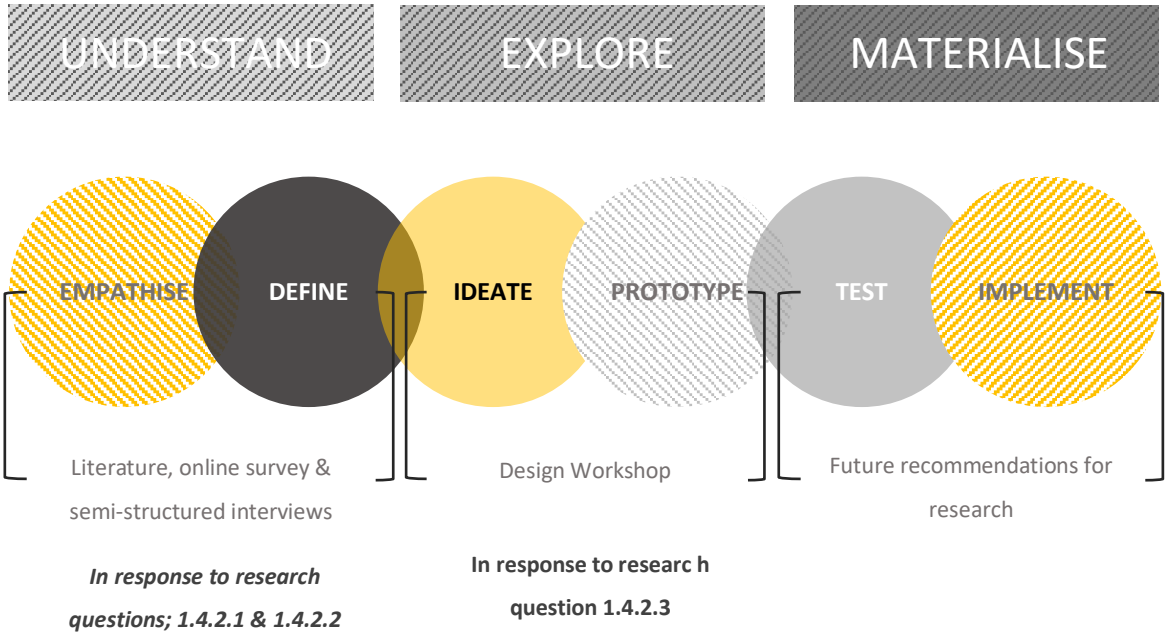


Figure 9: Infographic illustrating the core Design Thinking approach of the study, Source: Produced by author, 2018

This study used Design Thinking as the methodology. There are multiple Design Thinking models with processes stemming from explorations within industry such as IDEO, the study however used the Design Thinking process from a research perspective utilising phases such as; empathize, define, ideate and prototype to provide a structure in addressing the research sub questions. Design Thinking is inherently empathetic, this quality allowed for deeper understanding of the participants within the research. As seen above in figure 9, the application of the Design thinking phases were as follows; the 'empathize' phase was used to understand the product design SME industry by utilising literature to investigate South African SMEs and common challenges these businesses faced. This was in responses to research question 1.4.2.1. How do product design SMEs impact the local economy within South Africa. In addition, the use of online surveys to establish an enterprise demographic for a deeper the understanding into the product design SME industry in Cape Town. Finally, through the use of semi-structured interviews, the research explored the main challenges product design SMEs face. From the deeper understanding gained from the empathise phases, the study used the 'define' phase to co-define challenges as well as existing tools and systems that are inherent to the product design SMEs. Both the survey and semi-structured interviews formed the empathize and define phases of Design Thinking were in response to research question; 1.4.2.2. What are the challenges facing product design SMEs operating within the Western Cape South Africa. A design workshop was used to co-define these challenges and existing tools and systems with participants to observe all the research in order to discover where user's problems exist. Additionally, the design workshop was used to ideate possible

solution parameters to address the co-defined challenges. The ideation phase was able to produce a 'prototype' that possibly can be tested and implemented in product design SMEs. This Ideate and prototype phases was in response to research question; 1.4.2.3 What do product design companies perceive as the support criteria required to facilitate sustainable growth within the sector. Most importantly, the co-defined challenges and ideated solution parameters form a foundation for future research to develop and investigate further into the findings.

3.3. Methodology research approach overview

Study 1;

- *Method:* Online Survey (Survey Monkey)
- *Sample:* A total of 24 participants consisting of product design SMEs & product designers within the Western Cape completed the survey. Gender, age and ethnic specifics were not asked in the survey as the focus was placed on the business itself and no individuals. The businesses specialized predominantly in furniture design, design consultancy and retail design. Majority of the businesses had been in operation for 10 years or more, employing on average 0-5 employees and earning an annual turnover of under R500 000.
- *Procedure:* Procedure and layout of survey found in Appendix B.

Study 2;

- *Method:* Semi-structured Interviews
- *Sample:* The sample of the semi-structured interviews consisted of 3 participants. The sample of the semi-structured interviews is further elaborated in detail below under heading 3.4.2.1 Participant profiles: semi-structured interviews and design workshop.
- *Procedure:* The interviews consisted of defined talking points highlighted below under heading 3.4.2.2.1 Semi-structured interview talking points. The talking points were as follows; product design specialisation, common business challenges, product design management problem and tools/systems in place to address challenges.

Study 3;

- *Method:* Design Thinking Workshop
- *Sample:* The sample of the design thinking workshop consisted of 3 participants. The sample is further elaborated in detail below under heading 3.4.2.1 Participant profiles: semi-structured interviews and design workshop.
- *Procedure:* Procedure and layout found under heading 3.4.2.3. Method 3: Design workshop and Appendix C.

3.4. Blended research methods

The research report used a blended approach, using both quantitative and qualitative research types. Quantitative research was used within the study to illustrate the demographical layout of the product design SMEs environment with Western Cape South Africa. This was accomplished through using an online survey-based method for data collection. The Quantitative research, through the survey, formed the basis for the next stage in research; qualitative. A qualitative research approach was used to develop a better

understanding of product design SMEs as well as the main focus; the challenges faced by these product design SMEs within the Western Cape. This research was empathetic, as to align with the Design Thinking methodology allowing the research to gain a deeper insight. Design Thinking process structured the research methods throughout the study. Investigation into existing literature, online surveys and semi-structured interviews were used to empathize with the users. Additionally, the design workshop was used to 'define' and 'ideate' key challenges and possible solutions parameters to address them.

3.4.1.Quantitative

Quantitative research aims to quantify data and then to generalize the results from a sample of the population and asks questions such as 'how long' or 'how many' (MacDonald & Headlam. 2011:8). Quantitative research was originally used in physical sciences especially in chemistry and physics where there was a need to quantify data (Williams. 2007: 66). Quantitative research type was used within the study to collect statistical based data from participants utilising Survey's to create a demographic representation of product design SMEs in the Western Cape, South Africa. The data allowed for a quantifiable overview of product design SMEs landscape in the Western Cape, answering to one of the first objectives of the Research Report, as well as a basis for future qualitative semi-structure interviews. The online survey was used directly to answer research sub-question 1.4.b.1). How do product design SMEs impact the local economy within South Africa? This was done in order to establish their importance as well as to investigate challenges faced by the product design SMEs.

3.4.1.1. Method 1: Online survey

A survey is a tool for gathering data by asking a set of predetermined questions to participants that fall within the sample population in order to ascertain the desired information (MSG, 2018). Surveys can be used for both quantitative and qualitative research types and has the following two main purposes; firstly, to describe certain characteristics of a sample or population, and secondly to test hypotheses within the population (Research Methodology, 2017). The main focus of the survey was to collect quantitative data in order to illustrate the demographic layout environment of product design SMEs in Western Cape. The use of online surveys was in line with the Design Thinking process phase 'empathize' and used to gain better understanding of the users and the industry they work in. In addition to illustrating the product design environment, the survey also investigated challenges that these SMEs might face. Participants were also asked if they would be willing to participate in future data collection, such as the semi-structured interviews and design workshop (qualitative research methods). The survey made use of a quantifiable set of data for visual mapping in order to screen participants and for comparison with literature. The reason for screening the participants post-survey was to establish key participants that would bring more value to the research without any bias. This vetting of participants ensured that the participants in future data collection are centred on the main idea of the project. The challenges brought out in the survey formed the basis for following semi-structured

interviews to gain a better understanding of these issues or experiences in design process management from a more qualitative point of view. An online platform called Survey Monkey was used to set up, collect and analyse the data, the survey used can be found in Appendix B. Research into the various product design SMEs companies within Cape Town established a list of potential participants, these participants were contacted and asked to complete the surveys. Additionally, participants were approached within a closed Facebook group comprising of past design students as well as design companies.

3.4.2.Qualitative

Qualitative research is focused around the quality of information being gathered, as it attempts to understand the reasons and motivations for actions, establishing how people may understand their experiences (MacDonald & Headlam, 2011: 8). Qualitative research has a history in the social sciences, health sciences, and humanities and has expanded into a wide range of other disciplines such as design (Lockyer, 2008). The research report utilised qualitative methods such as semi-structured interviews and a Design workshop to answer research sub-questions: 1.4.b.2). What are the challenges facing product design SMEs operating within the Western Cape South Africa? As well as 1.4.b.3). What do product design companies perceive as the support criteria required to facilitate sustainable growth within the sector? The qualitative research was based on the online surveys in order to investigate, more thoroughly, the experiences and challenges that product design SMEs face, which is the main focus of the research. This was vital for the research as it often happens that the participants/user's reasoning and actions provide crucial information used in the design process. By using this type of research, it allowed for a better understanding into the product design SMEs environment as well as challenges that are faced within Design Process Management. The qualitative data was collected through methods such as semi-structured interviews and a design workshop. These were then analysed using The Braun & Clarke 6 step method to thematic data analysis.

3.4.2.1. Participant profiles: semi-structured interviews and design workshop

3.4.2.1.1. Participant SSI-01-11 & DW-01-11

Participant SSI-01-11 stated that they have been within the design industry for 11 years. Achieved a Bachelor's Degree of Technology in Industrial Design from Cape Peninsula University of Technology. The business that they manage and co-own specialises in product development where they do not specialise in anything in particular. More specifically, the participant mentions that the business specialises in product design. As a design consultancy, compared to businesses that specialise in visual thinking or systems design, there is a large difference in the execution, purpose and the use of the design at the end of the day. The business deals specifically with the development and manufacture of products. The participant states that even though this should be looked at as a field of its own, it often incorporates a lot of other areas.

3.4.2.1.2. Participant SSI-02-08

Participant SSI-02-08 stated that they have been within the design industry for 8 years. Achieved a Bachelor's Degree of Technology in Industrial Design from Cape Peninsula University of Technology. Participant SSI-02-08 explained that they have specialised in two different fields, firstly, as a product designer where they have both owned a business, and secondly where they have both worked as senior product designers. Their role as a senior product designer for their design business, which specialises in design as a service, involves taking a project from start to finish. Participant SSI-02-08 commented that they often deal with the management of design resources as well as suppliers. Secondly, participant SSI-02-08, who also owns a company, specialises in sculptural and furniture design and exhibits in galleries. Participant SSI-02-08 stated that within this business they focus predominantly on what they want to create and retail those particular products.

3.4.2.1.3. Participant SSI-03-14 & DW-02-14

Participant SSI-03-14 stated that they have been working within the design industry for 14 years. Achieved a Bachelor's Degree of Technology in Industrial Design from Cape Peninsula University of Technology. Participant SSI-03-14 stated that their business that they manage and co-own specialises in building prototypes, which is how the business started, as well as short-run production and manufacture as well as bespoke machinery. Participant SSI-03-14 said that their business produces high end finished prototypes for research, product testing as well as marketing. Within this specialisation, the business combines their Industrial design department with their mechatronics department for product prototyping and development. On top of high end prototyping, participant SSI-03-14 said the business also focuses on short run manufacturing and producing high-end products at low volumes. The businesses processes that are in place allow for production of high end products at low volumes while still being competitive in its pricing. Lastly, participant SSI-03-14 said the business also focuses on bespoke machine design. Where they use both their industrial and mechatronics departments.

3.4.2.1.4. Participant DW-03-05

Participant DW-03-05 has worked as a designer for 5 years in the industry and has reach a mid-level designer status. Achieved a Bachelor's Degree of Technology in Industrial Design from Cape Peninsula University of Technology.

3.4.2.2. Method 2: Semi-structured interviews

A semi-structured interview is a qualitative-driven data collection method that researchers use to ask participants a number of predetermined but very open-ended questions. This allows for control of the subject of discussions within the interview, unlike unstructured interviews (SAGE, 2018). The benefit of semi-structured interviews is that the researcher is able to prepare questions prior to interviews. At the same time, it allows for participants to feel free enough to discuss or express their views and opinions in order to gain deeper understandings (RWJF, 2018).

Semi-structured interviews were used to gain a better insight into the experiences, and more importantly; the challenges that product design SMEs face on a daily basis. The use of qualitative research method allowed for the collection of information that was quality driven, as well as focused on the reasoning and motivations of the participants. This formulated deeper understanding into the participants and their responses. The interviews were structured on and around data results gained from the online survey from participants who established themselves as willing for further research. The participants, acquired through the surveys, having existing knowledge of the study, allowed for more in depth, formulated responses into refined topics of interest to the study. This also allowed for deeper understandings within the product design SMEs sector. Semi-structured interviews were used in line with the Design Thinking process phase of 'empathise', which was used to dive deeper into the challenges found by participants developing an in depth understanding from a user perspective.

The interviews were used to investigate the specialization of product design SMEs within Cape and the challenges that surround it. As well as common business challenges faced by these SMEs, to look at more specific 'management' challenges'. Challenges faced within the design process management as well as what tools or systems that were being put into place to address these challenges as well as what was missing. These were defined into talking points as seen below to address the studies research questions.

3.4.2.2.1. Semi-structured interview talking points

- Product design specialisation

This talking point was a result of the online survey findings illustrating the diversification within SMES's in Cape Town. This became a topic of interest during the interviews in which investigation into whether specialising into certain fields brought about unique or added challenges into the business. Hence why the participants were asked about their business specialisation as well as any particular challenges or experiences that they felt were unique to their relevant specialisations.

- Common business challenges

This talking point was used to formulate a comparison amongst findings from secondary research regarding South African SMEs. This was done to establish the similarities or differences in challenges that product design SMEs in Cape Town face to that of South African SMEs. This talking point was the initial stage of addressing the research sub-question; 'What are the challenges facing product design SMEs operating within the Western Cape South Africa?'

- Product design management challenges

This talking point investigated more managerial challenges that product design SMEs face (illustrated in findings chapter where 10% of participants indicated that 'Management' was a common challenge). This

talking point was the continuation of addressing the research sub-question; 'What are the challenges facing product design SMEs operating within the Western Cape South Africa?'

- Product design process management challenges

This talking point investigated the design process and challenges faced in managing this process (a key focus in the study was to investigate into design process management challenges). This talking point was the continuation of addressing the research sub-question; 'What are the challenges facing product design SMEs operating within the Western Cape South Africa?'

- Tools/Systems in place to address challenges

This talking point investigated the systems or tools used by participants to address challenges that they face. This talking point was the initiation of addressing the necessary criteria needed to support product design SMEs in Cape town, addressing the research sub-question; 'What do product design companies perceive as the support criteria required to facilitate sustainable growth within the sector'.

These talking points formed the structure and flow of the interviews, all the interviews were recorded on a mobile device for transcribing the data.

3.4.2.3. Method 3: Design workshop

A design workshop was used to co-define key challenges experienced by product design businesses as well as ideate the necessary support structure for product design SMEs. The design workshop, aligning with the core Design Thinking approach of the study, used the 'define' phase to investigate the challenges found from Secondary research, online surveys and semi-structured interviews. Most importantly the workshop made use of the participants, firstly, to co-define these challenges and secondarily the participants 'ideated' possible approaches and solutions to address these key challenges. These 2 phases, 'define' and 'ideate' formed the main purpose of the design workshop and more importantly was in line with the studies core Design Thinking approach.

The design workshop was broken down into the following activities:

- Co-defining key challenges within product design businesses
- Co-defining existing key tools or systems used within product design businesses
- Defining key challenges hierarchy
- Ideating fundamental parameters that solutions need to address in order to promote and sustain successful product design SMEs.

At the start of the design workshop the participants were thanked and provided with snacks and beverages for the workshop. Each participant received a design workshop pack that included: a consent form, pen, note pad, a specific coloured marker, a specific coloured post-it, a list for writing down key challenge hierarchy

and a list for writing down key existing tools/systems hierarchy. The reason for the specific coloured markers and post-it's was in order to track which participant said what within the workshop which made transcribing and analysing easier.

Before starting, the participants were briefed on what the study was focusing on as well as a brief overview of the workshop. An itinerary list for the workshop can be found in Appendix D.

- Co-defining key challenges within product design businesses

This activity was used to co-define key challenges depicted from Secondary research, online surveys and semi-structured interviews. Key challenges defined in the *Findings chapter: Semi-structured interview outcomes used for the design workshop* were displayed individually on a panel in which each challenge was discussed with participants. Interesting aspects within each key challenge brought up by the participants was written on a post-it and stuck onto the relevant challenge. Participants were also asked to add any additional key challenges that they thoughts were vital to the study.

- Co-defining existing key tools or systems used within product design businesses.

A similar activity, as illustrated above, was used to discuss and illustrate the key existing tools or systems used in product design businesses.

- Defining the key challenges hierarchy

Following the task of discussing and co-defining existing tools or systems used within design businesses, participants were asked to define a hierarchy of the key challenges previously discussed. The participants were asked to individually list the challenges in a hierarchy on the list provided in the design workshop pack. Due to time constraints, the participants were asked to collectively define the top three key challenges (one of the participants had a previously planned meeting). Out of the other key challenges, only three main challenges were placed in hierarchy as the workshop still needed to ideate possible parameters that solutions need to address in the following activity. These top three main challenges were then used in the following ideation of fundamental parameters that solutions need to address.

- Ideating fundamental parameters that solutions need to address in order to promote and sustain successful product design SMEs.

The top three main challenges, co-defined and collectively placed in hierarchy by participants, were then discussed individually. Each challenge was addressed and parameters for solutions revolving around the challenges were discussed as well as mind-mapped onto sheets of A1 paper. This was repeated for all three main challenges.

After this activity the participants were thanked, and the design workshop was ended.

3.5. Conceptual framework - Change Management

The term 'managing change' refers to the making of certain changes in planning and managing, with the aim to implement new and more effective systems in an ongoing company (Nickols, 2016: 1). Change management is a process that utilises tools and techniques to manage change, and more importantly, the people that the change has an influence on, in order to achieve the required businesses outcomes. It uses these tools to help individuals make successful transitions that result in the acceptance and fulfilment of change (PROSCI, 2018). Along with this task of managing change comes the task of managing the impact it has on people, which is often very complicated as managers need to help employees cope with these changes (Nickols, 2016: 2). By using a holistic framework, Change Management is able to help employers understand what to expect and how to manage change in order for it to engage the whole organisation (Strategy, 2004: 3).

3.5.1.Lewin's 3-stage model of change

Kurt Lewin introduced the three-step change model in 1951 (Kritsonis, 2005: 1). Lewin's model consists of three steps or processes, namely; unfreezing, movement/change and lastly, refreezing (Hussain; Lei; Akram; Haider; Hussain; & Ali, 2016: 1). The model relies on a dynamic balance of opposite forces driving change as it steers employees in the desired direction. Forces that restrain change do not lead employees in the correct direction and therefore these forces are needed to be analysed by Lewin's three step model to encourage the shift in balance to the planned direction of change (Kritsonis, 2005: 1). Lewin's model strives to maintain the status quo for change and is one of the earlier and fundamental models (Hussain et al, 2016: 2). The first step consists of 'unfreezing' the equilibrium/status quo. This can be achieved through three methods; Increase driving forces that steer behaviours away from equilibrium, decrease restraining forces that negatively affect movement as well as a combination of these two methods mentioned above. The second step is movement, which is the process of changing the behaviour, this can be achieved by the following three actions: convincing employees that the equilibrium is not beneficial, working together to find new and more relevant information and lastly to connect the views of the company. The third and final step of Lewin's 3-stage model is refreezing, which consists of taking the necessary steps to implement change to ensure a stabilized new equilibrium. This third and final step of Lewin's model can be achieved by reinforcing new patterns through both formal and informal mechanisms (Kritsonis, 2005: 2). Both Blomqvist (2017: 29) and Hossan (2015: 60) write that the Lewin´s 3 step model is often referred to as an outdated model unable to work with a changing world as it is too simple for complex change and it is because of this that the model is often dismissed. The Lewin's model is seen as too simplistic or mechanistic and not appropriate for the continuous change found in the world today where organisational change is an ongoing open-ended process that is subjected to uncertain environments (Hossan, 2015: 60). However, even with this being said, there are some very good qualities to this 3 stage model, such as the fact that the model is very easily understood and therefore simpler to apply to managing change (Blomqvist, 2017: 31).

Table 5: Lewin's 3 phases for Change Management, Source: SWANSEA, (Accessed 2018): 1-2

Phases	*Description*	*Application in study*
Phase 1: Unfreeze	Determine what needs to change. - Survey the organisation to understand the current state. - Understand why change has to take place.	Online surveys and semi-structured interviews were be used to unpack and understand product design SMEs experiences and challenges in the Western Cape as well as create an enterprise demographic of the sector within the city of Cape Town.
	Ensure there is strong support from upper management. - Use Stakeholder Analysis and Stakeholder Management to identify and win the support of key people within the organisation. - Frame the issue as one of organisation-wide importance.	
	Create the need for change. - Create a compelling message as to why change has to occur. - Use your vision and strategy as supporting evidence. - Communicate the vision in terms of the change required. - Emphasize the "why".	
	Manage and understand the doubts and concerns - Remain open to employee concerns and address in terms of the need to change.	
Phase 2: Change	Communicate often. - Do so throughout the planning and implementation of the changes. - Describe the benefits. - Explain exactly the how the changes will affect everyone. - Prepare everyone for what is coming.	The design workshop was used to both co-define as well as ideate key challenges and possible solution parameters in order to address these challenges found to influence the success of the product design SMEs
	Dispel rumours. - Answer questions openly and honestly. - Deal with problems immediately. - Relate the need for change back to operational necessities.	
	Empower action. - Provide lots of opportunity for employee involvement. - Have line managers provide day-to-day direction.	
	Involve people in the process. - Generate short-term wins to reinforce the change. - Negotiate with external stakeholders as necessary (such as employee organisations).	
Phase 3: Refreeze	Anchor the changes into the culture. - Identity what supports the change. - Identify barriers to sustaining change.	The possible solution parameters co-defined and ideated by participants in the design workshop can be used as a prototype within the product design SME sector in order to test the findings. In doing so the study provided a foundation for further research in product design challenges and solutions needed to promote the sustainable growth of these businesses.
	Develop ways to sustain the change. - Ensure leadership support. - Create a reward system. - Establish feedback systems. - Adapt the organisational structure as necessary.	
	Provide support and training. - Keep everyone informed and supported.	
	Celebrate success!	

3.6. Sampling & Population

A convenient sampling method was used for selecting a sample for the research. Convenience sampling is a method where the individuals of the target population are chosen for the purpose of the study on specific practical criteria such as availability or accessibility (Dörnyei, 2007). However, there is a disadvantage to convenience sampling where it is more than likely going to be biased (Farrokhi & Hamidabad, 2012: 785; Mackey & Gass, 2005). The target population for the project was product design SMEs based within the city of Cape Town in the Western Cape of South Africa. A list of SMEs that fitted the criteria were contacted and asked permission to be a part of the study. The research report aimed to collect between 20-30 participants for the online surveys of which 24 participants were part of the final survey. Additionally the use of the survey was used to determine the different types of design SMEs within the Western Cape as found in Figure 10. The reason to determine the different types of design SMEs in the Western Cape was to supply a demographical layout describing the product design industry in more depth. There was no real focus specifically on the different types of design SMEs but rather an overview on the demography. there was no real focus on the type of company for the semi-structured interviews and workshop due to the focus being more about the importance of the managerial positions allowing more data collected regarding the challenges in running a product design business, as well as only having access to certain participants. Once the surveys were completed and participants who had indicated their wiliness to participate in future research were screened and selected for both the semi-structured interviews and design workshop. The study aimed to have between 3-5 participants within the semi-structured interviews and design workshop. These participants were screened and chosen dependent on availability and access.

3.7. Data analysis introduction

The research report used tools such as screening, statistical analysis and visual mapping to analyse the online survey. Survey Monkey, the online platform used to host the survey, recorded, processed and analysed the data which was in turn added to the findings chapter. A ‘Braun and Clarke’s 6 step method to Thematic Analysis’ was used to analyse all qualitative data recorded from the semi-structured interviews and design workshop alongside with visual mapping to represent data graphically. These tools and methods will be discussed below in the following section.

3.7.1.Quantitative data analysis

3.7.1.1. Statistical analysis

Statistical analysis is a component of data analytics and involves the collecting and examining of all the data samples within a collection of research where samples can be drawn. The aim of statistical analysis is to identify trends within the data (TechTarget, 2018). Statistical analysis methods are used in the planning, analysing, designing and collection of data in a study in order to report on the research findings. It often gives meaningless numbers meaning and therefor giving life to lifeless data (Ali & Bhaskar, 2016: 662). The research

report used Survey Monkey's features to analyse the statistical data into graphs, tables and figures which were then used in the findings chapter

3.7.1.2. Online survey screening

Screening was used to select participants who established willingness to participate in further research. Certain participants were approached for the interviews and workshop in relation to their accessibility to the researcher, experience within the design sector as well as wiliness to participant in both the semi-structured interviews and Design workshop. It was vital that participants were willing to participate in both aspects of research, firstly in order to be comfortable with the research as well as have an investment in addressing the key challenges the product design SME face on a day-to-day basis.

3.7.1.3. Visual mapping

Visual mapping is a technique that illustrates how people see relationships between concepts or data, it provides visual representation to understand dynamic patterns in data (Wheeldon, 2009: 69). Visual mapping was used to illustrate data collected from the online surveys, semi-structured interviews and Design workshop. Statistical data collected from the online surveys was visually represented in the form of graphs found in the Findings Chapter. These visual representations of data were also used in the semi-structured interviews alongside talking points to dive deeper into qualitative research. Data collected from the online survey and semi-structured interviews were analysed, and where necessary, were visually represented for participants in the design workshop.

3.7.1.4. Coding

Coding was used throughout all methods of the research report. The online surveys used the code: OS, the semi-structured interviews utilised the code: SSI and the Design workshop used the code: DW. For example; a participant from the semi-structured interviews was assigned the code SSI-03-14. SSI refers to the type of method and the number that follows was used to indicate the number of the participant and finally the last number is used to indicate the amount of years the participant has been in the design industry. The reason for the reference to the amount of years within the industry is to validate their responses according to their experience. This type of coding was used to protect the participant's identity and their privacy as stated in the Ethics section above. Coding was also used within the thematic data analysis to separate and categorize emerging data from the research.

3.8. Qualitative data analysis - Thematic data analysis

Thematic Analysis (TA) is a method of analysis that is used to identify, analyse and record patterns in data (Braun & Clarke, 2006: 79). The reason for the use of this method of thematic analysis is to analyse the semi-structure interviews and design workshop. It was used to highlight patterns within the qualitative data between participants based on the quantitative data collected in the online survey. TA looks at coding

qualitative data to identify and describe the data collected. The patterns discovered through the use of this thematic analysis approach in the semi-structured interviews, as well as data collected in the survey's, formed the basis for the Design workshop.

3.8.1.Braun and Clarke 6 step method to TA

Braun and Clarke, 2006 model, can be viewed as more flexible theoretical approach to TA, with emphasis on the flexibility. It can be identified as an analytic method rather than a methodology which most other TA model are. The reasoning is that the examination of patterns across language does not need theory of language, explanation of the framework meaning for people, experiences or practices. It should be viewed as a linear model where one cannot proceed to the next phases without correctly completing the prior; rather analysis is a recursive process (Clarke & Braun, 2013: 120-121). A Thematic analysis is a straight forward qualitative analysis that often does not require detailed approaches as other methods, however, even though it is relatively easy to conduct, there are several pitfalls that can result in poor data analysis. Firstly, there is the failure to actually analyse the data, as TA is not just collection of data extracts but rather a collection illustrative analytical points that the researcher makes about the data. Secondly is using the data collection themes as the themes reported, indicating that no analytical work has been done. Thirdly is an unconvincing analysis where themes are overlapping too much or not consistent, this occurs when the researcher fills adequately capture the majority of the data. Fourthly is the mismatch between analytic statements and data, where these statements cannot be supported or are contradicted by the data. Lastly is the mismatch of theory and analytic statements or research questions (Braun & Clarke, 2006: 24-26).

Table 6: Braun & Clarke six step method to TA, Source: Clarke & Braun, 2013: 120-121

Six phases of thematic analysis	Description	Application
FAMILIARISATION WITH THE DATA:	It is important that the researcher is immersed within the data in order to familiarise themselves. This can be achieved by reading, re-reading and even listening to audio play back of the data. This is done to ensure that no analytical observations are lost.	All data captured by the study was analysed shortly after completing each method. This was done in order to allow for the researcher to have a good recollection of the data and the process of data collection. After transcribing all data from both the interviews and design workshop the data was read through a few times in order to familiarise with the data.
CODING:	This is a common approach in majority of thematic analysis approaches, it involves generating labels for important features of research in order to refer to and create themes with. Coding is a simple analytical method of data reduction.	After re-familiarising with the data each participant was coded for ethical purposes as well as ease of analysis. Participants were coded and their responses given certain text colour enabling the researcher to find patterns with the data easier.
SEARCHING FOR THEMES:	Themes are meaningful patterns found within data that are relevant to the research question. It consists of all codes collected being built together to make arguments to either validate or differ from research question. At the end of this phase the researcher is able to collect all coded data relevant to themes that have emerged.	The use of coding and text colouring for participant's response allowed for easier searching for emerging themes within the data collected from both the interviews and design workshop.
REVIEWING THEMES:	This involves validating the themes against the relation of the coded data and the full data-set. The researcher is able to reflect on themes and be able to decide if they tell a convincing story validating the research question. It is important that each individual theme is defined as well as the internal relationships between each theme.	Emerging discussion points and themes within the data was re-read and reviewed in order to make for better flow of reading. This allowed the research to review all themes.
DEFINING AND NAMING THEMES:	During this phase the researcher is required to write up detailed analysis of each theme in order to identify the essence of each theme and in doing so builds a concise and informative name for each theme.	Emerging themes were coded and label as headings for paragraphs where participant discussion points and definitions of the theme were written.
WRITING UP:	Writing is an important element to analytic processes in TA. It involves stringing together the analytic narrative and data extracts to tell the reader the story about the data.	Finally, all the key themes were written up in order to provide a good flow within the Findings chapter.

3.8.2. Interpretation of data

Emerging themes from the data were interpreted thought-out the process as the Braun & Clarke six step method to TA provided a clear and linear process to interpret data as well as to formulate valuable discussion points. The final stages of data analysis involved utilising key themes defined and coded within the discussion chapter of the study, where additional literature was included to further validate the data findings against existing knowledge.

4. Findings

4.1 Introduction

The followings finding chapter illustrates Cape Town's product design SME enterprise demographic, challenges that these SME face in running product design businesses as well as the necessary support structure needed to build sustainable product design SMEs in Cape Town South Africa. Firstly, the research used the enterprise demographic to investigate aspects such as field specialisation, business operational length, geographical location, employment rate, annual turnover as well as early investigation into challenges and existing tools or systems used by product design SMEs in Cape Town. Secondly key challenges experienced by product design SMEs are illustrated and suggested solution parameters are presented in order to support these SMEs in building sustainable business.

4.2 Online surveys

4.2.1 Online survey analysis

Online surveys were analysed through the online platform, Survey Monkey. Survey Monkey allowed for the collection and analysis of all data from the surveys. These were represented graphically either through tables or graphs by Survey Monkey, the researcher converted these graphs and tables into a design style that suited the overall style of the research report. These findings were displayed in the findings chapter per question, where the data was illustrated visually in order to map the data as well as a brief summary of each question was written up alongside these visuals.

4.2.2 Overview

The following online survey findings are in response to the first research sub-question: 1.4.b.1) how do product design SMEs impact the local economy within South Africa? The quantitative findings from the online survey illustrate the enterprise demographic of Cape Town based product design SMEs and their contribution to the South African Economy. Additionally, the online survey was used to start investigation into the challenges that are experienced by product design SMEs based in Cape Town. A total of 24 participants (product design SMEs & product designers) completed the survey. Of those 24 participants one was removed due to vindictive responses. The following findings are broken down into the 10 questions presented to the participants in the online survey.

4.2.3 Cape Town product design SME enterprise demographic

4.2.3.1 Specialisation of design businesses

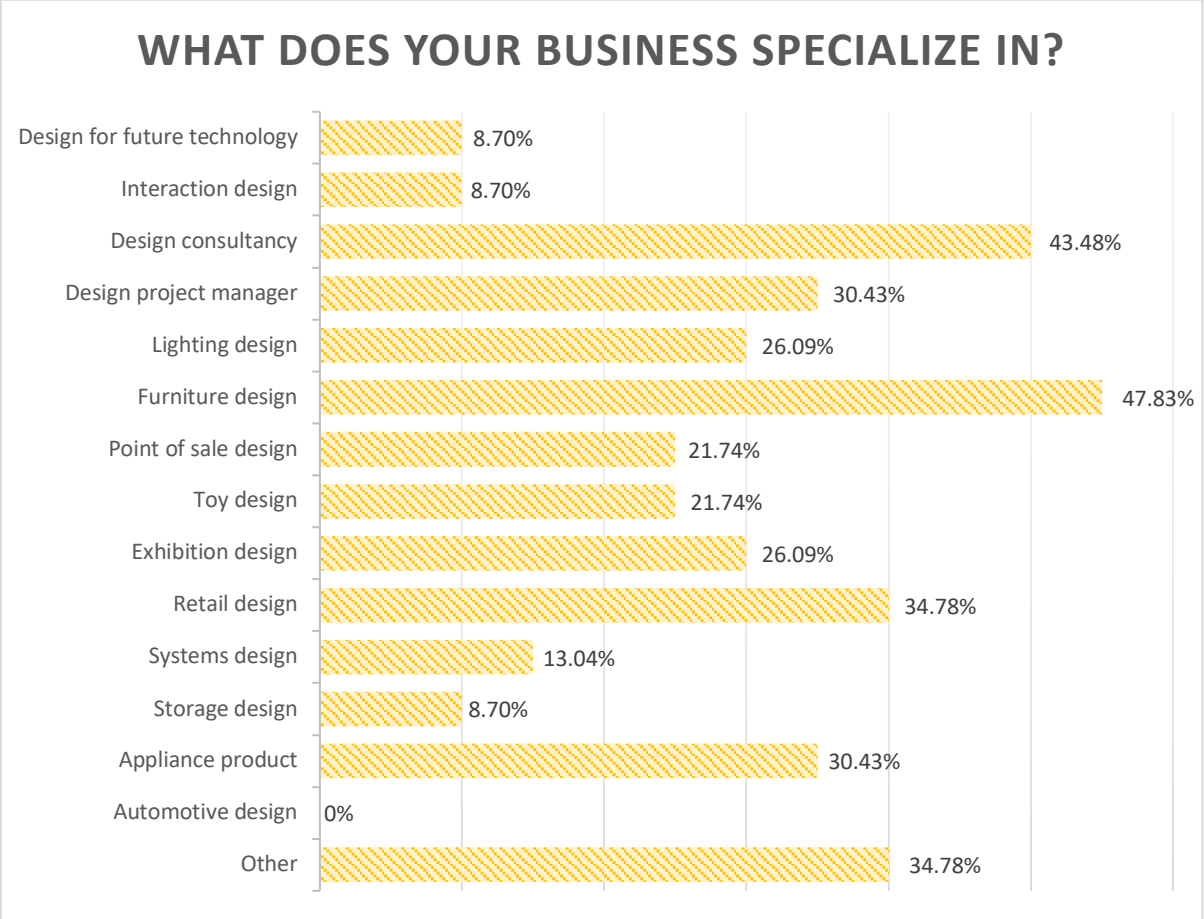


Figure 10: Cape Town product design SME Industries, Source: Produced by author, 2018

Question 1 in the online survey illustrates the diversity of specialisation within the product design SME sector in Cape Town. The question was a multi-choice option. 'Furniture' as well as 'design consultancy; had the highest responses with 47.8% and 43.5% participants, respectively, indicating these as their industries. Following these industries were 'retail design', 'design project manager' & 'other'. Interestingly within 'other' more industries were defined by participants and can be view below. Additional responses within specialisation included; medical equipment design, packaging design, signage and wayfinding, watercraft and yacht design, installation art, soft goods development and visual thinking.

4.2.3.2 Design business operational length

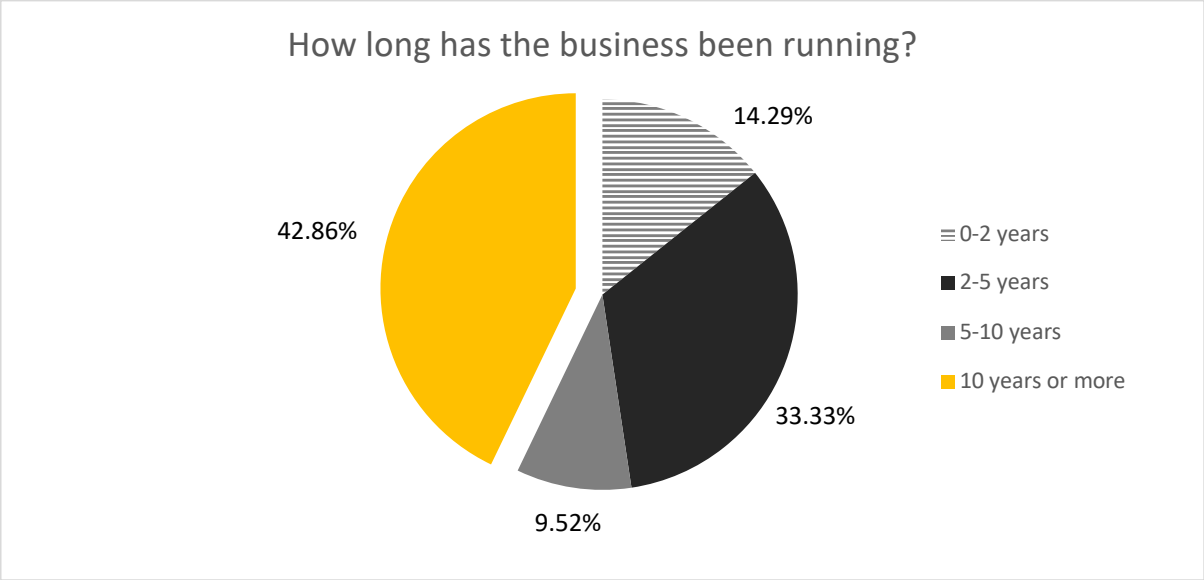


Figure 11: Cape Town product design SME business operation period, Source: Produced by author, 2018

Question 2 illustrates the operational length of the product design SMEs businesses. Majority of the participants, 42.86%, indicated that their business had been in operational for more than '10 years or more' followed by 33.33% of participants who had been for '2-5 years'. 14.29% of product design SMEs indicated that they had be operational for '0-2 years' and finally 9.52% indicated that they had been for '5-10 years'.

*2 participants skipped this question.

4.2.3.3 Design business geographical location

Question 3 illustrates the demographic location of the product design SMEs within Cape Town. Majority of the SMEs, 39%, indicated that the 'City Bowl' is their location of their business. This was followed by the 'Southern Suburbs' with 21.7%, 'Northern Suburbs' with 13%, with an equal 4.3% for the 'Atlantic Seaboard', Southern Peninsula', 'Helderberg as well as the 'Other. None of the SMEs indicated that their businesses location feel into both the 'Cape Flats' and 'West Coast' locations. Regarding 'Other', which was initially 14.3%, the participants responses included; the Cape Winelands, Woodstock & George. The Cape Winelands can be classified as the 'Northern Suburbs' and Woodstock falls within the 'City Bowl' district. These responses were then added to their respective locations and 'Other' was reduced to 4.3%. In relation to the SME located in George, they specified that they had been working within Cape Town and had only recently moved to George, their responses were too valuable and even though they were out of the defined location of the study they were added.

*2 participants skipped this question.

4.2.3.4 Design business employment rate

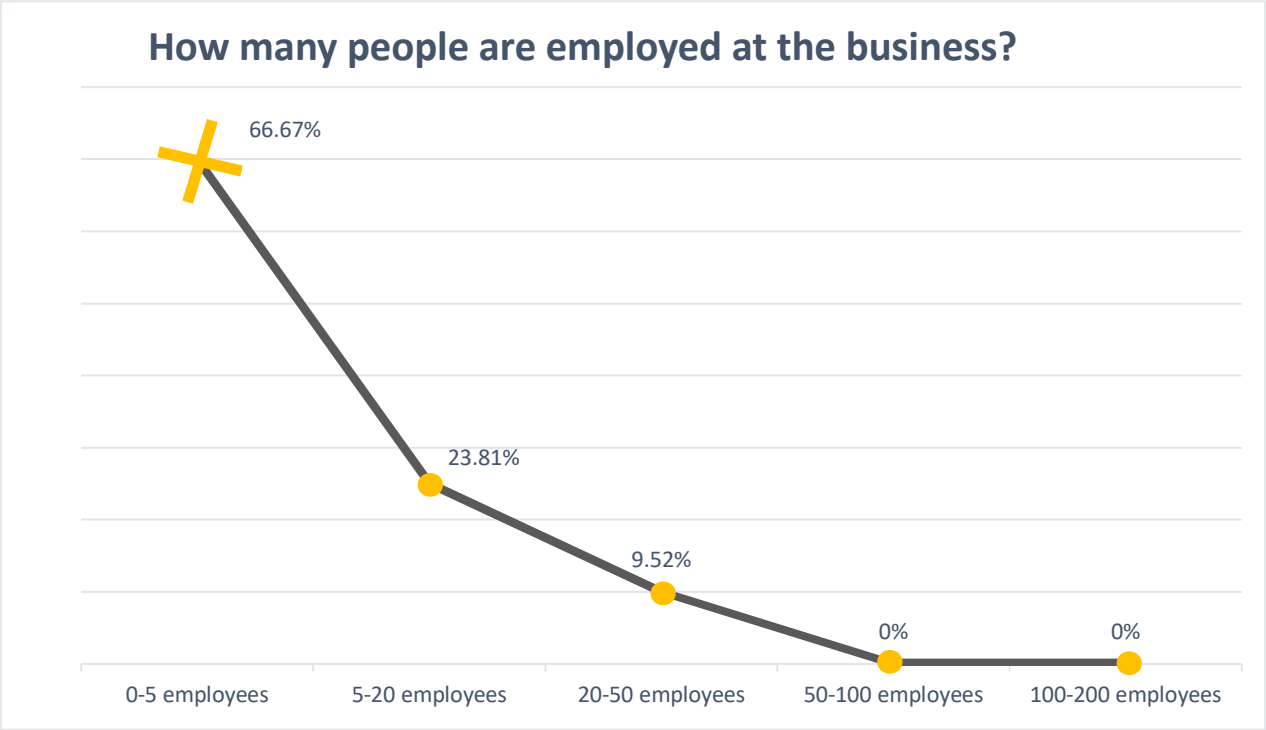


Figure 12: Cape Town Product design SME employment rate, Source: Produced by author, 2018

Question 4 indicated the number of employees the product design SMEs employed contributing to the employment rate within South Africa. Majority of product design SMEs, 66.6%, employ between '0-5 employees'. This is followed by '5-20 employees' with 23.8% and '20-50 employees' with 9.5%. None of the product design SMEs indicated that they employed '50-100' or '100-200' employees.

*2 participants skipped this question.

4.2.3.5 Design business annual turnover

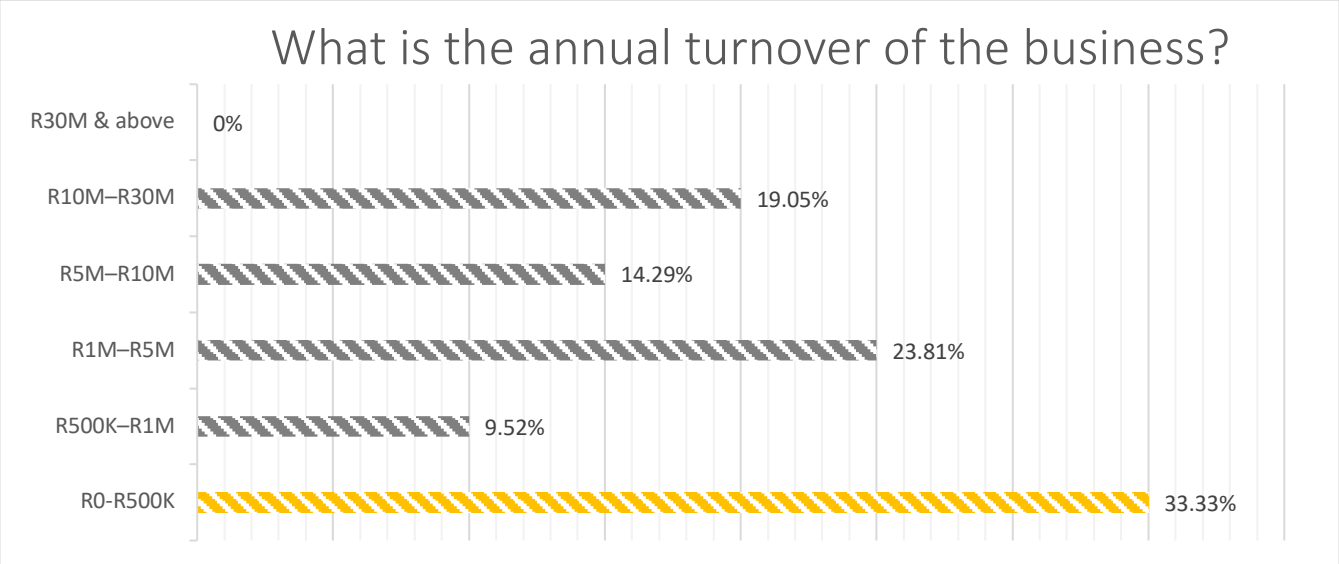


Figure 13: Cape Town product design SME annual turnover, Source: Produced by author, 2018

Question 5 illustrates the annual turnover of product design SMEs in Cape Town. Majority of the SMEs, with 33.3%, indicated that the business earned 'R0-R500K' followed by 23.8% of participants indicating that their businesses earned between 'R1M-R5M' a year. This was followed by 19% indicating their business earned 'R10-R30M', 14.3% indicating their business earned 'R5-R10M' and finally 9.5% indicating their business earned 'R500K-R1M'.

*2 participants skipped this question.

4.2.3.6 Most common business challenges

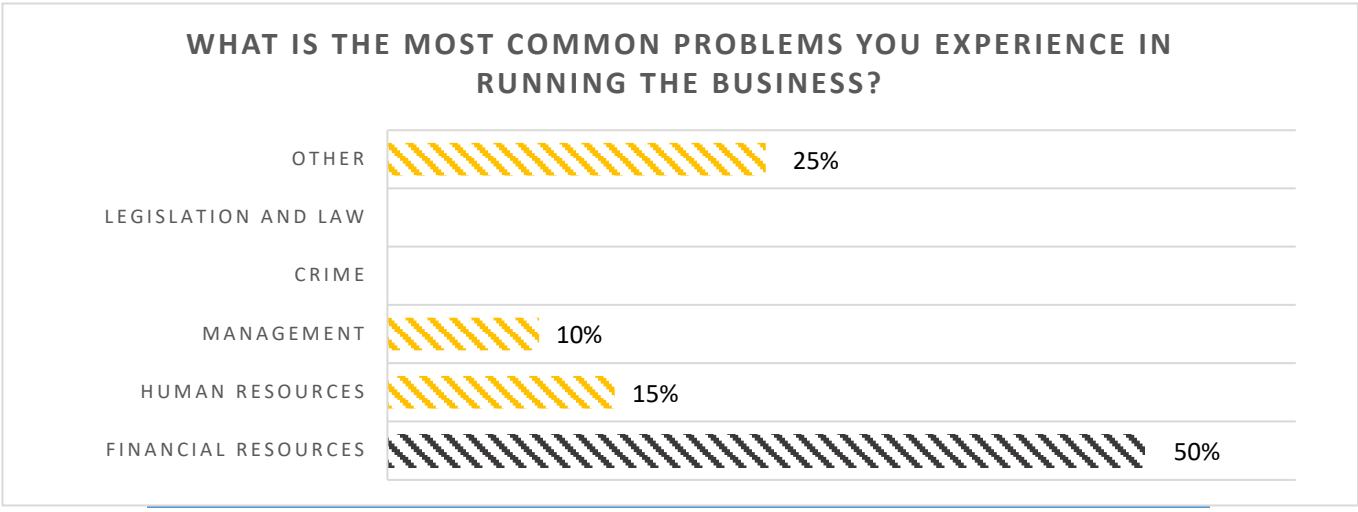


Figure 14: Cape Town product design SME common business challenges, Source: Produced by author, 2018

Question 6 was the start into the investigation of challenges faced by product design SMEs based in Cape Town. Based on findings from Secondary research conducted in the Literature review the following main challenges faced by South African SMEs were; Financial resources, human resources, management, crime and legislation and law. Majority of SMEs, with 50%, indicated that 'financial resources' being one of the largest challenges in running a business. This was followed by 'other' with 25% of participants. Within the 'other' responses bar the following participants responses were collected: All of the above, 3rd party manufactures timing, cash flow (Finding a way to hold on while waiting for clients to pay), reaching customers and clients in South Africa not understanding the value of 'our' services. Following 'other', 'human resources' accounted for 15% of the participants. Finally, 10% of the SMEs indicated that 'management' was a challenge in running a product design business. Both 'crime' and 'legislation and law' received no results.

*3 participants skipped this question.

4.2.3.7 Design business management challenges

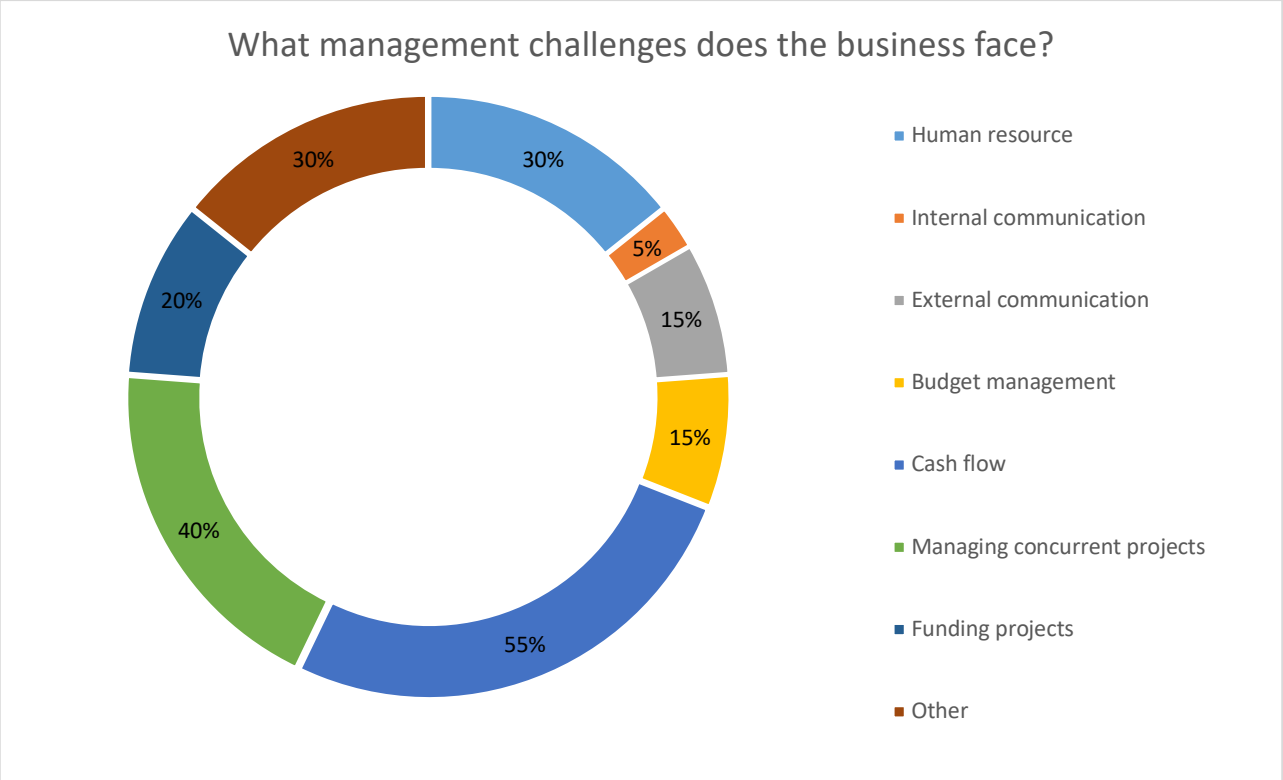


Figure 15: Cape Town product design SME common management challenges, Source: Produced by author, 2018

Question 7 investigated the challenges found within the management of product design SMEs, this question refined into management challenges as it was one of the main focuses of the study. Question 7 was a multi-choice option. Most of the SMEs responded that managing the 'cash flow' within the business was a major challenge. This was followed by 'managing concurrent project', 'human resources' and 'other'.

Additional response specified as 'other': All of the above; 3rd party manufactures timing; bunch of creatives together is a recipe for disaster, everyone cannot be creative, someone needs to make sales, and someone needs to management finances and admin; play on people strengths once you get to a level of multiple people involved; marketing & social media; time and skilled manufacturing as well as missing technology.

*3 participants skipped this question.

4.2.3.8 Design process management challenges

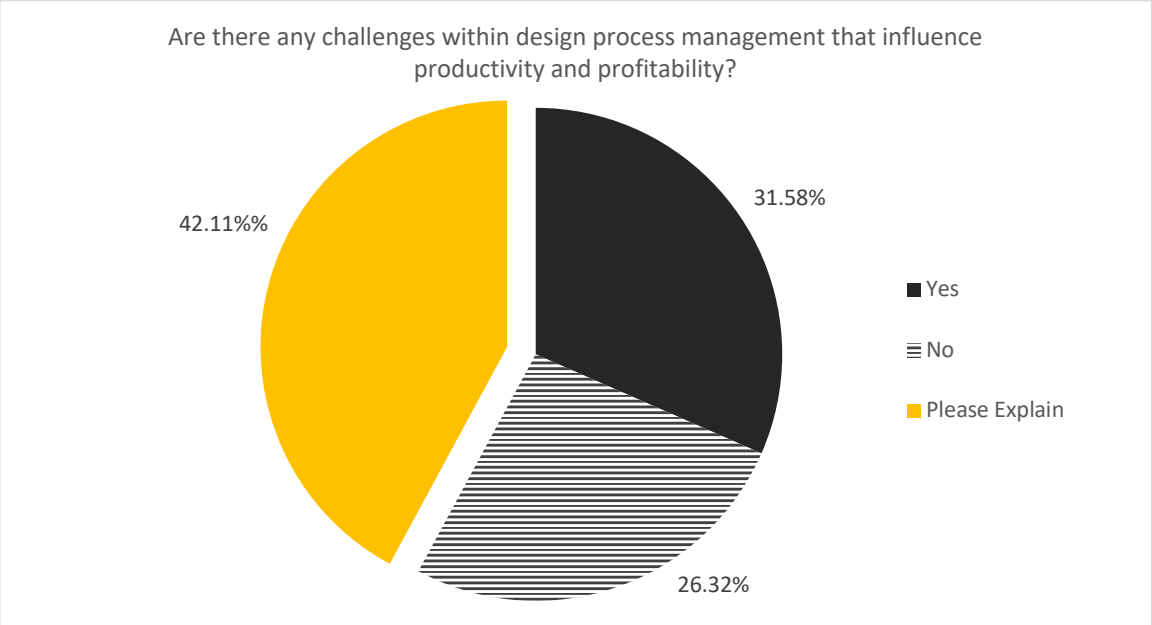


Figure 16: Cape Town product design SME design process management challenges, Source: Produced by author, 2018

Question 8 investigated challenges faced with the design process management, as described in the glossary. 31.6% of the SMEs indicated that there are challenges in the design process management with 26.3% stating that there were none. 42.1% of the participants referred to the 'please explain' of which the following responses were recorded. Additional response specified within the design process management included that South Africa clients not having enough budget for a project, managing people as well as the process, managing unrealistic client expectations, the process from concept to final product, deliverables timing, payment structures with the client, the lack of motivated, knowledgeable and skilled suppliers for prototyping and finally costing a project.

*4 participants skipped this question.

4.2.3.9 Existing tool or systems used in addressing challenges

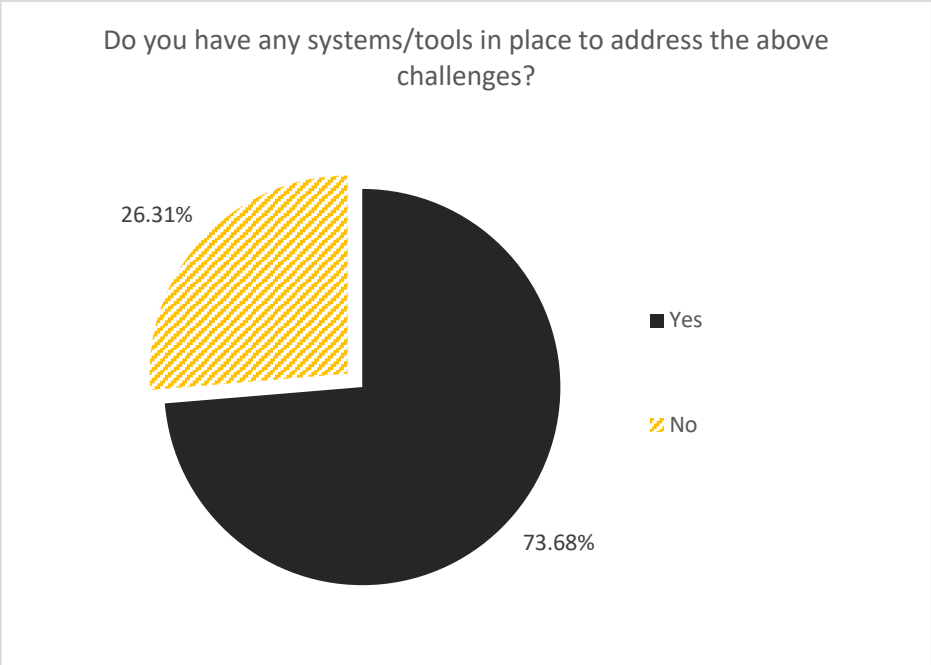


Figure 17: Cape Town product design SME existing tools/systems addressing challenges, Source: Produced by author, 2018

Question 9 illustrates what tools or systems are in place in order to overcome certain challenges. Majority of the product design SMEs, with 73.7%, stated that they had tool or systems in place to resolve certain challenges. The remaining 26.3% of the participants said they had no tools or systems in place.

*4 participants skipped this question.

4.2.3.10 Topic of interest for further research to establish participants for interviews and workshop

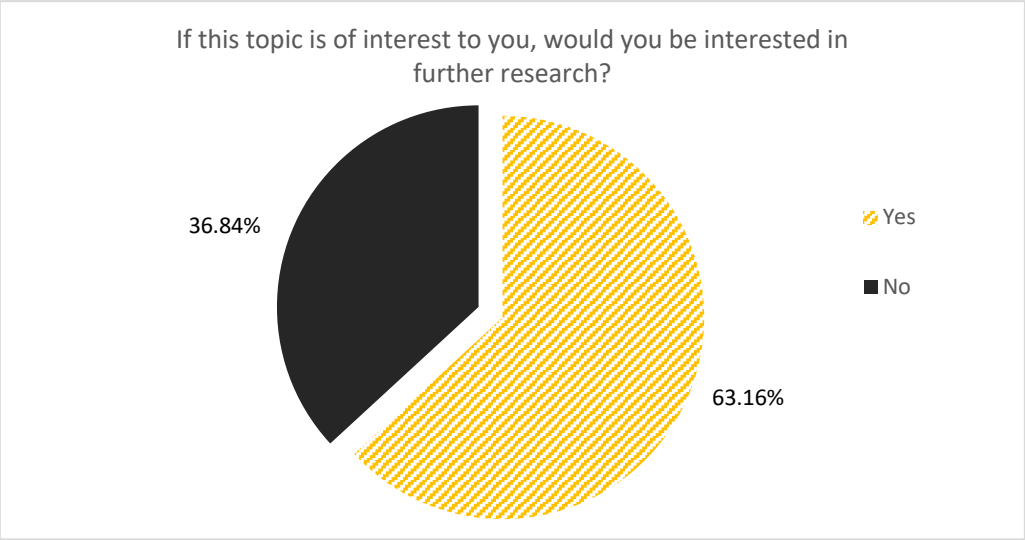


Figure 18: Cape Town product design SME further research participation, Source: Produced by author, 2018

Question 10 was used to establish participants that were willing to continue in further research around the studies topic, Majority of participants, with 63.1%, stated that they were interested and willing to do so. The remaining 36.8% of participants were not interested in participating in the study. Contacts were provided by participants in this question and were used to get in contact with certain participants for the semi-structured interviews as well as the Design workshop.

*participants skipped this question.

4.3 Semi-structured interviews

4.3.1 Overview

The following findings investigated in the semi-structured interviews were used in response to the research sub-question: 1.4.b.2) What are the challenges facing product design SMEs operating within the Western Cape South Africa. The interviews also briefly addressed the research sub-question: 1.4.b.3) What do product design companies perceive as the support criteria required to facilitate sustainable growth within the sector. The semi-structured interviews findings explored challenges with product design businesses in Cape Town by interviewing three participants in management or ownership positions. The findings of the interviews highlighted that some of the main challenges faced by product design business were both financial and human resources, managing both clients and suppliers, misunderstanding in design value and project management were specifically managing resource inefficiency, project scope, design unknowns, project progress in comparison to the brief and using effective design reviews. The interviews also touched on existing tools or systems that were put in place by product business to support their business. Some of these tools or systems consisted of utilising effective project planning alongside project forecasting programs, project priority systems, programs used to streamline business workflow and finally effective networking within the design industry.

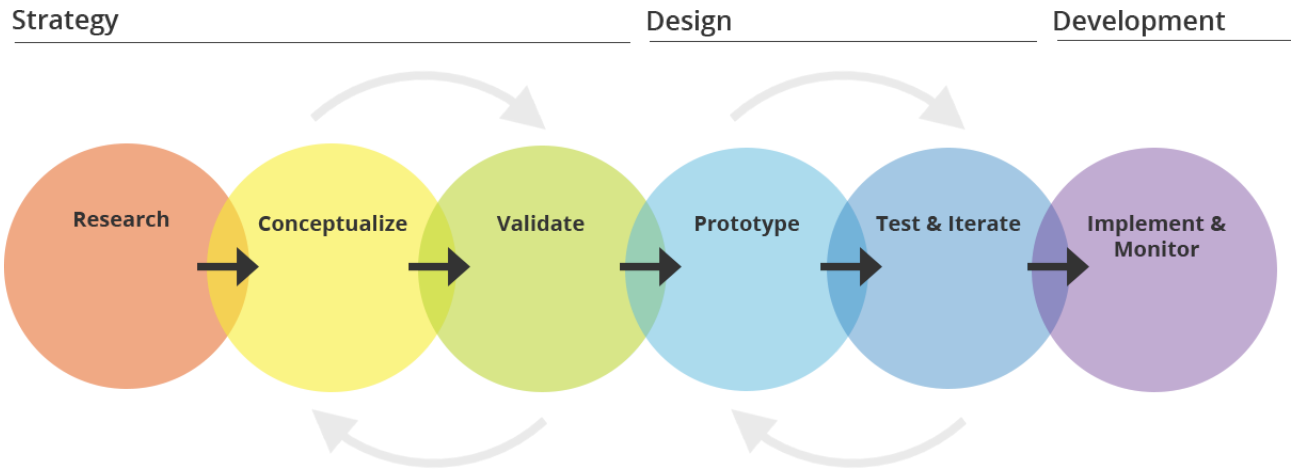
4.3.2 Semi-structured interviews analysis

Talking points were developed through the secondary research as well as the online surveys. These talking points included; product design specialisation, common business challenges, product design management challenges, product design process management challenges and tools or systems in place to address challenges. These talking points formed the structure and the flow of the semi-structured interviews as well as themes used to analyse the data. The semi-structured interviews were recorded on a mobile device and the voice recordings were transcribed through the use of google voice note tool to convert the data into text. Once all the interview recordings were transcribed, the data was read through a few times to understand and familiarise with the data as per Braun and Clarke 6 step method to TA. Next the data was coded for ethics and TA purposes into relevant themes. These themes were grouped as the main talking points: product design specialisation, common business challenges, product design management challenges, product design process management challenges and tools or systems in place to address challenges. Each participant's interview was coded, and the textual data coloured differently. The reason for changing the colour of the text for each participant was to group similar emerging themes within the data under each talking point. This made it easier to search and review themes as per the Braun and Clarke 6 step method. All the emerging themes were defined and written up under the following umbrella themes; '*design challenges within general business practice, specialisation and management'* and *suggested existing ways to address challenges within product design businesses'* within the semi-structures interview in the findings chapter. Outcomes from the semi-

structured interviews, as illustrated in the *Findings chapter: Semi-structured interview outcomes used for the design workshop,* were then used to plan for the design workshop.

4.3.3 Design challenges within general business practice, specialisation and management

The three participants in the semi-structured interviews agreed that design is a diverse industry and is full of challenges. Participant SSI-02-08 specifically mentioned that it is often that design businesses do not specialise in one entity, but rather many. Similarly, participant SSI-01-11 mentions that there is a generic design process for all designers and that no matter what field they are in they tend to follow a similar process. Participant SSI-03-14 mentioned that the design industry is about challenges and everything in it challenging.



Standard Product Design Process, Source: Davision, D. 2019.

4.3.3.1 Challenges within financial resources

Participant SSI-03-14 briefly discussed the issues within financial resources when running a design business. The comments centred on the business point of view and the main point of a business is to make money. Participant SSI-03-14 mentioned the challenges of working in Cape Town is the limited market regarding product development. Participant SSI-01-11 stated that one of the biggest challenges in a design consultancy is cash flow, which is directly related to the management. Participant SSI-02-08, when talking about financial resources, commented about small businesses and the challenge of keeping overheads low in order to spend the time to build the business. Participant SSI-02-08 pointed out that something as small as business location can have an influence on the business. When deciding where the business is going to operate from there is a lot to consider such as stock storage, space to manufacture, assembly etc. Renting space in Cape Town is a massive challenge according to participant SSI-02-08 as it is just too expensive. Rental in Cape for design SME can be seen as a deterrent in starting a small business. Interestingly it is mentioned that limited space means

outsourcing jobs which links to suppliers, discussed later on, and whether the business is able to work with as well as produce quality of work.

Participant SSI-01-11 mentioned that costing of a project can be difficult, even with experience. The participant commented on the difficulty of relaying additional costs to a client during the work stages of a project, because a client does not want to be surprised or pay extra on a project. Similarly, participant SSI-03-14 said that material costs are often too high, and this can become a deterrent to the production of quality product. The participant mentioned that the sourcing of material may result in the business to import materials, which affects the costing. The financial implication of importing materials can be seen in the fluctuation of the exchange rate especially when dealing with the client who had prior prototypes made for a certain amount and when the exchange rate goes up now have more expensive prototypes. This issue often results in clients insisting on poor quality materials found locally. Participant SSI-03-14 mentioned that when this happens it results in the final prototype to reflect poorly on the final mass-produced product. The participant stated this is the same for the machine side of the business, regarding certain componentry that cannot be bought locally and has to be imported which therefore has an influence on the cost. Additionally, participant SSI-02-08 commented it is often a challenge to that there are not enough incentives from a tax or SARS perspective if you are a small business. Participant SSI-02-08 felt the option for loan and/funding for small business is limited in South Africa in comparison to that of Australia or other countries. There are a few options available, but the participant felt that they are limited and aimed at certain ethnic groups.

4.3.3.2 Challenges within human resources

Participant SSI-03-14 mentioned that human resources are often a challenge within general business. Finding staff who will embrace the company values, identity and are passionate for the work they do has proved difficult. In addition to participant SSI-03-14 mentions that finding skilled staff that are able to work within a dynamic environment such as a design business can be tricky. Finding employees that are not only able to understand the process and materials and but also are able to work on a multitude of diverse jobs often jumping back and forth between them. The participant suggested that if the human resources element is not managed correctly it can become harmful in messing staff around.

4.3.3.3 Challenges within work flow & efficiency

Participant SSI-01-11 mentioned that within design, efficiency in the design is often a sensitive thing because there is a *"certain amount of work that needs to be done in a certain amount of time and you don't always know until you get to the end of the process if the work you have done is going to pay off"* (Participant SSI-01-11). Participant SSI-01-11 commented that if it the design is not in the right direction it will lead to repeating the process to get a different result. Importantly, managing the design process is about limiting the amount of time this process occurs. Management with experience would be able to avoid this process occurring too many times, but the challenge in design companies that have a multitude of projects that are running simultaneously, and managers are not being always able to be involved in the details. Participant SSI-02-08 commented on how

resource efficiency is linked to depletion of budget or time where sometimes resources use too much of the allocated time to accomplish tasks or not enough time allocated for the work. Participant SSI-01-11 mentioned that as a designer who is involved with a project, when a certain departure point is reached the designer can either continue with the design direction or need to relook at it. The participant continued to explain that having good design reviews at these junction points either with management or another designer in order to get feedback and input often helps in preventing time being over spent or not efficiently used. Interestingly participant SSI-02-08 mentioned that designers often have to limit themselves in order to meet budget and time deadlines which can have an influence on innovation in products. Often a project is capped in order to meet the budget or time deadlines from the client which stunts the product development. However participant SSI-02-08 does mention that when clients understand the value of design and sees the value in further product development, budgets and timelines are extended. When Participant SSI-01-11 was asked if there should be a tool or system put in place to aid the designer to evaluate their work and ensure that the work they are doing is in the correct direction, participant SSI-01-11 agreed and said that this could be addressed by using design reviews. Participant SSI-01-11 said how design reviews are critical in the design process and these are done by breaking the project up into different junctions where decisions need to be made.

4.3.3.4 The value of design

Participant SSI-02-08 found it challenging that Cape Town clients do not understand the value of design. Participant SSI-02-08 felt clients have no understanding into the value of creative thinking that designers offer as a service as well as not understanding the thought processes that goes into developing a product. Clients that do not understand this type of service are less involved in the project. Participant SSI-02-08 mentioned that some education into what design is and offers should be provided to clients who approach design companies in order for the client to be more invested in the development as well as to understand what they are getting at the end of the project. If a client understands the design process and value they are able to know what to expect, this particularly gives the designer more freedom where the client is able to respect the decisions that have gone into the development. Participant SSI-02-08 made an analogy to the profession of architecture where if a client goes to an architect there is no questioning the design or drawings that are produced, interestingly they feel like this should be the same in the design field. Where the client needs to realise and respect the designers' solutions because this is what they have studied.

4.3.3.5 Challenges faced when dealing with suppliers

All three participants agreed that suppliers with Cape Town give design businesses many challenges. Participant SSI-02-08 mentioned a challenge that design businesses often face is in the actual manufacturing of the product. The participant mentioned that it is often very difficult to get things made in South Africa due to suppliers. Participant SSI-03-14 agreed and said that there are limited services and quality offered by suppliers in Cape Town. Participant SSI-01-11, specifically talking about a product design consultancy,

mentions that their business relies heavily on suppliers for the development of a project. The participant said that because of Cape Town being a very small industrial hub it does have limitations with these suppliers regarding what they can do, materials they work with, processes they offer, timelines they can work to as well as the communication with companies. Participant SSI-01-11 does not think this problem is unique to Cape Town and can be found countrywide. The issue comes down to the limitations of suppliers and this often leads design companies designing to meet those limitations. Participant SSI-02-08 touched on the fact that there is not a diversity in suppliers in South Africa compared to the rest of the world and this then limits certain development in products due to processes or materials that are not available. Participant SSI-03-14 mentioned that because of these factors they try manufacture in- house. Participant SSI-03-14 commented on how the company changes the process of manufacture of the designs or materials in order produce the product in-house and not rely on suppliers in Cape Town. The participant said that producing in-house will have an influence on the increase in labour which adds to the overall costs and time. This becomes important when managing resources as it becomes a juggling act of project priority due to multiple projects that overlap. Participant SSI-02-08 said that when looking at America and Europe there are often generations upon generations that pursue certain professions, such as carpentry. Most of these people choose these careers out of passion and so it reflects in their work. Whereas he participant believed that in South Africa some of suppliers do not have the same approach. This makes it difficult to navigate when developing projects as there is no shared enthusiasm in the work.

Participant SSI-01-11 and Participant SSI-02-08 also addressed that these suppliers often want the same part repeated multiple times due to it being cheaper for them to produce and they're able to make profit off these types of jobs. Participant SSI-02-08 said that even when the suppliers do agree to do developmental jobs they charge you much higher set up and part costs. Participant SSI-01-11 commented that suppliers do not want a company who specialises in product development to approach them with one offs or prototypes. The participant said that it is important that there is always an understanding from the suppliers point that projects might fall through and that comes down to the risk of the suppliers need to take. Participant SSI-01-11 commented that this is a deterrent for suppliers as they often spend money and time into the development and no production work comes of it. Sometimes these costs are covered by over charging for the development.

"This is the nature of development, that there is always this risk of the project falling through" (Participant SSI-01-11).

Interestingly participant SSI-01-11 said that as a manager one should try to mitigate the risk through good design and communication with the client. According to participant SSI-02-08 similarly said there are limitations due to suppliers' unwillingness to push their boundaries. The participant goes on to mention that there seems to be a lack of understanding by the suppliers of the significance of the designer's work. Participant SSI-01-11 was asked if whether or not it would be good to have a sole prototyping-based supplier,

where this supplier would specialize in the development in the project focusing of one offs and prototypes. Participant SSI-01-11 responded that is partly what their business offers however they outsource all the manufacturing of these projects due to the variety of projects that the business works on, the different materials and processes they would rather rely on outsourcing as the expenses of all the machinery to offer those in-house processes is a deterrent. Participant SSI-01-11 stated that to have a company that specializes in prototyping is very difficult because there is not enough work within Cape Town to warrant it. However participant SSI-01-11 stated that this idea would work if there were more design consultancies and a bigger market to feed them the work because then they can focus purely on the prototyping and not the design. Participant SSI-01-11, did however mention that prototyping and design go hand in hand and the need for design thinking in prototyping is extremely valuable and in that sense the participant stated that a pure prototyping company would NOT work due to the lack of design involved in the prototyping.

Participant SSI-01-11 said relationship building with the suppliers is vital in order for them to understand the value of what the design business is doing as well as understanding that they are in it for the long run and hopefully get the production run at the end of the day. The reason why this type of relationship takes such a long time, accordingly to participant SSI-01-11, is that you must go through a lot of projects to build that understanding. Another way of building this is putting in supplier's agreements in place which guarantees the suppliers the production work. These are often passed down to the client who also signs these agreements.

"Having good relationships with suppliers is extremely important, it is the only way you will get the communication and quality or workmanship" (Participant SSI-01-11).

Participant SSI-01-11 mentioned that forming good relationships with suppliers can sometimes lead suppliers to push their own limitations. Participant SSI-03-14 also agreed and commented that when there is no way around using external suppliers their business does have a few suppliers they use, and they have really good relationships with. Participant SSI-03-14 commented that a mutually beneficial relationship between suppliers and the business can become reciprocal, in the instance where the business can produce work for the supplier to aid in the manufacture of some materials.

4.3.3.6 Challenges when dealing with clients

Participant SSI-02-08 mentioned that often clients that approach design businesses in Cape Town can be classified as 'dreamers' where they often have good ideas for products yet never follow through with the product. Clients are assumed to be afraid of committing to the project. The participant mentioned that there is an 80/20 ratio where 20% of clients fall through after the project costing. The participant said that one reason for this is the economy in South Africa which makes the follow through of projects a challenge. Participant SSI-01-11 indicated that because of the nature of a design consultancy there is a range of clients and this in itself can offer its own unique challenges. Every client has their own expectations, firstly for what

they want their product/project to become and secondly their expectations of their interactions with you as a company. Some clients are not involved at all in the process and leave the business to do their work, where other clients want to be very involved in the project. This dictates what the business can or cannot do, which can influence the outcome of the project in a sense that either the business has the freedom to determine the outcome or not due to the client being very specific on they want. Participant SSI-01-11 said that their business prefers when the clients have input into the project because there is a sense of ownership from the client's side and therefore become more invested. This often leads to the client being happier at the end of the day. When a client is invested and has input they are more aware of the back and forth and see the challenges in the project often understanding the value at the end of the day. If clients do not have this input, they are often not as invested and do not necessarily see the value that has been put into the project. Participant SSI-03-14 added, talking about managing the client's expectations is often difficult because the design process is a complicated process. The participant addressed the fact that because there are always complications in this industry it can become challenging when the client needs to understand these complications. Participant SSI-03-14 commented that it is difficult managing clients when complications arise and often when the client does not understand these complications, they move their project to another business. Participant SSI-03-14 commented on how South Africans are always looking for the best deal and are quick to jump ship when things go wrong, often approaching other design businesses. The participant stated other businesses promise to complete the project for cheaper and quicker, however, some of these companies try to get these jobs in order to maintain cash flow.

Participant SSI-03-14 referred to the ‘discovery phase’ and how it is important that the projects are anchored; understanding if it is feasible. The ‘discovery phase’ should be used to draw a line for the client and illustrate all the possibilities for the problem, the risks, and an idea of cost of the projects. Participant SSI-03-14 stated that this then makes it ‘a go or no go’ situation part of the project which is presented to the client to make that call. The participant even mentioned that this decision sometimes comes down to a client having access to key people that are able to make the project work.

Participant SSI-01-11 mentioned most challenges surrounding clients comes down to communication with clients, and that their business uses weekly updates to the clients to keep them informed and invested. The participant state that there are two reasons for these weekly updates, based on experience, they found that from a management point, taking on many projects result in only attending to the projects with higher level of priority. Projects that are smaller or in a dormant stage do not always get the attention they deserve and often this is when clients start asking questions. Participant SSI-01-11 mentioned clients add to the stress of running a company by questioning the project progress. This is what makes the client updates important as they can pre-empt the client questioning problems as well as update the client on the status of the project. Participant SSI-01-11 said that this method has worked very well to satisfy the clients and has prevented stress within the business. Additionally, participant SSI-01-11 said that as a manager to have a day a week

where they have a very good overview of progress of each project, with these insights they are able to action certain activities to accomplish the project. Importantly both the manager and the client then are involved in the plans of action resulting in complete transparency at the end of the day. Transparency in a project is very important. Participant SSI-01-11 stated that these weekly updates are not the only communication with the clients, they are over and beyond any other communication such as meetings, calls and so forth. This has become standard practice and the clients have learnt to expect these updates and if they do not receive them they start questioning. Participant SSI-03-14 and participant SSI-01-11 agreed that communication with the client at least on a weekly basis to give an overview progress report of the project is very important. Additionally, participant SSI-03-14 mentioned that this is important for when complications do arise the business can always refer back to these weekly updates.

4.3.3.7 Challenges within project management

When talking about project management issues, participant SSI-03-14 mentioned that management is a very iterative process and is always being fine-tuned. Participant SSI-01-11 felt that specifically within a product design consultancy, there is a certain process approach on a micro level that is applied to the specifics of a certain project but on a macro level all projects are treated the same. Projects all follow a process that have a start and end point even though the start and endpoints are different in the projects. Participant SSI-01-11 explained that it can be either only doing research for a product to just conceptual work or even just setting up manufacturing of an existing concept. They continue to state that the phases vary in each project, but the more important thing is that they each have a growth where they;

"Move from a position of less define to a position of more define" (Participant SSI-01-11)

Participant SSI-01-11 illustrated that within the differences of approaches on a micro versus a macro is where in a business is fined tuned and adjusted. These adjustments are important because it is about maximising the efficiency in resources, time and the budget use. Participant SSI-01-11 explained that a macro level approach should be the same for all the different types of projects. The challenge comes in when the approach is what needs to allow for the different variances in projects. Participant SSI-01-11 said that in product design management; an overview has to be the exact same for every project but needs flexibility within the lower levels. Not being flexible in the lower levels limits the outcome of the project stunting innovation. It also causes conflict between the business and the design side. The business is dictating that things have to be consistent where things need to fall into place so that there is predictability. But down on a micro level, within the design side, the project needs to be open ended where there is freedom that allows the design to develop organically through the process. The challenge is the marriage of these two where the predictability needed for the business is against the organic nature of the design process. Participant SSI-01-11 mentioned that their business has not got this marriage just right yet, this is because it is always a work in

progress and having experience helps. For an example, within the micro level an experienced manager will be able to predict a projects projection and will be able to plan accordingly.

"If you stand back your approach has to be the same but that approach when you go into the details needs to allow for more wide variety of directions, approaches, clients or types of projects" (Participant SSI-01-11).

Participant SSI-03-14 also mentioned that there are a few key role players within the business and these role players obviously have different rolls to perform in the project. The biggest challenge is to make sure that everyone knows that they are on the same team and there is no department vs department scenario. Participant SSI-01-11 said something similar but more along the lines of managing multiple team members on a single project is often challenging and a new aspect to their business. The participant commented that there are often challenges when there are multiple people working on a large project and especially how to effectively get two or more people to work on a project efficiently.

When asked about design process management, participant SSI-01-11 responded by saying that it is less part of management but more part of the resources responsibility. The resource (designer) manages the processes, however, management must apply the overall schedule of the project to ensure things run in a certain timeline and to the budget. The actual design process is expected to be managed by the designer. Participant SSI-01-11 illustrated the reason for this is firstly; it takes off a load from management and secondly; it gives ownership to the designer where the theory of this is to allow for more freedom in the process to explore and innovate. If the design process is dictated by management, participant SSI-01-11 thought that the business will benefit from the predictability, however, the participant suggested that the designers would feel to constricted and could limit the organic nature of product development. Interestingly participant SSI-01-11 said that if this had to be done it would;

"benefit the company but would defeat the objective of what you as a design company is trying to do" (Participant SSI-01-11).

Regarding the issue known as designing in isolation, this is where designers do not have a global stance of want they working on and getting too involved in the details, participant SSI-01-11 explained that the designer needs perspective on the project and having outside stimulus to get the answers is very important where a designer should not be just sit at their desk and come up with the solutions. It is important for management to pick up on this and evaluate that the direction the designer is going to correct direction for the project. Participant SSI-01-11 illustrated that this comes down to the experience again of both the manager as well as the designer. Participant SSI-01-11 suggested the use of frequent designer reviews would help address this issue. Design reviews, as mentioned above within human resource challenges, and the increments that occur depend on the experience on the designer, the more experienced the designer the less often they occur which means less time wasted. The less experienced the designer the more often the

need for design reviews because without the experiences it is harder for the designer to know if what they are doing is not going to work for the project. Participant SSI-01-11 explained that they try to make these design reviews a less formal event in order to make it less of a time commitment compared to a formal approach as well as making it an easier to do more regularly. If this was formalised it would happen less often due to the fact that people do not like the idea of time wasting at meetings. These design reviews often are one on one and do not involve the whole team because as the participant has found that if it had to be brainstorm session it would take away time from other designer's project which can be an issue. Participant SSI-01-11 also brought up another interesting point that the more team members involved in these design reviews the longer process becomes. These are often then referred to as brainstorm sessions, and even though the participant SSI-01-11 felt that they take up too much time they offer valuable input to projects. This is because each designer can be given a chance to present their issues and can receive more valuable feedback from the team. From a management point of view these brainstorming session can be time consuming, however the possible results may be very beneficial long run it would be time saving.

Participant SSI-03-14 explained that another challenge with design project management is containing project scope specifically when dealing with product development. Especially when there is new design project where designers want to produce new and exciting stuff, but the client has their own expectations and has specified a certain budget to meet the brief. This relates back to project scope and making sure the project scope is kept in mind. Management, according to participant SSI-02-08, becomes a scaling approach where one needs to identify the requirements and available resources in order to get a project done within the project scope. Similarly, participant SSI-02-08 explained that it is important to stay within the parameters of the project that has been laid out in order to make a profit. Participant SSI-03-14 stated that a client has an expectation of what they are getting, and they are willing to pay for that, it becomes a problem when a designer spends more time on a project that is not meeting the project scope. However, sometimes a judgement is made where this extra time or cost which is spent on something innovative and has more market potential benefitting the client. This is where participant SSI-03-14 commented that their business often absorbs these costs. But at the same time participant SSI-03-14 mentioned that it is very important to let the client know the extra value in the service that they are receiving. Participant SSI-03-14 mentioned that the project scope is also important when it comes down to the client not having a defined brief where they are not very specific in the requirements. Participant SSI-03-14 said that it is important to define what the actual problem is that needs to be resolved. Defining the actual problem becomes important as often this exploration into what the problem is to define the project scope and create a specific brief filled with requirements suited to address that problem.

Participant SSI-03-14 mentioned that during this 'defining' the company is responsible for managing the expectations of a client and the outcomes that they can expect. This can be explained as; a design company need to create a brief in order to address the real problem as well as outline the outcomes of the project.

Participant SSI-03-14 said that this process is then broken down into phases where each phase is quoted for and at the end of each phase there is a result that is given to the client. Participant SSI-02-08 also states that realising a projects scope from the beginning is important when putting a viable plan together from concept to production. Participant SSI-02-08 advised that when dealing with a project that is completely new to the business, whatever time that would normally be allocated to the project must be doubled because of it being a new area of design where there is limited experience. This can also be broken down into whether it's a new material or process that has never been used. Participant SSI-02-08 explained that this is due to the plan being simple and straightforward in the beginning however there are a multitude of unknowns to the project which have an influence on the budget and timeline therefore putting in a buffer compensates for this.

"Managing Murphy" (Participant SSI-03-14)

Participant SSI-03-14 also talked about complications with a project and how they are handled, because there is bound for something to go wrong in the project, is just the nature of the design industry. The participant explained that it is how these complications are addressed and resolved that is key. Participant SSI-03-14 said the most challenging aspect of this is addressing these complications and how to resolve without damaging the timeline or budget whilst still keeping the client happy. Participant SSI-02-08 adds the importance of considering suppliers in early stages of the project in order to have a more considered concept from the start. Managing the *"domino effect of suppliers"* (Participant SSI-02-08) and the influence on lead times is often challenging. When managing a project that utilises multiple suppliers it is important to grasp the effect of each supplier on the next and the possible lead time implications they have if something goes wrong. It is suggested that this can be managed better by using a single supplier to produce the work instead of multiple ensuring that there's no reliance on the work.

4.3.4 Suggested and existing ways to address challenges within product design businesses

4.3.4.1 Project planning programs

All three participants agreed that a form of project planning was absolutely necessary in running a product design business. Participant SSI-01-11 mentioned from a management side, keeping track of multiple projects and their progress is very important and a project planner is used in most cases. These tools can be used to track individual hours as well as tracking the phases of project, ensuring the phases within projects are running on time. Participant SSI-02-08 agreed and mentioned that project forecasting tools are vital in running projects in order to meet those tasks within the allocated time. This allows for management of a multitude of projects where knowing the status of each project as well as completion of certain phases in project that needs to be addressed. Participant SSI-01-11 interestingly also mentions that these break down into phases or timelines can be shared with clients in order for them to see the overall forecast of the project even though timelines change due to the organic process of product development. Noting the organic nature of timelines that are not fixed but form a guideline is very important to understand. Importantly, participant

SSI-01-11 mentioned that these timelines are determined by the budget available from the client and not necessarily the time that the designer needs. Interestingly, participant SSI-01-11 commented that a junior design may have been given 10 hours to complete a task, whereas they might actually need 12 or 13 hours which has to be absorbed either by the designer in overtime or by the company, as this extra time cost cannot be expected to be paid by the client. The participant said that this can be prevented by using the daily design reviews in order to keep the designer on track and to make sure no additional time is lost. Participant SSI-02-08 commented that most business use Gantt charts but it is not strictly limited to digital tools, where own systems can be put in place such as notes, diaries etc. Participant SSI-01-11 mentioned that they use a Gantt chart program and has been invaluable, mentioning it being the biggest tool that their business has used on a management level. Participant SSI-03-14 said their company also made use of Gantt charts to track progress of projects. On top of this participant SSI-03-14 commented that they use financial reports that are semi-automated, in order to effectively management the projects and give feedback to clients.

4.3.4.2 Programs used to streamline business workflow

On top of using project planning programs, participant SSI-02-08 suggested tools or systems need to be put in place that streamline the businesses workflow for smaller businesses. The participant mentions that managing accounts through book keeping programs was very helpful for them. Programs such as; Zero, Sage or Fresh books. This allows for ease in management of cash flow, overheads, invoices and expenses. By streamlining the businesses cash flow process through the use of programs make life easier and will minimise time spent on financial management thus allowing for more productive time utilised on designing and product development from which the business makes money. Participant SSI-02-08 illustrated that a business should not be spending unnecessary time on trying to figure out the vast complexities of financial management but rather stream line it by using programs that do it for you.

4.3.4.3 Resource workflow optimisation

Participant SSI-01-11 commented on challenges within optimising workflow for designers, such as having set templates or filing systems in place to make it easier and more time efficient. The participant felt that there can be big improvements within these aspects of the designer workflow. Providing the correct tools for design and the cost implications for those tools. Participant SSI-01-11 commented on if tools or systems could be developed and put in place in order to make work more efficient specifically from resources.

4.3.4.4 Daily meetings

Participant SSI-03-14 mentioned that they have 15-20-minute staff meetings every morning and involves every single person in the business, where various projects are run through and progress and any complications are discussed. The participant said that this puts everyone within the business on the same page and able to create a priority list for projects.

4.3.4.5 Project scope and answering the project brief

Participant SSI-01-11 also stated that if a tool or system could be developed and used to gauge whether the brief was met. Participant SSI-01-11 felt that there could be a better way to finding out if a brief was being answered as well as where project scope creep can be identified earlier in a project. Participant SSI-01-11 commented that time wastage on a project is due to doing work that might have not being part of the original brief. This is because there are often a lot of grey areas when designing, so knowing whether the design is answering the brief or when a project has grown beyond the requirements of the brief is important.

4.3.4.6 Design unknowns

Participant SSI-01-11 illustrated that when designing you are often designing for an unknown and the brief cannot always encompass everything, causing designers to carry out work on the project that was not necessarily part of the original brief. Participant SSI-01-11 wondered if there could be a way in understanding when this phenomenon happens because those are the times when projects go under review and the client needs to be brought in and made aware of what is going on, most often requiring more time and often a re-costing on the project. This can be classified as project scope creep which participant SSI-01-11 believed is a big challenge. Trying to prevent scope creep is important in order not to surprise clients regarding possible changes and re-costing as well as from a business standpoint will mean you cannot continue to work on the project. Participant SSI-01-11 believed that defining the scope in the beginning is incredibly important.

"What are you designing for, what are you not designing for" (Participant SSI-01-11).

4.3.4.7 Comparison between project progress and the brief

Participant SSI-01-11 said that they would like a means to box requirements very specifically where comparing the projects progress against the brief which can be used to see if the project is on track, preventing project scope creep. Participant SSI-01-11 this can partly be resolved by having more time allocated for the conceptual phase, where more thorough research and concepts are produced.

4.3.4.8 Priority systems

Participant SSI-03-14 said that because jobs do not necessarily start and end in one go their business uses a priority system to analyse which projects to focus on. Through the use of mathematical tools to analyse each project phase the specific projects are then important phases are given priority.

4.3.4.9 Design industry networking

Participant SSI-02-08 mentioned the importance of networking, such as utilising existing platforms that are available within the industry. The participant mentions two Facebook groups which designers in Cape Town utilise as a community-based forum where advice, suppliers' contacts and material expertise can be shared. Participant SSI-02-08 said that some of their best suppliers were found on these types of forums. These were the exact forums that the survey used to collect data from Cape Town based design companies.

4.3.5 Semi-structured interview outcomes

4.3.5.1 Main challenges within product design businesses

- Using design reviews/junctions
- Managing Project Scope
- Resource/designer inefficiency
- Comparing project progress against the brief
- Managing clients
- Managing Suppliers
- Managing design unknowns
- Project Management

4.3.5.2 Ways to address challenges within product design businesses

- Using existing programs and tools to streamline the business work flow
- Using project planning programs
- Using project priority systems
- Using financial forecasting tools
- Networking with the industry

4.4 Design workshop

4.4.1 Overview

The following findings investigated in the design workshop were used in response to both the research sub-question: 1.4.b.2) what the challenges are facing product design SMEs operating within the Western Cape South Africa and 1.4.b.3) what do product design companies perceive as the support criteria required to facilitate sustainable growth within the sector. Specifically, the design workshop was used to both 'co-define' main challenges that product design businesses face within the City of Cape Town as well as 'ideate' possible solution parameters to address these challenges. Challenges that surfaced within the semi-structured interviews were discussed and broken down into detailed specifics. The design workshop was used to list these challenges in a sense of hierarchy and due to time constraints on the workshop illustrated the top three key challenges that product design business face. These challenges were, in order; managing clients, managing project scope and finally managing design unknowns. These top three key challenges were then addressed, and possible solution parameters were ideated. The solutions parameters can be seen as a possible prototype the product design SMEs can implement in order to test these findings and in doing so provided support to Cape Town based design SMEs.

4.4.2 Design workshop analysis

Semi-structured interviews outcomes formed the basis for the design workshop activities (found in semi-structure interview outcomes). These key themes with the challenges, existing tools and systems were also

used as key themes for data analysis. The design workshop audio was digitally recorded, as well as photographically captured.

The design workshop was broken down into the following activities:

- Co-defining key challenges within product design businesses
- Co-defining existing key tools or systems used within product design businesses
- Defining the key challenges hierarchy
- Ideating fundamental solution parameters

Participants were provided with specific coloured pens, post-its and note pads which made coding as well as transcribing each participant's responses easier. This also allowed for easy analysis and cross reference from the audio, photographic as well as tangible written responses on the post-its. The design workshop was transcribed by listening to the audio recording and typing out participants responses. Because the design workshop had broken the main themes down into activities and subdivided each activity into discussion points. Locating and transcribing each discussion point was relatively easy. In addition to transcribing the audio recording reference and cross checking occurred by referring to the post-its and notes found within the workshop material such as post-it notes and so forth. After transacting all the data from both audio, and the workshop material it was re-read a few times to understand and familiarise with the data as per Braun and Clarke 6 step method to TA. All participants were coded into their unique codes for ethical considerations. Each discussion point explored both the co-defining challenges as well as co-defining tools and systems became a theme within the thematic analysis process as it was a continuation with relevant themes found within the semi-structured interviews. Each participant's responses transcribed from audio recordings or from discussion post-it's were given a specific text colour where writing up the design workshop findings started. This was used to group similar emerging discussion points within the data and allow for a better flow of reading. This also made it easier to search and review themes as per the Braun and Clarke 6 step method. Workshop material used for ideating possible solution parameters were converted to digital representations allowing easy of cross referencing when writing up the findings. Finally, the data was written up within the various emerging themes and a final review was used to finalise the findings chapter.

4.4.3 Co-defined challenges within product design businesses

Figure 19: Product design SME challenges design workshop material, Produced by Author, 2018

4.4.3.1 Resource/designer inefficiency

Participant DW-01-11 felt that skill level regarding resources/designers has a direct link to the resources inefficiency. DW-03-05 added to this talking point by mentioning the lack of historical internships within the design industry and that are bigger design internship available overseas (Europe) in comparison to that offered in South Africa. Both participant DW-01-11 and DW-03-05 commented on the lack of these internships available to students while studying offering real working world experience within the industry. Participants DW-03-05 and DW-01-11 summarised that the skill sets that students enter the industry is insufficient and that there is a large gap between finishing at tertiary and entering the industry. Participant DW-02-14 agreed and commented that most design companies must train designers from scratch when they enter the industry. Participant DW-03-05 suggested that students should rather go work within the design industry for 2 years before studying the necessary courses in order to get that required experience expected from design business.

Participant DW-02-14 suggested also the alignment of motivation, where the participant explains an aspect of designer inefficiency is linked to the motivation a designer shares towards a project and if the resources

are motivated by the project they become inefficient and the project will drag out. The Participant concluded this point by stating that both the business interests and the resources motivations should be aligned to prevent resource inefficiency. It is important that the resource is able to see the bigger picture and what is good for the business. Adding to this participant DW-01-11 stated that it is a bit of a selfish point of view from a designer because they should see it as an opportunity for experience. Participant DW-03-05 commented that there is almost too much attention given to younger designers within Cape Town, where they mention there should be more focus on designers who have vast more experience in the industry.

Participant DW-01-11 touched on another interesting aspect that often influences resource efficiency which is the clarity of the brief. Participant DW-01-11 mentioned that making sure that the brief is clear to the resource is very important and suggests that people interpret briefs differently and the challenge is how to communicate the brief to different resources so that each of the resources are fully able to understand the requirements. Partly agreeing, participant DW-02-14, suggested that something that is more relevant than the previous point is resources is not knowing the software well enough. Participant DW-02-14 suggested that pride can be an influence in this point where resources will not ask for help if they are struggling with something within the software, which they try to figure out themselves and end up wasting time and becoming inefficient. Participant DW-01-11 also commented on another aspect that aligns with the previous point which is to effectively research, where the ability to research certain materials, process or contacts to talk to is crucial within the design industry directly is linked to wastage of time within a project. Participant DW-03-05 concluded by mentioning the lack of mentorships and as a designer when coming out of studies they would have liked to have had that opportunity.

4.4.3.2 Using design reviews/junctions

Participant DW-02-14 mentioned that their business struggles with 'hallway reviews' which are between doors which becomes to informal. The Participant mentioned that this makes for very informal discussions and difficult to keep track of what was decided. The Participant continued and stated that to do a thorough design review on a complex project is very difficult. This is because it is very challenging for management, who is not as involved as the resource, to understand every decision and within a structured manner find problems. Participant DW-01-11 agreed with this statement and adds that to truly understand the design and every decision that was made is difficult and because of this, things can be missed, such as fits, tolerances and so forth. Participant DW-02-14 said that to actually get through these complex projects and to understand every aspect takes too long and there is simply not time for this. This phenomenon can be summarised as not understanding the full picture of what is being reviewed due to the projects complexity and the time that would be needed to do so is not available. Participant DW-02-14 mentioned that this is also linked to the briefing stage of a project.

Participant DW-02-14 mentioned that there are a certain amount of trust issues in less experienced designers where participant DW-01-11 agreed and comments that as management you have to rely on the resources to do the work correctly and less experienced designers do not often get this right, therefore the work they provide is not necessarily trusted and needs to be reviewed more thoroughly. Participant DW-01-11 referred back to what participant DW-02-14 said about the 'hallway reviews' and the formality of keeping track of the decisions made on a project. Both participant DW-01-11 and DW-02-14 stated that keeping track of the decisions and the responsibility of it is very important. Participant DW-02-14 stated that there should be some form of checklist that should be used when conducting design reviews where for each project it may vary but will allow for a more structured formalise tracking of decision making. Participant DW-01-11 commented that is crucial that decisions and the responsibilities are formalised within these design reviews.

4.4.3.3 Managing project scope

Participant DW-01-11 mentioned that this is their business biggest gripe due to it being such a grey area and because it is such a grey area the biggest challenge is to define; how do you define the project scope? Within a project initially it is easy as you are able to quote on the specified requirements but as you start to design those requirements become a little grey around the borders. Participant DW-01-11 asked; when does a manager say what is part of development and what is venturing into something unknown and completely new work. Participant DW-01-11 mentioned that as a part of design consultant-based business they take on challenges of development of something that has not been done before and inevitably there are things within the scope that are unknowns. Participant DW-01-11 commented that so many times it ends up being detrimental to the business when the project strays further away from what was originally asked for. Participant DW-01-11 stated that how you define project scope is one of the biggest challenges for their business. Also, in a way that the client can understand when a business has to ask for more money due to the project growing. Participant DW-02-14 commented that their biggest issue with project scope is managing the client and their expectations, making it clear right in the beginning. Participant DW-02-14 commented that this is difficult to do in product development as one cannot know exactly what is going to be done 100 percent.

Participant DW-02-14 continued to say that most clients approach product development businesses with a 'feature' based idea for a product where the feature does a certain task, but the Participant mentioned that this is not necessarily the actual problem. It comes down to understanding what the client wants to achieve and breaking it up into manageable pieces. Participant DW-01-11 agreed and commented that clients often have the solution in mind and not the actual problem. Participant DW-03-05 added to this point by mentioning that then it is about convincing them of the new solution that might not necessarily be similar to what the client proposed in the beginning of the project. Participant DW-02-14 agreed firmly with this point and said that it becomes a challenge to convince the client that the new possible solution will be better for the project at the end of the day. Participant DW-01-11 stated that often the client just expects you to

implement new and better solutions, however, this was not costed at the beginning of the project and then this becomes an issue. Both participants DW-01-11 and DW-02-14 linked it to the other key challenge which is managing clients.

4.4.3.4 Comparing project progress against the brief

Participant DW-01-11 felt that design reviews come in come in to play when tracking the progress of the project against the brief. Participant DW-02-14 commented that if the project scope is not understood or if the resource is inefficient it has an effect on the progress of the project. Participant DW-02-14 mentioned that comparing project progress to the brief is a challenge within itself, where managing the scope or resource efficiency are factors of this problem. Both participant DW-01-11 and DW-02-14 agreed that it is a specific challenge and the problem is that you can only compare the two when you actually done and the possibility of all the work being done might not pay off and has to be redone or the approach changed.

4.4.3.5 Managing clients

Participant DW-02-14 referred to communication being the biggest challenge when managing clients. The challenge being that often clients do not respond to emails or progress updates and then only when the client decides to be involved they start to question the work even though these updates were illustrated to them. This links back to whether clients are being involved enough within a project as discussed in the semi-structured interviews. Participant DW-02-14 added that each client has their own way of communicating which is often challenging. Participant DW-01-11 mentioned that some clients want to be more involved than other clients and this has a direct effect on the way or manner that communication happens with the client. Participant DW-01-11 agreed and states that at the end of the day communication is the crux of managing clients.

Participant DW-02-14 also touches on the level of involvement of the client being an issue, not only in regard to communication but with getting the client to let go of their preconceived ideas of what the project is and getting them to let go for the greater good of the product. Participant DW-01-11 agreed strongly with this point and mentions it is often a challenge to convince clients to let go of certain expectation or emotional connection that they had for the product for the greater good of the project. Participant DW-02-14 said that often clients have emotional connections to a very ‘feature’ based aspect of the project that might not necessarily be the best possible solution to the actual problem at hand.

Participant DW-02-14 touched on another important aspect in managing clients which is getting the client to pay on time. Participant DW-02-14 explained this further by mentioning that clients are incrementally invoiced for phases within a project based on progress, linking to progress versus the brief, where the business relies on that payment and has projected it into their financial forecasting. When a client does not pay it puts the business under serious strain regarding cash flow, interestingly participant DW-01-11 mentioned that clients often state that they will get the business the money but expect you to carry on with

the next phase of the project. Participant DW-01-11 commented that payments structures with clients is very challenging to manage.

Participant DW-03-05 illustrated another aspect is convincing clients of the value of the work that is being handed over can at times be difficult. This can link back to clients not understanding the true value of what design is and what design offers. Participant DW-01-11 agreed and illustrated an example where if you show a client a particular drawing, which may have taken 100 hours, but all the client sees is a drawing and often questions if it works due to them not understanding. Participant DW-01-11 commented that convincing the client and illustrating the value of the work is crucial. Participant DW-02-14 mentioned an important insight, which is the value of the design does not always come down to the time spent on the design but the thinking behind the design. Participant DW-02-14 gave an example of this where if five hours is spent on a design, and only five hours, but it is worth R3 million in revenue over the next year if done the way in which the design company has proposed and that this is a good example of what the true value of design is. Participant DW-02-14 mentioned that it becomes challenging when the client questions that now the five hours costs so much more but fail to understand the reason as to why. Participant DW-01-11 adds by mentioning that it's not just five hours of work because it's the business history and experience within the field that has come into those five hours.

4.4.3.6 Managing Suppliers

Participant DW-02-14 commented that managing suppliers should be a full-time job and someone should be employed to do this. Participant DW-01-11 agreed and questioned if it was only specific to Cape Town. Participant DW-01-11 mentioned that the priority of design business work with some suppliers is irrelevant to these suppliers because of the low volume developmental based work that design business requires. Participant DW-01-11 commented that it comes down to the supplier saying; where is the volume? Participant DW-01-11 and DW-02-14 both commented on the willingness of suppliers to go through the development of a project and generally 'these one off here and there' can lead to higher volumes into production. Participant DW-01-11 mentioned that this comes down to the relationship with the supplier, participant DW-03-05 interestingly commented about the supplier and from their point of view, so many companies go to them with products promising high volume production but the project falls through, participant DW-03-05 mentioned that these suppliers must hear this a lot and therefore might be the reason they are hesitant to take development type jobs. Participant DW-01-11 agreed with participant DW-03-05 but again refers to building a good relationship with these suppliers and eventually you will get suppliers that are willing to do the work. Participant DW-02-14 also touched on the lead times that these suppliers give for development based projects and this is always a struggle as the design businesses often need to push suppliers to get work out quicker but from a suppliers perspective it may be new work that they are not necessarily comfortable with yet and therefore leave more time to get the job completed factoring in compactions very much like a product design business needs to.

Participant DW-01-11 mentioned their business had considered putting in penalties with suppliers. Participant DW-02-14 commented on this point, saying that you would need volume in order to put penalties in place with suppliers as well as you are also managing these suppliers negatively which is not the best way to go about it in their experience. Participant DW-01-11 commented that with managing suppliers, in most cases suppliers work in different ways which can be a challenge to understand as well as time consuming to make sure for example a set of drawings are laid out specifically for the supplier. Participant DW-01-11 mentioned that optimising this could be beneficial to the business so that time is not wasted. Participant DW-01-11 stated that there needs to be an understanding from the business as to what works for each of these suppliers and provide that from the start to optimise time. Participant DW-02-14 agreed with participant DW-01-11 and added that it is also a challenge getting the businesses resources to adhere to it.

Participant DW-01-11 commented about another aspect of managing clients which is the lack of knowledge from the suppliers. This links back to the semi-structured interviews where participant SSI-02-08 stated that staff at these suppliers are often not enthusiastic about their work and have fallen into these jobs leading them to be very unhelpful. Participant DW-01-11 mentioned that, yes, the lack of knowledge is an issue but another aspect to it is the willingness to share this information

4.4.3.7 Managing design unknowns

Participants often referred to the unpredictability and 'unknown' elements in a design process. In any product design process 'unknows' may refer to areas of the project where there are unforeseeable occurrences. For example it could be that a manufacture takes on a project but later finds that they are unable to produce what is exactly needed, or a certain material that was used has run out in South Africa causing delays in the project time line and even as simple as an sick employee unable to finish a task.

Participant DW-01-11 stated that managing the design unknowns is directly linked to project scope. Participant DW-01-11 also mentioned it is linked to the resources experience and whether the resource is able to flag these unknowns when they arise. Participant DW-02-14 mentioned that the bigger challenge to managing design unknowns is getting them to surface early on with in a project. Participant DW-02-14 and DW-03-05 said that this is good if it happens early because as a designer this is what you want when developing ideas and solutions. Participant DW-02-14 commented that if they arise earlier management can deal with them and still leave enough time to address them, streamlining the process. Participant DW-03-05 and DW-01-11 added to this by commenting that maybe it is necessary in these early stages when these new solutions are proposed to question them and unpick the possibilities very finely. Participant DW-03-05 commented that explicit detailing of these solutions would help in realising the possible issues with the solution. Participant DW-02-14 mentioned that sometimes these details cannot be seen and then it becomes

a case of 'managing murphy' and how can this be done. Participant DW-01-11 commented a possible solution is having checklists and thoroughness in place to prevent these design unknowns emerging.

4.4.3.8 Project Management

All participants stated that all the above challenges were a form of issues found within project management and concluded that this should be the umbrella challenge for project scope, managing clients or suppliers, design unknowns, managing resources, project progress and meeting the brief. Participant DW-02-14 stated that project management is three things: scope, budget and time. Participant DW-01-11 stated that not having the correct tools nor the skill to use the tools to manage can cause issues. Participant DW-02-14 also mentioned access to information regarding the progress and budget, and that sometimes it is difficult to know what was spent on a project both in time and money.

4.4.3.9 Effective product testing

Participant DW-03-05 mentioned that there is often not enough time allocated to proper product testing. Participant DW-03-05 stated that this is often caused by deadlines which effects the thoroughness at which product prototypes are tested. Participant DW-03-05 mentioned that in their experience testing is not seen as actual work, which is an issue. Participant DW-03-05 commented that testing is vital for the success of a product because at the end of the day the end user needs to have some input to the product to make sure that it is fulfilling the need. Participant DW-01-11 stated that sometimes it is just not part of the process and is never costed as a phase, and in most cases should be.

4.4.4 Co-defined existing tools or systems used within product design businesses

Figure 20: Product design SME existing tools & systems design workshop material, Produced by Author, 2018

4.4.4.1 Using project planning programs

All the participants agreed that project planning tools are very necessary but more specifically participant DW-02-14 mentioned that understanding the sequence of which things need to happen within a project is more important and participant DW-01-11 stated that these tools will not necessarily inform you. Participant DW-02-14 mentioned that these tools are powerful and good for planning, however, it comes down to the tool is only good as the user. Participant DW-01-11 continued to mention that these types of programs are good for oversight where access to information is easy, but stats that project planning in itself is the more important aspect from a management perspective. Participant DW-02-14 agreed with this and mentions that the tool just makes it visual. Participant DW-03-05 interesting enough related this to having good enough briefs from the start. Participant DW-02-14 agreed with this as they mention that work break down structure comes down to the brief.

4.4.4.2 Using existing programs and tools to streamline the business work flow

Participant DW-01-11 mentions that this is valid but only up to a point, where they mention that at the end of the day people or resources that are good in those areas will be needed. However participant DW-01-11 did state that for small businesses these programs are very necessary and do make running the business easier. Participant DW-01-11 continued to say that again it comes down to the user at the end of the day similarly to participant DW-02-14 who said the same thing about project planning programs. Participant DW-02-14 stated, although, these types of tools are not particular to specifically a design business but most business. Participant DW-01-11 agreed and mentioned that businesses are definitely going to be using these types of tools and commented that they are unaware of any business that does not use these types of tools. Participant DW-03-05 also commented that these types of tools cannot force a person to do the work and at the end of the day there is still a human element to it that has to perform the work. Participant DW-03-05 stated that there will always be this human element.

4.4.4.3 Using project priority systems

Participant DW-01-11 illustrated that if the projects are planned correctly or perfectly the project planning programs should be able to show you which projects have more priority. Participant DW-01-11 did, however, think that a project can never be planned correctly and perfectly in relation to design. Participant DW-02-14 mentioned that it also comes down to what each individual business thinks is a priority, where it can be either ‘first-in, first-out’, ‘biggest benefit for your business’ or ‘most realistic project that is going to be successful for the client’. Participant DW-02-14 stated that the business needs to identify its own priority mechanism and then based off that work out a priority system. Participant DW-01-11 mentioned that they do not think that a mechanism like this even exists and theoretically should it be necessary to prioritize projects because if the projects are run correctly there should not a need to put priority systems in place. Participant DW-01-11 commented that it is asking for a solution to a problem that needs to be fixed which proper project is planning. Participant DW-01-11 said that this problem should be addressed and not putting something in

place to solve that problem such as project priority. Participant DW-01-11, however, did say that this is unrealistic as this wouldn't exist unless in a perfect world.

4.4.4.4 Using financial forecasting tools

All participants agreed and said that this should be an absolute standard amongst all business especially a product design business.

4.4.4.5 Networking with the industry

Participant DW-01-11 mentioned that this is often a difficult aspect within the design industry and participant DW-02-14 agreed. Participant DW-02-14 mentioned that there is often a conflict of interest issue as well as if information is shared about a project whether it be about a material or a supplier it might infringe on non-disclosure agreements that might be in place with clients. Participant DW-01-11 continued to agree and mentioned the biggest issues would be firstly confidentiality and secondly business contacts belonging to other businesses. Participant DW-02-14 agreed to this and illustrated further that if contacts are shared it can possibly have an effect on the business relationship with a supplier which can be detrimental. This becomes major issue where if the business is reliant on that particular relationship. Participant DW-01-11 explained that it is for this reason that networking is so difficult, where they go on to mention that it is good for when you starting out and have not got a lot of contacts but when you have built relationships with contacts, which often takes years, you do not want to risk these relationships by introducing competition to them. Participant DW-02-14 suggested that networking within the industry should not be done with a business's competitors but rather with suppliers or potential clients. Participant DW-01-11 agreed and said it should be less about sharing knowledge but more about building a customer base. Participant DW-01-11 interestingly stated that this is a serious challenge, especially in Cape Town, because it is just so small. Participant DW-03-05 interestingly also comment on freelancers and how they can network very well, and this is because they are dependent on this system to get in work. Participant DW-03-05 stated that most companies are very secretive and do not give out information about contacts or suppliers.

4.4.5 Individual participant hierarchy of defined existing tools and systems

Table 7: Individual participant list of existing tools and systems in hierarchy, Produced by Author, 2018

Hierarchy of defined tools & systems	DW-01-11	DW-02-14	DW-03-05
1	Project planning programs	Project priority system	Programs & tools used to streamline business workflow
2	Project priority system	Programs & tools used to streamline business workflow	Project priority system
3	Programs & tools used to streamline business workflow	Financial forecasting tools	Financial forecasting tools
4	Financial forecasting tools	Project planning programs	Project planning programs
5	Networking	Networking	Networking

4.4.6 Individual participant hierarchy of defined key challenges

Table 8: Individual participant list of key defined challenges in hierarchy, Produced by Author, 2018

Hierarchy of defined challenges	DW-01-11	DW-02-14	DW-03-05
1	Project management	Managing clients	Project management
2	Managing clients	Managing project scope	Managing project scope
3	Managing design unknowns	Resource/designer inefficiency	Managing clients
4	Managing project scope	Managing design unknowns	Project progress versus brief
5	Resource/designer inefficiency	Design reviews/junctions	Product testing
6	Design reviews/junctions	Product testing	Design reviews/junctions
7	Project progress versus brief	Managing suppliers	Managing design unknowns
8	Managing suppliers	Project progress versus brief	Managing suppliers
9	Product testing	Project management	Resource/designer inefficiency

4.4.7 Collective group hierarchy of defined key challenges

Table 9: Group collective list of key defined challenges in hierarchy, Produced by Author, 2018

Hierarchy of defined challenges	Challenge
1	Managing clients
2	Managing project scope
3	Managing design unknowns

4.4.8 Solutions parameters needed to address the 3 main challenges

4.4.8.1 Managing clients

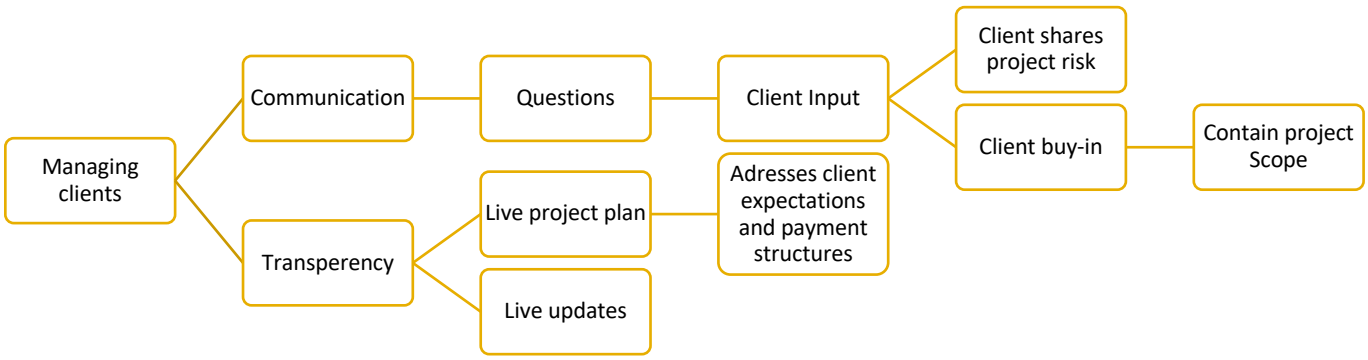


Figure 21: Solution parameters for managing clients, Produced by Author, 2018

Participant DW-02-14 stated that the most important thing when managing clients comes down to communication and how regularly this occurs. Participant DW-02-14 suggested the use of weekly updates and progress reports to the clients over mail, which both participant DW-02-14 and DW-01-11 do, where it is important that there is a regular occurrence and rhythm to it. Participant DW-02-14 felt that whether the client reads it or not it should be done. Participant DW-02-14 mentioned that when management does this they can gauge how involved the client is willing to be. Participant DW-01-11 and DW-02-14 both agreed that there should be good rhythm-based communication and should be driven by management within the business. Participant DW-01-11 suggested the use of live feedback with the client linking to complete transparency with the client. Participant DW-01-11 suggested allowing the client to have live feedback on the project timeline, budget even down to the CAD program and drawings. Which will allow the client to raise

questions which in turn creates more involvement within the project. Participant DW-02-14 commented that the weekly updates is a form of this live update where communication to the client with regards to the project progress, complications or so forth is illustrated to the client. Participant DW-01-11 and DW-02-14 importantly mentioned that this could be vital as the client could have input when presented with these updates or live feedbacks increasing their involvement in the project and shared risk. This interestingly enough could address the misunderstanding of design value by clients, where if a client is forced to be more involved and shares the risks they are able to understand the approach to matters by the design company. Participant DW-01-11 stated that alongside live updates there should be a live and shared project plan which links to the challenges with addressing payment structures. Participant DW-01-11 commented that in doing so the client is able to see the milestone which will illustrate to the client as to when they can expect an outcome of the milestone, as well as see when they need to make another payment.

All participants agree that effective and good communication is key in managing clients, interest inly participant DW-03-05 also mentioned the fact that it is not just about communicating something but making sure and knowing that the client understands in order to prevent miscommunication. Participant DW-03-05 mentioned that miscommunication can be a huge issue within this solution parameter due to the fact one can think that you are communicating but could be a complete miscommunication. Participant DW-01-11 agreed and mentioned that because all clients are different, management needs to know that whatever is being communicated is being understood by the client and how can one do this? Participant DW-03-05 suggested possibly using a set of questions that the client needs to respond to. Participant DW-01-11 continued to say that this could be used to in a sense to force the client to get involved within the project as well as sharing the risk with the client. Participant DW-02-14 agreed and commented that this is a good way to generate client buy-in, so that at the end of the project the client does not question the final outcome but understands the decision making that went into it. Participant DW-02-14 even mentions that if the outcome is not what the client wanted in the beginning of the project, it is what they want now due to their involvement and shared risk. This addresses the challenge of convincing the client of certain design decisions or new product directions that might have not been accepted if this solution parameter was not introduced. Participant DW-02-14 also commented that this could also contain the project scope. Enabling the management of the project scope and the client expectation of the scope easier. Participant DW-02-14 continued to say that when a new design direction is found that was not originally costed on, management can communicate it to the client and either requote the client or carry on. This can be a junction where either the client continues with new direction or the old direction, even though the design business suggests not to, which puts more risk onto the client at the end of the day and repeating the process of making them more invested. Participant DW-02-14 importantly states that when the new direction is chosen and is re-costed the project scope, design requirements and deliverables are all changed and there is new risk of design unknowns introduced and it is important to illustrate this to the client.

4.4.8.2 Managing Project Scope

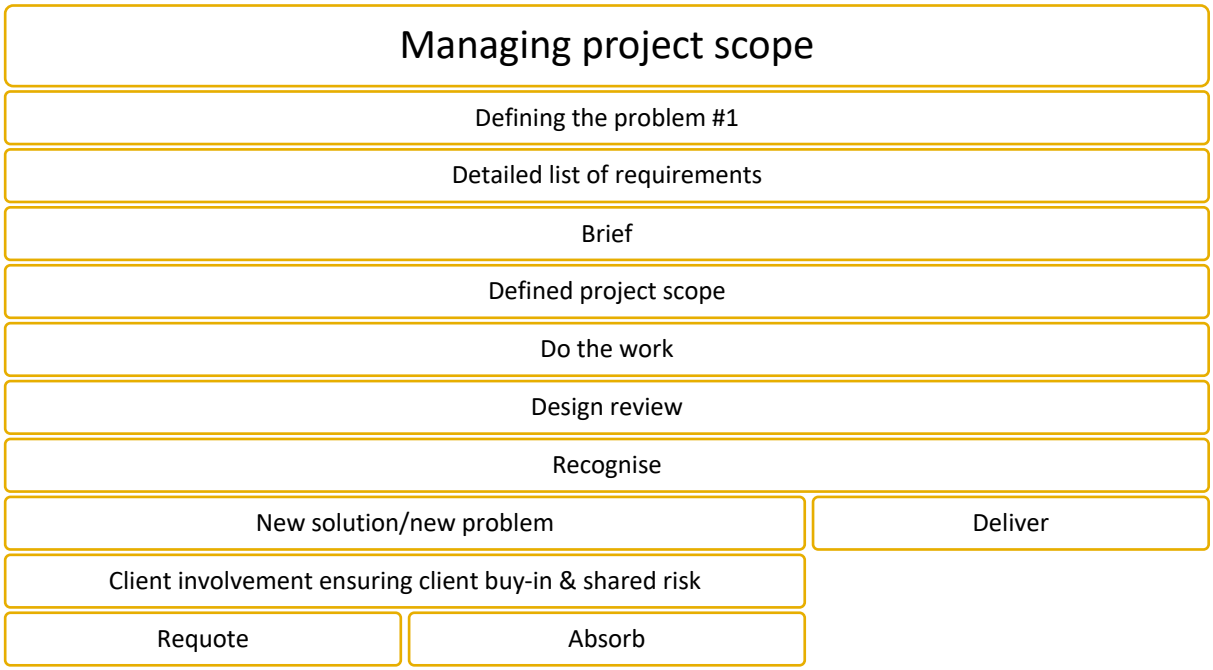


Figure 22: Solution parameters for managing project scope, Produced by Author, 2018

Participant DW-01-11 mentioned that the project scope has a direct link to a well-written brief, where there are a defined set of requirements. Participant DW-02-14 agreed and added that a real defined problem is very important when trying to prevent project scope creep. Participant DW-01-11 stated that defining the problem should be able to allow for detailing the set of requirements which should provide the scope. Participant DW-02-14 commented that after the process of defining the problem where the requirements are set, building the brief which provides the project scope the business will then need to do the work. Both participants DW-02-14 and DW-01-11 agreed that then in this process of doing working it may be that possible design unknowns arise. Participant DW-02-14 commented that after the work has been done and there is a new proposed solution it will need to be either re-quoted or absorbed which will be communicated to the client where client involvement will create shared risk as well as client buy-in. Participant DW-01-11 mentioned that in the case of absorbing it depends on the business and what is beneficial for the business, participant DW-01-11 explained that sometimes the new solution is easier or cheaper to accomplish. It is important to recognize when there is a shift in project scope and when to make that decision of either absorbing or re-costing.

Participant DW-02-14 mentioned that because you are creating client involvement within the new solution you effectively create shared risk and client buy-in which will be able to convince the client that the new solution will indeed be better. Participant DW-02-14 mentioned that if the first challenged mentioned above

is done correctly, communication, the more likely outcome then absorbing will be requoting. Participant DW-01-11 explained at the 'new solution' junction it may also create a new problem which will need to be addressed and the business cannot move forward until the new problem is addressed which becomes a design unknown. Participant DW-01-11 suggested that design reviews, whether it is a new solution or new problem, it is being able to recognise that it has happened. Participant DW-01-11 stated that if good design reviews are put in place these issues can be brought up earlier. Participant DW-01-11 commented that in this sense design reviews are necessary to recognise that the project scope has change and that there is a new solution or problem at hand. Participant DW-01-11 commented that how often are these design reviews needed as they do takes up a lot of time, however, participant DW-02-14 stated that they are very valuable. Participant DW-02-14 mentioned that when there is a new solution or problem it may lead to new design unknowns and links it to the third key challenge that is addressed.

4.4.8.3 Managing design unknowns

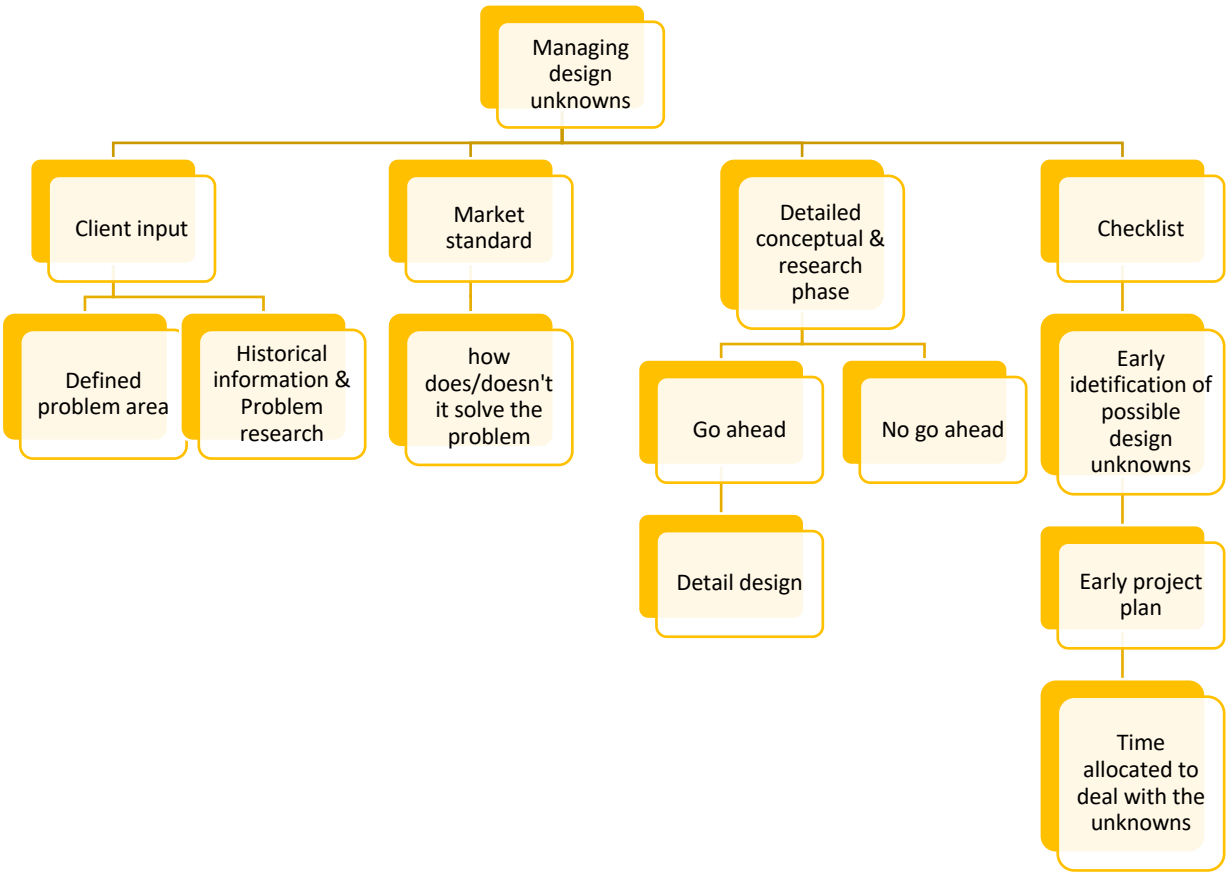


Figure 23: Solution parameters for managing design unknowns, Produced by Author, 2018

Participant DW-01-11 commented that the design unknowns should be addressed within the conceptual phase or development. Participant DW-01-11 mentioned that this is important as it will allow for these design

unknowns to surface early on in the project. Participant DW-01-11 stated that a detailed conceptual development should be able to uncover a lot of design unknowns at the start of the project, therefore enabling management to better plan for it in the detailed design phase. Participant DW-02-14 referred back to client input and what they are able to offer to the project. The Participant mentioned that doing thorough conceptual and research phase will lead to. Participant DW-01-11 mentioned that often it is the case where the excitement for the project overwhelms the oversight for the project, where it becomes an issue later on when certain design unknowns were not addressed and causes problems in the project. Participant DW-03-05 and DW-01-11 mentioned utilising a checklist system in order to slow this down and make sure that everything is considered before going ahead with the idea will surface design unknowns relating to the idea. Forcing the designer and management to have more in depth considerations of design direction possibly will pre-empted design unknowns. Participant DW-03-05 commented that by using the checklist you slow down the project direction in order for design unknowns to surface and be addressed allowing more time to be allocated to deal with these design unknowns. Participant DW-01-11 commented that the checklist can gauge whether the necessary research has been done, is all the information be explored in order to go into designing. Participant DW-02-14 agreed that if the problem is well defined it will provide a good enough checklist, which is dependent on the specifics of the project. Participant DW-02-14 also added that market standard should be considered to see what did or did not work in relation to solving the problem.

Participant DW-02-14 illustrated that if the checklist is done at the beginning identifying possible design unknowns or problems. This is then put into the early project plan which provides time to deal with these unknowns or figure out the possible solutions. Participant DW-01-11 mentioned that following the process mentioned above by participant DW-02-14 whereby a phased approach is applied to a project where only detailed research and conceptualising occurred where there is no commitment or costing of the whole project at the beginning. The Participant stated that by only doing this detailed research and conceptual phase at first and only costing only that it will be easier to define the project scope and brief and upon this either suggest to the client it isn't viable or quote for the next phase. Participant DW-02-14 mentioned something very important and that is as a business you do not want to say no to work because it is possible revenue for the business, however it is a design responsibility to be honest with the viability of a project and being able to tell a client that it might not work putting the discussion and risk onto them.

4.5 Limitations and reliability of findings

The reliability of the data collected was found to be adequate enough for the purpose of the study, although more participants could have been included within the online survey in order to form a stronger reliability of results. However the reliability and validity of data collected from both the semi-structured interviews and design workshop were good. This is due to the fact that all the participants involved, although only a few individuals, had a tertiary education and had several years' experience within the product design sector of

Western Cape. The findings collected from the online survey possibly had a bit of generalisability due to the limited amount of participants however both the semi-structured interviews and design workshop had limited amount. The data's generalisability, validity and reliability was good enough for the purpose of the study. However due to time constraints on the study, it is suggested for future research for more data to be collected from a larger array of participants within the Western Cape.

4.6 Conclusion

In conclusion, the above findings chapter found that Cape Town's product design SME enterprise demographic specialised in a multitude of design subfields - both developing and boosting innovation and technology. In response to research sub-question 1.2.4.1. How do product design SMEs impact the local economy within South Africa, the success of these businesses seems to be good as majority of business in the findings were found to be in operation for more than 10 years with a common annual turnover of R500 000 – R 5 million. These businesses were found to be mainly located within the city bowl and commonly employed 1 – 20 employees. The findings found, in response to research sub-question 1.2.4.2. What are the challenges facing product design SMEs operating within the Western Cape South Africa , that the product design SMEs found that challenges such as human resources, financial resources and project management to be major concerns in running a product design business. More specifically, the participants co-defined these challenges and found that management where managing clients, project scope and design unknowns to be the more important set of challenges needed to be addressed. Finally the findings also highlighted, in response to research sub-question 1.2.4.3. What do product design companies perceive as the support criteria required to facilitate sustainable growth within the sector, that firstly, the research found that in order to address challenges in managing client's participants suggested both good communication as well as transparency with clients. Secondly, the research revealed that to address challenges in project scope participants suggested utilising an approach which focused on in depth detailing of both the problem, project requirements and communication with the client. Lastly, the research indicated that in order to address challenges in managing design unknowns, the participants suggested utilising checklists to define and identify design unknowns early on in the project. In addition to this the research indicated that valuable client input to define problem areas as well as to provided prior knowledge of the project, market standard to explore existing solutions and finally utilising a detailed research and conceptual phase to test the viability of the project. The data also found that co-defined existing tools and systems currently used in the industry and these consisted of: project forecasting programs, tools to streamline business workflow, project priority systems, financial forecasting tools and effective networking within the design industry.

5. Discussion

5.1 Introduction

Product design SMEs can be seen as important contributor to South Africa's economic growth as well as a driving force for innovation and technology. However, as illustrated in secondary research and primary findings there are a multitude of challenges these businesses need to overcome. The study was able to provide a detailed enterprise demographic of the product design SME industry in order to empathize and understand the sector. It found that most of these SMEs with Cape Town were in operation for more than 10 years, employing on average 5 employees and most commonly earning between R500 000 per annum. The research also uncovered a number of emerging themes in relation to product design SME challenges and through co-defining these challenges with participants found that managing clients, project scope and design unknowns as the most important challenges. Ideation with participants in addressing these challenges formed possible solutions parameters such as good communication and transparency with clients, detailed definition and recognition process to manage project scope as well as systems for early identification of design unknowns within the creative process.

5.1 Cape Town product design SME enterprise demographic

The following points provide an overview and discussion into the various aspects that form Cape Town's product design SMEs enterprise demographic.

5.1.1 Product design SME specialisation

The research found that product design SMEs based in Cape Town specialise in a vast range of innovative fields. Interestingly this is due to the actual nature of product design as a process which can be applied almost into any field. Majority of SMEs within Cape Town specialise in design consultancy as well as furniture design but are not limited specifically to these fields. This illustrates how important product design SMEs are in building innovation and technology within a multitude of industries ultimately improving the living standard within South Africa. Literature showed that businesses that use innovation are usually more successful and have a stronger probability of surviving and this is due to innovation being a driver for competitive advantage (Krause & Schutte, 2015: 164). Product design SMEs are seen as positive innovation enables that feed creative disturbances within the economy. Innovation is able build on new technologies and materials and therefor aid in building better living conditions (Olawale & Garwe, 2010: 729) (Krause & Schutte, 2015: 164).

5.1.2 Product design SME length of operation

The research illustrated that product design SMEs have very long operational length with most having been in operation for two to five years and even ten years or more. This could possibly indicate the successfulness of product design SMEs within Cape Town, however, the research was limited in investigating SMEs that had failed in running a business. Research indicated that there is a portion of SMEs that had been in operation

for under two years. This portion of SMEs are important to address, as literature has indicated that this is a crucial time within a business, as most South African SMEs fail within the first two years of operation (Barnard et al, 2011: 112). If these SMEs are able to be supported to overcome the first two years of operation it is possible that they will be able to build successful and long lasting businesses.

5.1.3 Product design SME geographical location

The research found that majority of product design SMEs within Cape Town operated from the city bowl. This is interesting as the research found that there were often financial challenges with renting spaces within and closer to the city bowl. This suggests that SMEs would rather overcome the high expense of renting within the city bowl possibly due to the city being a better place to meet clients as well as being a hub for design businesses. The research was limited in ascertaining why these areas were so important for designers to be located around and possibly should be addressed in future research. A study conducted by Barnard et al (2011: 124) found that the business location had a direct effect on the survival rate of the business. This was because of certain areas within a metropolitan had better profit potentials. The study illustrated that is was important for business owners to consider factors which have an influence on location of the business such as rates of rentals, tariffs, inflation and interest rates as well as employment.

5.1.4 Product design SME employment rate

The research found that product design SMEs typically employed between 1 and 20 employees. Interestingly none of the SMEs employed more than 50 employees, this could suggest that design SMEs in Cape Town comprise of a few but specialised employees. Majority of the SMEs employed less than five employees, the research was limited in possibly investigating as to why these SMEs employee a small amount of staff. However a leading factor could be because designers are so specialised and skilled and perhaps these SMEs do not need as many staff as traditional businesses. Literature found that the design industry in the Western Cape contributed 80 000 people with work (Western Cape Design Strategy, 2012: 6).

5.1.5 Product design SME annual turnover

The research found that majority of product design SMEs within Cape Town have an annual turnover of between R0 to R 500 000 as well as R1 million to R5 million. From literature the design industry in the Western Cape contributed up to R14 billion per year the South African GDP (Western Cape Design Strategy, 2012: 6).

5.1.6 Product design SME challenges

The research found that common business challenges found to influence product design SMEs were financial resources, human resources as well as management. Literature found that South African SMEs challenges consisted of management, marketing, social resources, human resources and financial resources (Cant & Wiid, 2013: 707). Interestingly both South Africa SMEs as well as product design SMEs within Cape Town said that human resources, financial resources and management were the main challenges in running a business.

There were no participants that found crime or law and legislation, opposed to literature, to present any major challenges in running a product design business, however, issues did arise regarding tax and funding for small businesses. Challenges within management were found to be predominantly revolving around managing cash flow, managing concurrent projects as well as managing resources. Additionally links to challenges in managing clients and suppliers, project management specific to project scope and design unknowns were also found to be major concerns for participants. Challenges experienced by Cape Town based product design SMEs will be discussed in detail below.

5.1.7 Product design SME existing tools and systems

Majority of participants through the surveys indicated that they had tools or systems in place that were used to address specific challenges within running a product design business. However the portion of SMEs that did not indicate that they had existing tools or systems in place was more important to the research. This is because these SMEs are essentially the business that the research needs to target in order to support and grow the product design sector. These existing tools and systems will be discussed in more detail below.

5.2 Challenges experienced by Cape Town product design SMEs

The following discussion points were found by research to be vital areas in which challenges lie in running a successful product design business as well as the necessary solution parameters that would be needed to grow and support the industry.

5.2.1 Navigating clients through the creative process and the necessary solutions needed to address key challenges

The following discussion points illustrate the complex nature of challenges in managing clients in product development;

5.2.1.1 Client Involvement

The research found that participants typically felt that clients did not understand the value of design and the value of the service within a project. Generally it was found that most clients had a limited understanding in the value of the creative process as well as the thought processes that went into product development. This had an influence with how much clients were involved with projects and ultimately participants felt that this often presented challenges in managing clients. Frequently participants preferred clients that were more involved within a project as it created more investment and understanding of decisions regarding the product development. Literature found that the involvement of clients in product development can be seen in a multitude of industries, knowing and understanding the client's considerations in deciding on involvement within a project is immensely valuable for client and business alike (Brockhoff, 2003: 477).

The investment of the clients within a project allowed clients to know what to expect at certain phases as well as understand the value of design. The research found that participants felt that managing client

expectations was often challenging. A similar study conducted by Stone (2012:1) found that one of the most critical activities when in any design project was the element of engaging and managing the client's expectations. It found that it is sometimes the case that client's expectations are never fully expressed until they are unmet. Participants from within a design business, typically dealt with a multitude of clients and managing different client's expectations of the project outcome, as well as their expectations of the interactions with the company was challenging. This came down again to the level of involvement of the client within the project which influenced what they could or could not do as a business. This influenced project outcomes; in relation to either the business having freedom in determining outcomes or having the client limit the outcomes being very specific on what they wanted.

Participants agreed that sometimes a client's level of involvement was an issue. This was due to clients struggling to let go of preconceived ideas and expectations of the project. A study conducted by Andersson & Liedman (2013: ii) found that clients expectations reform along three dimensions. These include; the level of fuzziness, implicitness and unrealism. The study found that the client's expectations were influenced heavily by previous experiences as well as less knowledge within the project scope cause clients to become fuzzier, implicit and have unrealistic expectations for projects. The research found that challenges in convincing the client of the new ideas that benefit the project, asking the client to let go of expectations as well as emotional connections with certain aspects of a project. Linking managing these expectations to project scope where clients do not necessarily come with a problem but rather a feature based idea. It was necessary to convince clients to let go of these expectations and rather convince them on focusing on the actual problem in order to define the project scope effectively and in depth.

Generally participants preferred to have more involvement from clients because it created a sense of ownership from the client within the project convincing them to be more invested within the project. This was found to be effective in making the client happier at the end of the day due to them being invested in the project and understanding the decisions that were being made and therefore seeing the value of the design. Another reason the participants found for the promoting client involvement was due to the industry using complicated processes and having design unknowns it was easier to relay these complications to the client and try to get feedback from the clients in order to make them understand the complication rather than question the business. Participants found that when clients had no input to a project there would be often questioning and misunderstanding in the project. A study conducted by Brockhoff (2003: 478) found that the client involvement had a direct influence on product success where the more involved a client is within the project the more likely the product will be successful. The study did find that, even though within good client involvement there is unfortunately not guarantee of success and this could possibly come down to the nature of product development.

5.2.1.2 Client Commitment

Due to the nature of product development there are often complications that arise within a project. Participants found that it was challenging communicating these complications to clients. The challenge was in managing the clients when they do not understand the complications themselves. Which leads to another challenge within managing clients, which is commitment. Participants typically felt that when complications arose and clients do not understand the complications there are some cases where they take their business elsewhere. A study conducted by Brockhoff (2003: 467) also illustrated on the commonality of client customer regarding product characteristics, however, management is tasked to consider this information as valuable and inexpensive source for improvement on product features. Interestingly the study indicated that the use of complaints could be a form of quality control rather than new ideation for development. The study concluded that complaints have a significant role within adding possible value for product improvement. This can be linked to the research as participants found that when clients are not as involved in the project there is no understanding of all the processes and decision making that had led to the complication in the first place. Participants felt that in some cases clients are quick to take their business elsewhere either for a better costing or quick lead time, in some cases both.

Generally the participants found that clients within the city of Cape Town as having great ideas for products but having terrible commitment and follow through with projects. It was found that almost an 80/20 percent ratio was found, where 20 percent of participants would not follow through with a project after costing. This could be related to South Africa not having a good economy now as well as clients as South African's looking for a better deal and not understanding the value of design again.

5.2.1.3 Communication

Participants typically felt that communication was one of the biggest challenges with managing clients. This was found to be crucial and ultimately the crux with managing clients. Interestingly communication with each client is often challenging as often each client has their own individual way of communicating. When a client does not respond to communication or the weekly updates, linked to their involvement, and only decides to get involved when there are complications it is often a challenging time for the business. This is because decisions were made and communicated to the client through weekly updates but when the client does not bother get involved in those discussions it will make it difficult for the business to manage the client's expectations. Some of the participants implemented weekly updates to the clients to formalise and regularly communication with clients. The use of these repetitive updates was found to inform, and both invest clients within a project. Literature found that constructing and maintaining relationship with clients through good communication is very beneficial. As a good working relationship allows for credibility and professionalism, therefore, it is often what the clients experience with the business is one of the most significant ways in which a business is judged. The article found that a client's experience is able to shape the manner they speak

about the business and ultimately contribute to the businesses reputation within the market (IPENZ, 2005: 1).

When there are multiply projects running simultaneously, projects that have a higher level of priority are often attended to over others. This often led to smaller or dormant projects not getting the necessary attention casing clients to question the progress of the project. One of the major causes of stress within a business was clients questioning the status of their project. This is where communication through the weekly updates is vital, as it is used to pre-empt client asking questions as well as let every client know the exact status of their project. Additionally, participants found that the use of these weekly updates allowed for easier management of concurrent projects. This was because one day a week management was able to have a complete overview of every project whether it be high level priority or dormant project. This, the participants found, was very valuable as it prevented smaller projects from being over looked. Not only did the research find that these updates were beneficial to concurrent project overviews but additionally putting actionable plans for each. These plans of actions are not only seen by management but are relayed to the client allowing complete transparency. The research found that transparency in a project with a client is very important. Transparency allowed the participants to communicate every single aspect within a project cycle whether it was complications or deliverable and even expectations. A study conducted by Olechowski (2012: ii) found that transparency is a crucial aspect in product development risk management. The study found that transparency is useful for accurate shared progress on projects, it promotes stakeholder (client) involvement and aligns actions in addressing tasks of priority.

Research illustrated that weekly updates have become standard practice in some of the participants business and clients have become accustomed to this type of communication. However, participants found that the level of involvement of the client often had an influence on this type of communication. When clients do not read or respond to these updates they ultimately detached themselves slightly from the project which caused the clients questioning certain decisions at times. However, participants found that by using the weekly updates there was a level of insurance as when complications do surface management can always refer back to the updates that had been sent to the clients.

5.2.1.4 Client payment structures

For the most part participants agreed that managing payment structures with clients were often challenging. As a design business majority of the participant's bill is time and getting clients to pay in time is often very difficult. Participants rely and base cash flow off billable hours which they put into financial planning, if payments are missed it puts the businesses under serious stress. Participants illustrated this becomes complicated when managing clients who promise to pay for already completed phases or task of project while still expecting the business to move onto the next phase without payment being made. Limited literature on the challenges product design businesses in payments structures suggested that future research

should look into why these challenges occur and how to address them in order to promote sustainable cash flow in the business as well as satisfaction of the client.

5.2.1.5 Solution parameters addressing challenges with managing clients

The following discussion points explore possible solution parameters needed to address challenges in managing clients in product development;

In order to address challenges in managing client's, participants suggested both good communication as well as transparency with clients. Firstly participants suggested that within communication to the client; weekly updates can be used to regularly inform and involve client in decision making. This pre-empts the client's involvement within the project where questions can be asked to the client for their input sharing risk with the client. In doing this participants illustrated that it will create customer buy-in which is able to address containing project scope. Both Brockhoff (2003: 477) and Andersson & Liedman (2013: ii) found that true customer satisfaction was reached through evaluating the customers perceived quality of past service against their expectations for future service. This understanding is important for management and offers to improve product success by involving customers. The literature also found that the clients themselves need to clarify their own involvement to management to have valuable input into the project. Secondly participants suggested using complete transparency with the clients, where live updates and project planning could be offered to clients. This would promote client involvement leading to both client sharing the project risk as well as customer buy-in. It was suggested that by using live project planning it could possibly address managing the client's expectations as well as resolve payment structure issues.

The use of weekly updates, participants found they were able to present progress updates to clients, whether the client reads it or not. This will allow management to understand the willingness of the client's involvement within the project. The research indicated that allowing clients to possibly have live feedback on project timelines, budget or even CAD models would increase client involvement. This can pre-empt a client asking questions about certain aspect in real time and not at the end of the phase or project. Clients would theoretically be able have an input in decision making and therefore have shared project risk and buy-in. This could aid in addressing the misunderstanding of design value by clients. A similar study also found that it was important for management to educate clients through the process for them to understand certain decisions that were made in the project. Not only is this education vital but a continuous identification of client's expectations can be used to either change clients expectations as well as the outcomes of the project to achieve customer satisfaction. (Andersson & Liedman, 2013: ii). This approach could address customer involvement which would aid in client payment structures being on time, as clients will be able to see at each milestone what is expected to be delivered as well as paid. A study found that clients need to understand every aspect and stage within a project design process to know what is expected from them, deliverables as well as payment structures (Stone, 2012: 1).

Communication is key, and the research found that participants also stated that avoiding miscommunication is vital. It was found that is important that when communicating between different clients that the communication needs to be specifically catered to each individual client to ensure that whatever is being addressed is understood by the client. Participants found that it was often difficult to know whether client understood the feedback and suggested by utilising a checklist or a set of questions which clients need to respond to, could address this. This is in a way forcing the client to be involved within the project providing shared risk and buy-in. So that at the end of the project the client understands and is happy with the outcomes. Literature found that continuous, quality relationships will promote success within product development but is reliant on clear and regular communication. This communication needs to be both understood by the client as well as an understanding from the business of the client and their expectations (IPENZ, 2005: 1).

By forcing the client to be involved by using effective communication tools, participants found that it could possibly contain project scope. Brockhoff (2003: 479) found that the deliberate involvement of the client in market research, complexity of the project or knowledge contribution is vital within product development. The participants suggested that this would aid in managing clients expectations as well as if a project develops out of scope re-quote clients due to the that it was not part of the original project scope. This can create a junction point where either client gives a go ahead with the new direction or carry on course with the current design solution even though the product design business advises against it.

Solutions parameters for navigating clients through the creative process indicated by participants can be aligned to the six stages of the Design thinking process as follows:

- Empathizing: Transparency, Good communication & Customer Input
- Defining: Customer Input; Defining the problem; Questions; Historical information & problem research; Market standards; Addressing client expectations and payment structures.
- Ideating: Transparency(Live project plans & Live Updates); Client buy-in; Client shared project risk (Decision input); Client involvement through effective communication tools;
- Prototyping: Containing a co-defined project scope with the client
- Testing and Implementing: Design process

5.2.2 Managing project scope and the necessary solutions needed to address key challenges

The following discussion points illustrate characteristics of challenges within managing product scope;

5.2.2.1 Project scope grey areas

Within product development, business project scope was consistently a major issue due to it being such a grey area. A study conducted by Hooks & Wheatcraft (2001: 2) illustrated that a big influence in project failure is the failure to spend adequate time in the start of a project to correctly define the project scope and product requirements. At the start of a project a certain set of requirements are decided and costed upon, however

venturing further into the project these requirements are often changed and the project manager struggles with deciding; what is part of development and what is part of venturing into something unknown. Additionally, project grey areas can be linked to design unknowns within a project and how these design unknowns are necessary within the organic creative processes but if not managed correctly can cause challenges later on within a project. Project scope within development is seen as a challenge since there is a certain amount of these unknowns due to it being the development of something that does not necessary exist and therefore there is no benchmark to work off. Similarly, a study found that uncertainty (design unknowns) presents challenges within project management. A project management approach usually sets a baseline forecast in which the project follows, and the progress of the project is consistently compared to it. Challenges will be experience when there are high uncertainties within a project and this can create high risk and will need ongoing adjustments and correction plans to cater for these uncertainties (Jetter; Albar & Sperry, 2016: 46).

5.2.2.2 Project scope and the brief

One of the major concerns from participants was gauging whether or not a project was answering the brief and ensuring there is no project scope creep. The reason for the concern relates to the amount of time that is often wasted on working of tasks that are not necessarily answering the brief and are out of the project scope. A study conducted by Bois (2017: 15) illustrated project scope creep as the predisposition of the build-up of minor changes in the scope of a project. Where individually these minor changes have a minimum effect on the project but as collective can result in major increase on the projects times and cost. The study found that these minor changes in scope can be uncontrolled as well as unapproved and ultimately have an effect of the original project forecast. The research found that knowing and understanding when a project is venturing out of scope, management is able to interject and correct the resources working within that project in order to save wasting time. Interestingly this also links to the resources experience as well, due to the fact that a more experienced resource is able to pick up that the work they are doing is either in or out of project scope making them far more time efficient.

5.2.2.3 Project scope and managing clients

Another interesting aspect to managing project scope was that it also comes down to managing the client's expectations at the beginning of the project. It is important that project scope is defined and understood by the client as well as to ensure the clients expectations of a projects are aligned with the deliverable set out by the business. Hooks & Wheatcraft (2001: 1) illustrated that it is often a balance of demands involving; cost, time, quality, scope and clients with each having their own specific needs or expectations. A client's expectation links strongly back to managing and communicating effectively with clients. The participants illustrated that managing the client's expectations when it came to the deliverables of the project were often challenging. It was found that clients often approach product development businesses with a 'feature' based

idea for a product where they have preconceived idea of what the solution needs to look like. Most of the times this is not that actual problem that needs to be addressed. Having a poorly defined problem area is one of the leading factors causing issues within project scope. The research linked that this is also a cause for challenges within managing the client where product design businesses need to convince clients to let go of their preconceived ideas of what the product will be and focus on the actual problem in hand which will allow the business to organically provide plausible solutions. Van Zyl & Walker (1999: 1) similarly found that it is often difficult for managers, as it is not often possible to deliver exactly what the client had expected, especially in product innovation and development.

5.2.2.4 Solution Parameters in addressing challenges in managing project scope

The following discussion points highlight possible solution parameters that can be used to address challenges within managing product scope;

In order to address challenges in project scope participants suggested utilising an approach which focused on in depth detailing of both the problem, project requirements and communication with the client. The participants suggested the following process that could be used to address managing project scope.

A well-defined problem should be the starting point, linking back to clients not providing an actual problem. A truly defined problem area is vital in preventing project scope creep, as well providing an in-depth set of requirements. This detailed set of requirements will allow management to develop a detailed design brief to provide to resources. Hooks & Wheatcraft (2001: 1-2) stated that it is important for every project to be clearly defined with its scope being documented in order for a project to move forward successfully. The reason for the project scope to be defined and documented is that the project requirements can be coordinated and formalised. The study found that it is vital that these requirements are formalised, and the project scope is well defined by both the business as well as validated by the client. This enables agreement in the scope and the project will be able to go ahead. It was found that this can even help with good project planning and managing design unknowns. Once a good and detailed brief is put together the business is able to carry out the actions set in the project plan to address the brief. Bois (2017: 9) illustrated that a clearly defined project scope will allow for effective work breakdown structure, allowing the project to be broken done into smaller more manageable deliverables. Once the project scope is defined and a set of requirements is established, actual work can go ahead. During this work process it is possible that design unknowns might surface which may lead to new solutions needed. Possible use of design reviews will aid in bringing up possible design unknowns earlier, as well as recognising the shift in project scope. If the new solution is the way forward the participants suggested that at this junction clients can be re-quoted for the new project scope or the cost can be absorbed by the business. This absorbing will be dependent on what is most beneficial for the business. Participants illustrated at this point in the approach it is vital to recognise that there has been a shift in project scope in order to either absorb or re-quote. Interestingly Bois (2017: 9) found that issues within project

costing accuracy can also be linked to definition quality of the project scope. As the study found that cost estimates rely heavily on the scope of the project defining key phases which get costed at the beginning of the project. This can be linked to design unknowns emerging within a project influencing these phases and ultimately causing issues with the original projected project cost. The participants suggested that after the recognition stage the project can either diverge with the new or old solution. The research found that the participants would rather the client go with the new solution as to provide more client involvement, shared risk and buy-in which will add to the success of the project. Interestingly the research found that if effective communication is withheld with the client it will be more likely that the client will decided to go with the new solution. Once the new solution direction is chosen, participants suggested that there is a possibility that there will be new problems and design unknowns that will have to be addressed.

Solutions parameters for managing project scope indicated by participants can be aligned to the six stages of the Design thinking process as follows:

- Empathizing: Defining the problem; Communication & Transparency with client;
- Defining: Defining the problem; Detailed list of requirements; Brief = Defined project scope
- Ideating: Do the work; Design Review.
- Prototyping: Design review; Recognise;
- Testing and Implementing: Recognise; New solution/new problem (which leads to more client involvement ensuring client buy-in which will either be a requote or absorb the extra costs) OR deliver design.

5.2.3 Managing design unknowns and suggested processes to address key challenges

The following discussion points illustrate aspects within the challenges in managing design unknowns in the creative process;

5.2.3.1 Design Unknowns being part of the creative process

Literature found that the term 'uncertainty' is a vague concept that is used to illustrate the probability of certain assumptions made during designing that could possibly be incorrect or present unknown factors that have an influence on the outcome of the project (De Weck, Eckert & Clarkson, 2007: 1). Within product development there are bound to be unknowns and this unfortunately is just part of the creative process. The main reason why there are design unknowns within a project is the very nature of product development itself. In most cases these products are the first of their kind and there is no benchmark to work off hence often designing, one cannot necessarily know the outcome of. Similarly, De Weck, Eckert & Clarkson (2007: 1) illustrated that uncertainty (design unknowns) can both negatively and positively influence a product development. Design unknowns were found to be a vital part of the creative process where designers often need the organic nature of design unknowns for developing ideas and solutions.

5.2.3.2 Getting design unknowns surfacing early

Participants were accustomed to these design unknowns but had challenges in managing them. Participants illustrated that it was important that design unknowns surfaced early enough within a project so that time is not wasted on redundant work which is often outside the project scope and secondly that time can be allocated to address these unknowns. This can be linked to the nature of product development where one is often designing for an unknown and the brief cannot encompass all aspects of the project. Managing the unknowns and understanding when this happens is vital in management of projects. Understanding when design unknowns occur causing project scope creep is very important, as these are the scenario's where clients start to question, and designs go under review. When this occurs, it can be detrimental to a project timeline and budget often requiring a re-costing on the project. Participants collectively agreed that preventing design unknowns which influences project scope creep was important so as not to surprise clients with possible design changes and re-costings of phases within a project. Bois (2017: 10) found that if unknowns or deficiencies in scope are not found early enough and before work has begun it may have an influence on the project outcome. The study found that if this occurred it sometimes led to client either paying more for the variations or the project may not be completed within budget and time. Typically, participants mentioned that when design unknowns surface early on within a project it is good for both the designer as well as management. Knowing the design unknowns early on in a project, management is able to deal with the unknowns an allocated time needed to address them.

5.2.3.3 Design unknowns linked to designer experience

One of the leading factors that influenced the early surfacing of design unknowns was the designers experience within a project. Participants generally counted on more experienced designers to flag design unknowns relatively easy and early enough within a project, however, junior designer having less experience often cannot pick up on these design unknowns. It was found that a lot of time is wasted by the less experienced designers on work that is not necessarily part of the project scope due to these resources not picking up on these design unknowns.

5.2.3.4 Solution parameters in addressing challenges in managing design unknowns

The following discussion points highlight possible solution parameters necessary to address challenges in managing design unknowns;

The research found that in order to address challenges in managing design unknowns, the participants suggested utilising checklists to define and identify design unknowns early on in the project, valuable client input to define problem areas as well as to provided prior knowledge of the project, market standards to explore existing solutions and finally utilising a detailed research and conceptual phase to test the viability of the project.

Client input at the start of the project was invaluable. Firstly, in order to have an involved client, as discussed above, and secondly what the client is able to input at the start of the project. Participants found that good client input at the start of the project helped provide a defined problem area. Additionally, when clients are able to provide historical information on the project regarding what they have done and found is very beneficial. This links to another point found by research, which is the market standard revolving around the problem area. Exploring the market standard was found to be vital as it can be used to see what did or did not work in relation to solving the problem. Participants suggested that the use of a detailed research and conceptual phase could indicate design unknowns earlier on in the project. Russo; Sbragia & Sih Oih Yu (2017: 2) found that early recognition of unknowns in innovative projects is key. Early identification as well as sensemaking of these unknowns will aid in alleviate unwanted side effects of uncertainties.

By using these phases' participants felt that design unknowns would possibly surface earlier on within a project and therefore allow management more time to better plan and deal with these unknowns in the detailed design phase. Similarly, Russo; Sbragia & Sih Oih Yu (2017: 2) found that early recognition and sense making of unknowns within innovative projects allows management time to diminish their effects. Additionally, it was found that by using this detailed phase approach as a standalone the business does not commit to the project and only costs for this phase. In doing so it could possibly be easier to define project scope and provided a detailed brief revolving around the defined problem area. This will allow the business to test the viability of the project and either suggest to the client to go ahead or end the project to save them money. By having a defined problem area and project scope, the list of requirements in the brief will possibly limit the amount of design unknowns.

Once a project is found viable, participants suggested the use of a checklist systems to firstly; slow down the excitement within project which can often lead oversight. Participants found that oversight within a project can often prevent design unknowns from surfacing. Van Zyl & Walker (1999: 3) found that often emotional attachments to certain product attributes by designers can cause design unknowns. This is because time and effort from the designer is put into the project where they become attached to products and often fail to make objective decisions. By utilising a checklist system to slow down oversight and to force management to perform in-depth considerations will pre-empt design unknowns to surface early on. This will allow for more time within the project to address these design unknowns.

Solutions parameters for managing design unknowns indicated by participants can be aligned to the six stages of the Design thinking process as follows:

- Empathizing: Communication = Client input & Co-defined problem; Market standard;
- Defining: Market standard (how does it or doesn't solve the current need); Client Input (Defined problem area & Historical information of project and problem research)
- Ideating: Checklist; Detailed conceptual & research phase(go ahead OR not a go ahead).

- Prototyping: Detailed conceptual & research phase; Checklist (Early identification] of possible design unknowns); Design;
- Testing and Implementing: Design; Early Project plan; Time allocated to deal with future design unknowns.

5.3 Additional co-defined existing tools and systems used within Cape Town product design SMEs

5.3.1 Using project planning programs

The research found that participants often utilised project forecasting programs for effective project management. These programs allowed participants to keep track of multiple projects and their progress. These programs are used not only to track individual project hours as well as to ensure the project is running on time through each phase and if not, put in plans to address it. Participants found that these types of programs were vital in the business, however, understanding project management and the sequence of which things need to happen was more important. Generally, participants found that these programs do not necessarily tell management what to do but rather visually represent what was laid out by management. Therefore, it is vital for management to understand and have experience in project management. At the end of the day these programs were found to be very powerful and vital in managing projects within a design business but comes down to the user in control and their experience with planning. The use of these programs allowed for great oversight of projects as well as access to information regarding a project, but again linked to the user having the correct knowledge in planning itself. A link between good project forecasting and the brief, where a good detailed brief often allowed for easier and more in depth project planning. This links it back to effective and in depth briefing from the client.

Another aspect that participants found these programs useful for was illustrating timelines and progress to clients linking back to complete transparency. Participants indicated that due to the nature of product development these timelines form organically and these tools allowed visual representation that can be used to communicate with the client. Interestingly enough it was found that project timelines were determined by the budget allocated by the client. This often was an issue due to certain tasks being allocated certain amount of hours where in fact designers needed more time in order to truly address the task in hand. This had cost implications on the business as often designers would have to use more time the allocated time determined by the budget. It is often the case that the business had to absorb these costs. This can be linked back to challenges found within costing a project, to overcome this participants found that the use of design reviews reduced time being wastage on unfitting design directions. These design reviews are used to keep designers on track and therefor save time that the business would normally absorb. Clarkson & Wynn (2009: 11) found that delivering a project on time and in budget is vital for the success of a company. Management who are able to schedule projects effectively can support the design process by increasing the reliability of these plans as well as mitigate future cost for re-planning.

5.3.2 Using existing programs and tools to streamline the business work flow

The research found that participants utilised a multitude of programs in order to stream line the businesses workflow. Participants generally did mention that these tools are not only specific for product design but are most likely found in a multitude of different types of businesses. Participants found that for small business the use of programs that are able to make the daily workflow of a business more efficient are important. Programs such as accounting software that could be used for financial forecasting, invoicing as well as managing cash flow and expenses. This theory of using any programs that aid in certain task in a business is to effectively minimise time spent on these tasks. Therefore, allowing more time to be allocated in productive work bringing in cash flow to the business. However, it must be stated that this to, very much like project forecasting programs, comes down to the user and their efficiency and experience. Some participants found that these programs are valid, but it was important that these people or resources needed to learn instead of always relying on these types of tools. At the end of the day these tools cannot force people to do the work and there will always be a human element in performing the actual work.

5.3.3 Using project priority systems

It was found that participants utilised project priority systems. Participants typically found that projects within a product design business do not necessarily start and end in one go but rather bounces between different stages of different projects. Participants found that utilising a project priority system they were able to address projects with higher level of importance whether it was to meet a tight deadline or to meet financial projections necessary for the businesses cash flow. These project priority systems differed from business to business, whether it is beneficial for the business or more realistic for the client. The research found that participants felt that these priority mechanisms needed to be identified by each individual business and what works for them. Project planning has a direct effect on utilising priority systems. If a project is planned in depth and correctly as well as being in line with other concurrent projects, the project planning programs should indicate which projects have more priority than others. Interestingly certain participants felt that there is a need for these priority systems. If there was effective project planning theoretically there would be no need to priorities projects. This is in a way putting a system in place to live with a problem and not actually addressing the actual problem at hand, which can be linked to effective management of the project scope, management of clients as well as management of design unknowns. Lehtola; Kauppinen & Kujala (2004: 1) found that prioritizing is an important aspect within product development. This is because when deadlines are close, budgets are tight and the client's expectations are high, the business must be able to deliver to meet those demands. The study found that a multitude of projects often do not meet all the requirements due to limited time or budget and even resource constraints.

5.3.4 Using financial forecasting tools

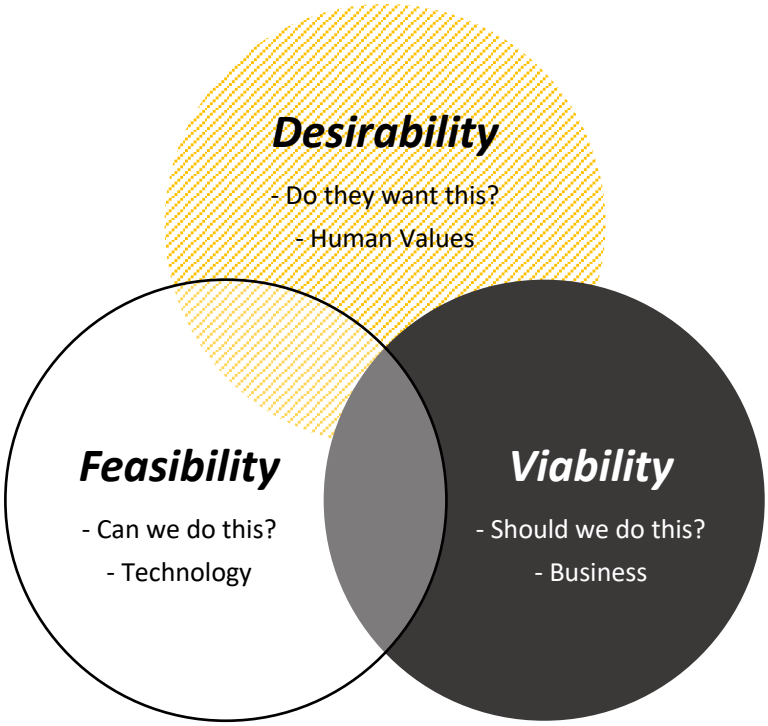
Generally, the research found that participants felt that financial forecasting is vital in any business and it is not necessarily specific to product design businesses. Typically, the participants felt strongly that these tools were crucial in managing cash flow, expenses and so forth but still came down to the user at the end of the day.

5.3.5 Networking with the industry

Networking within the design industry can be beneficial for the business, however, it is a complicated and often conflicting process. Typically, the participants found that networking is a difficult aspect due to conflict of interests from business to business. The conflict of interest comes in when discussing work or project where there are strict non-disclosure agreements with clients. This limits the business with who and what they are allowed to discuss not only with other business in the industry but with suppliers as well. There was concern with sharing information about certain suppliers as it possibly could change their relationship with suppliers affecting their business which might rely on these suppliers. It is for this reason that networking was found to be so difficult, businesses spend a lot of time building relationships with suppliers and value these relationships, especially within the design industry. This can be linked back to the challenges in working with suppliers and their willingness to do development work for design businesses. How networking should be done in the industry, in accordance to participants, is it should not involve the businesses competitors but rather with potential new suppliers or clients. Effective networking should be less about sharing knowledge but more about building a customer base. Especially within Cape Town because of it being such a small industry. It is suggested that further researcher into the challenges of effective networking within the design industry in Cape Town is needed in order to create support structure to new businesses looking to establish a client base as well as suppliers.

5.2 Application of design within product design SMEs of the Western Cape

It is evident form the online survey that product design SMEs based in the Western Cape want tools or systems to promote sustainable growth within their businesses. 74% of participants found there to be challenges within the product design management of business. 26% of participants having no tools or systems in place addressing these challenges and 73% having some form of tool or system in order to overcome the various challenges in running a product design SME in Cape Town.



The feasibility of implementing the solution parameters found within the study is plausible. It is suggested that further research into the testing and implementation of trials of the found support solution parameters in addressing the key challenges co-defined from product design SMEs in Cape Town.

The viability of promoting sustainable growth by providing solution parameters to the key challenges within product design SMEs in Cape Town is great. It is evident that SMEs provide valuable contribution to South Africa's economy and living standards. The study has also illustrated that there is a demand for support within the product design SME sector. By providing sustainable support to this sector we can contribute even more so to South Africa's economy and wellbeing.

Figure 24: The use of Design Thinking in product design SMEs of the Western Cape

5.3 Conclusion

The study found that South African SMEs are vital in building the economy, providing jobs and the promotion of innovation. However, these SMEs are faced with serious challenges that affect their ability to build successful and sustainable businesses. South Africa, having one of the highest ranked failure rate of SMEs, should be motivated to address these challenges in order to support these businesses. The research illustrated that product design SMEs within the Western Cape also face challenges that hinder their success and due to the gap in knowledge the study aimed to investigate the SMEs sector. In doing so, the research provided an enterprise demographic on product design SMEs within Cape Town. This demographic illustrated the vast amount of specializations within the industry, proving that the design SMEs provide critical input into building innovation and technology. The study also found that the majority of these Cape Town based product design SMEs had been in operation for more than five years, and in most cases 10 years or more. This illustrates that once SMEs are able to overcome the first 2 years of operation they are able to build sustainable businesses. In addition, the literature revealed that the design economy is booming, as an estimated R14 billion was contributed to the South African GDP per year in 2012. The research found that most of product design SMEs in Cape Town had an average annual turnover of R500 000 - R1 Million per annum and employed between 1-20 employees.

The deep investigation into the challenges these SMEs face found that financial resources, human resources and management to be the most common business challenges within the Western Cape. Specifically, management within product development was found to be the biggest challenge. Emerging themes within Cape Town product design SMEs which influenced the success of product development management were: managing clients, project scope and design unknowns. The research firstly found that issues in managing clients within Cape Town came down to client involvement, commitment, payments structures as well as effective communication. Secondly, issues that effected project scope included the project scope grey areas, managing clients in relation to the scope and comparing the project progress to the brief. Lastly the issues that were found within the management of design unknowns consisted of design unknowns be part of the creative process, allowing design unknowns to surface early as well as designer experience. To address these key challenges within product design SMEs based in the Western Cape the research found that through ideating possible solutions parameters that provided good communication and transparency with clients, detailed definition and recognition processes to manage project scope as well as systems for early identification of design unknowns within the creative process.

6. Conclusion & Recommendations

6.1 Overview

This study contributed towards supporting sustainable growth within the product design SME sector of South Africa. In response to the main research question: "How can sustainable growth of product design SMEs in the Western Cape be supported?", the study investigated the product design SME industry, and provided an enterprise demographic in order to better understand and empathize with the sector. By using this understanding, the challenges that influence a product design SMEs success were investigated to provided co-defined and ideated critical solution parameters for key challenges that can be tested within the industry. In doing so, the research provided both a foundation for future research and support measures that provided the necessary support to build sustainable growth within the Product Design sector. The following concluding points address how the study addressed the main research question:

6.2 Research sub-question 1.4.2.1: How do Product design SMEs impact the local economy within South Africa?

Literature found that within South Africa, as well as globally, SMEs play a crucial part in contributing to the economy, employment rate as well as standard living conditions. South African SMEs account for 90 percent of formal business and contribute 57 percent of the gross domestic product as well as 60 percent of employment. Yet these SMEs face several challenges that often cause them to fail with majority of South African SMEs failing to operate past two years. The research found that the SME failure rate within South African is 63% ranking one of the highest globally. The research found that there are millions of Rands that are being lost due to SMEs failing, and Product Design SMEs within Cape Town are no different.

The study supported these SMEs by using design thinking as a tool for innovation and problem solving as to promote sustainable growth within the Product Design sector. The study first provided an enterprise demographic in order to better understand the Product Design industry. The enterprise demographic found that these SMEs diversify into multiple fields, the majority of the SMEs had been operation between 5-10 years, most generated an annual turnover of R500 000 – R 5 million and employed 1 – 20 employees, and the majority of the SMEs operated from the city bowl. The enterprise demographic also partially explored common business challenges identified by the product design SMEs in Cape Town.

6.3 Research sub-question 1.4.2.2: What are the challenges facing Product design SMEs operating within the Western Cape South Africa?

The study found that similarly to the literature, product design SMES also have issues with financial resources and management, human resources and general management. The research found that product design SMEs in Cape Town experienced challenges in utilising effective design reviews, managing project scope, designer inefficiency, managing clients, comparing the project progress against the brief, managing suppliers and

managing design unknowns. The research found that these challenges were all part of management within product development. These specifically key co-defined challenges within management consisted of managing clients, project scope and design unknowns (in hierarchy) and was found to be the main contribution of the study. The research found that management within product development was affected by challenges in firstly; managing clients where client involvement and communication had an influence on the success of the project. Secondly, managing clients in relation to the project scope was found to be one of the influencing aspects of managing project scope. Other issues that influence the successful management of project scope were: project scope grey areas and design unknowns in the product development process, as well as constant comparison to the brief to gauge whether the project requirements were being met. And lastly, design unknowns were influenced by designer experience level, getting design unknowns to surface early and finally the fact that design unknowns are an integrated part of the creative process.

6.4 Research sub-question 1.4.2.3: What do Product design companies perceive as the support criteria required to facilitate sustainable growth within the sector?

The study found that in addressing the co-defined management challenges (managing clients, project scope and design unknowns) within product design SMEs based in Cape Town, firstly, the use of good and repetitive communication coupled with project transparency would aid in addressing challenges within client management. Secondly the implementation of an approach utilising in-depth detailing of problem areas, project requirements and client communication and involvement was vital in managing project scope effectively. Lastly the implementation of a process utilising checklists to recognise and define possible design unknowns early within in a project, pre-empting client involvement, exploring the market standard and a single detailed research and conceptual phase before starting a project in order to test the product viability would aid in addressing challenges within managing design unknowns. The research also co-defined existing tools and systems currently in place within the product design SMEs sector of Cape Town that aid in building a sustainable business. These tools and systems consisted of; project forecasting programs, tools to streamline business workflow, project priority systems, financial forecasting tools and effective networking within the design industry.

6.5 Recommendations for future research

Firstly, it is recommended that more explicit investigations are undertaken into the product design SMEs to provide a highly detailed enterprise demographic of the sector. This study was limited to the amount of resources available and the time in order to collect data. Therefore, a more detailed and bigger study should be conducted in order to truly investigate the industry so as to better provide support in it.

An investigation into the other design sectors is also recommended, in order to deepen the understanding of the design industry within Cape Town, and it could possibly highlight differences or similarities with this research. Additionally, more research within the specified key challenges in product design SMEs to start to

ideate more in-depth solutions or processes in order to overcome these challenges would be beneficial. The ideated solution parameters (addressing the key challenges in managing clients, project scope and design unknowns) should also be tested within the industry to provide a benchmark for future prototypes and research.

6.6 Reflection on Design Thinking as methodology

Design thinking as an ideology allowed for a user-centred approach in solving complex problems. This was because Design Thinking is more of a conceptual foundation, in contrast to linear based problem-solving approaches. Design Thinking as a research methodology was found in practice to be a well-structured process that offered a multitude of tools in order to address the research main research questions. Utilising the 'empathise, define, ideate, prototype, test and implement phases' to structure the research allowed the study to be empathetic, gaining deeper insights into the product design SME industry and the challenges they face. Design Thinking's empathetic approach through the use of literature and research methods provided a detailed understanding of product design SMEs. This was done in order to co-define key challenges as well as address these challenges by using ideation of possible solution parameters to form a prototype. As illustrated, this 'prototype' of knowledge forms the foundation for future research into similar topics and could possibly be tested within the industry to gauge the level of support provided to Cape Town product design SMEs.

6.7 Autobiographical conclusion

The study was relatively easy going and I think this was due to the detailing and in depth planning that went into the proposal, which allowed me to focus purely on the collection of data. I think the only challenging aspect of the study was organising participant's availability for the interviews or design workshop. Being a product designer within the industry for 3 years, I had come to know some of the participants and to stage professional data collection was often challenging. The most rewarding part of this research was to see participants in the design workshop genuinely getting involved and ideating solutions that themselves would implement. Seeing their input and dedication to solve these problems truly validated the study for me proving that there is immense value in the research. Looking back on the process and effort that went into the study, I honestly can say I am proud to be a part of research looking at supporting product design SMEs in South Africa.

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Form 1b: To be completed by researcher.

Consent Form

Participant Code: Date:

You are invited to participate in a research study conducted by Mr Matthew Greeff, from the Faculty of Informatics and Design, at the Cape Peninsula University of Technology (CPUT).

I hope to learn about **challenges & experiences within the product design SME industry**. Research activities may include observations, interviews and workshops. These form part of my MTech: Design study, titled '*Product design challenges of Small to Medium Enterprises in the Western Cape: A Design Thinking approach'*. The time and aim or each session will be communicated in a short introduction and you will be able to decide whether you would like to participate. Taking part is completely voluntary and you welcome to stop participating whenever you like. Any information that is obtained in connection with this study will remain confidential and comments in text will be linked to a pseudonym of your choosing.

If you have any questions about the study or the research activities, please feel free to contact me at designprocessresearch@gmail.com or on +27 79 524 4411.

Today's Activity/ Session

This section includes information about our session today and asks permission to use any photographs or videos that feature you, as well as comment you made during the session.

Date and Time:

Activities: Semi-structured interview

Permission to use media, quotes and materials

Tick all appropriate boxes:

If a box it not ticked it means you do not give consent for these materials to be used.

☐	I give consent for **photographs** of me, taken in today's session to be used in academic publications and activities.
☐	I give consent for **video** of me, taken in today's session to be used in academic publications and activities.
☐	I give consent for any **quotes** I made today, to be used in academic publications and activities.
☐	I give consent for any **workshop materials** I contributed to today, to be used in academic publications and activities.

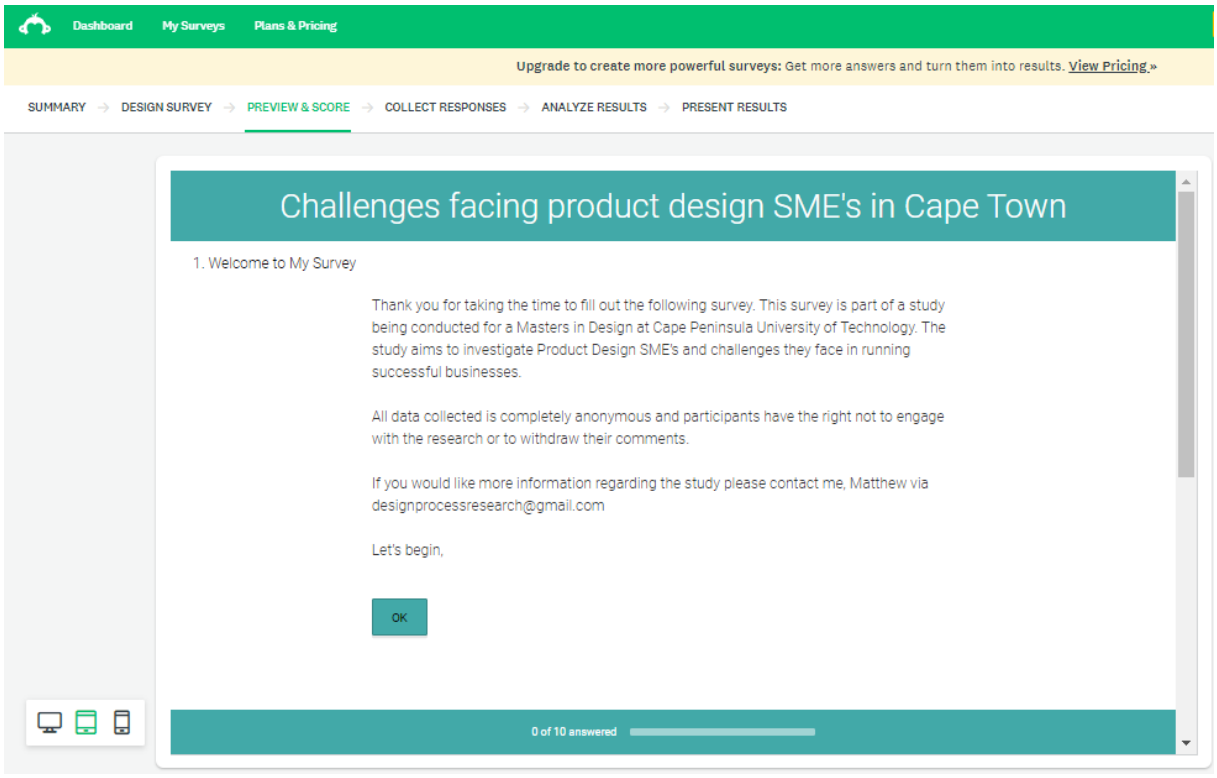
Your signature indicates that you have read and understand the information provided above, that you willingly agree to participate, that you understand that you may withdraw your consent at any time.

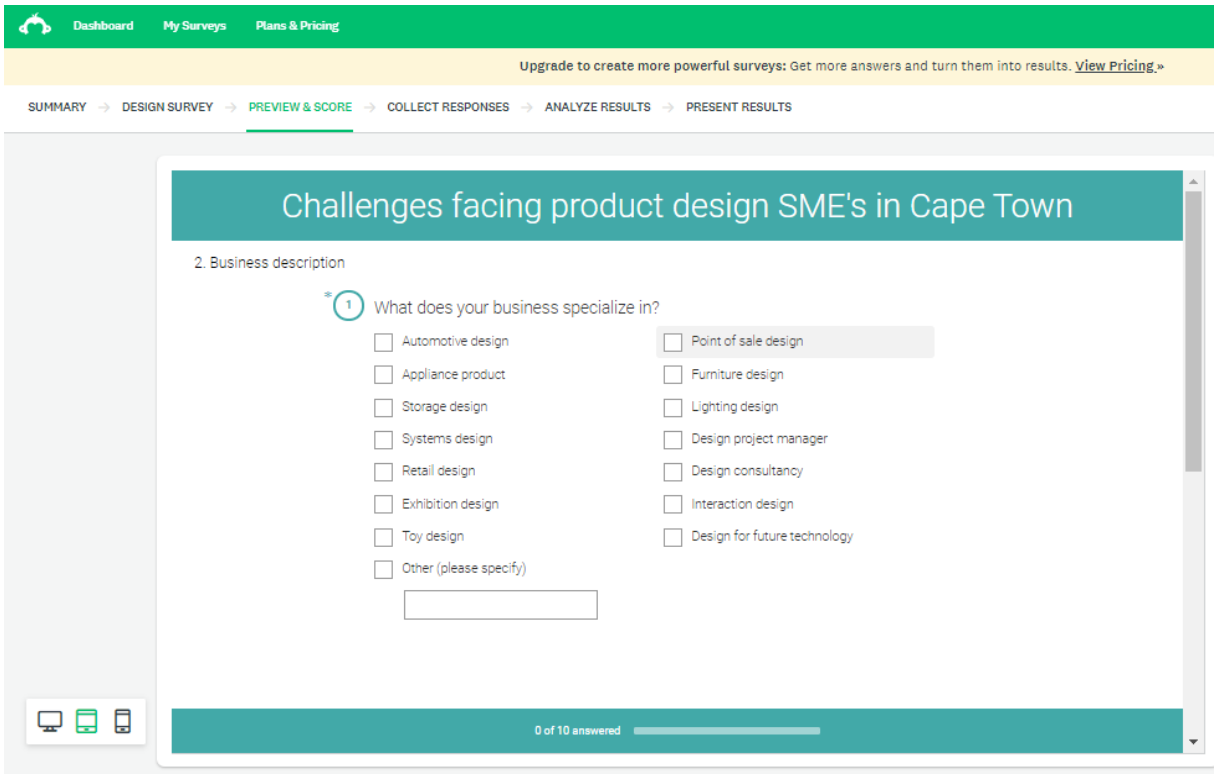
Name:

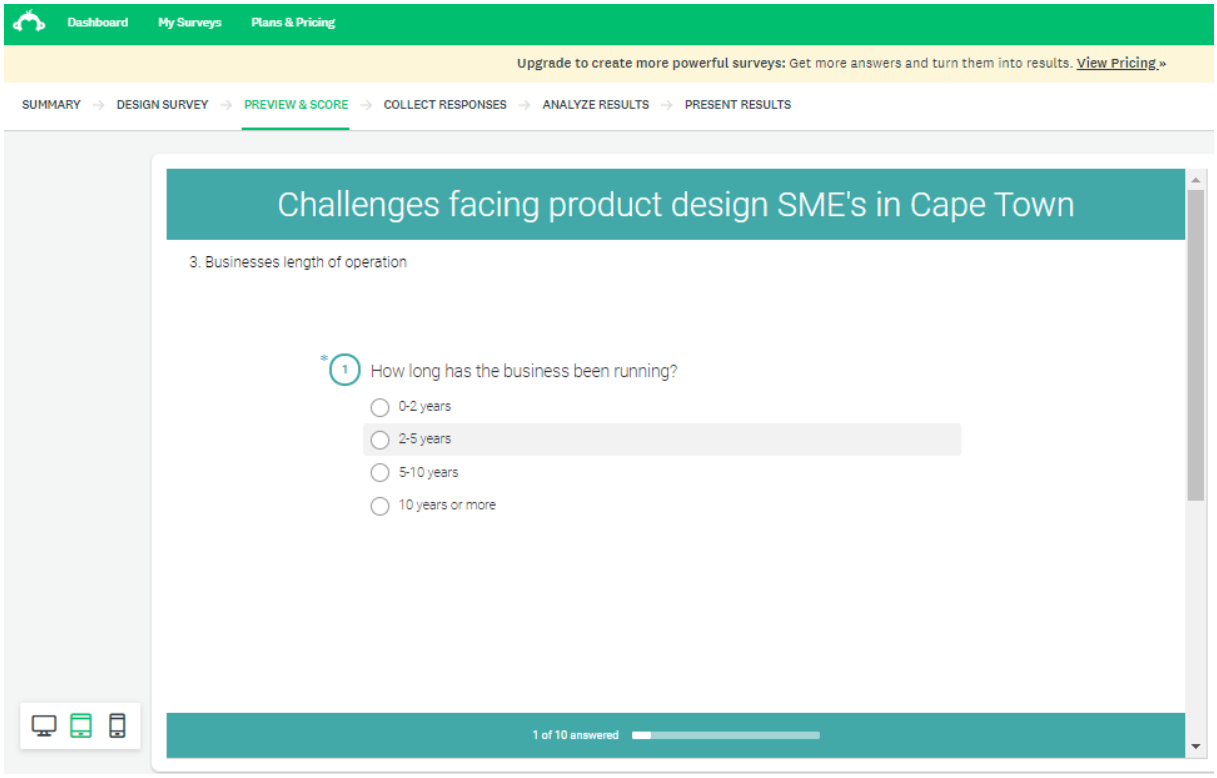
Signature: Date:

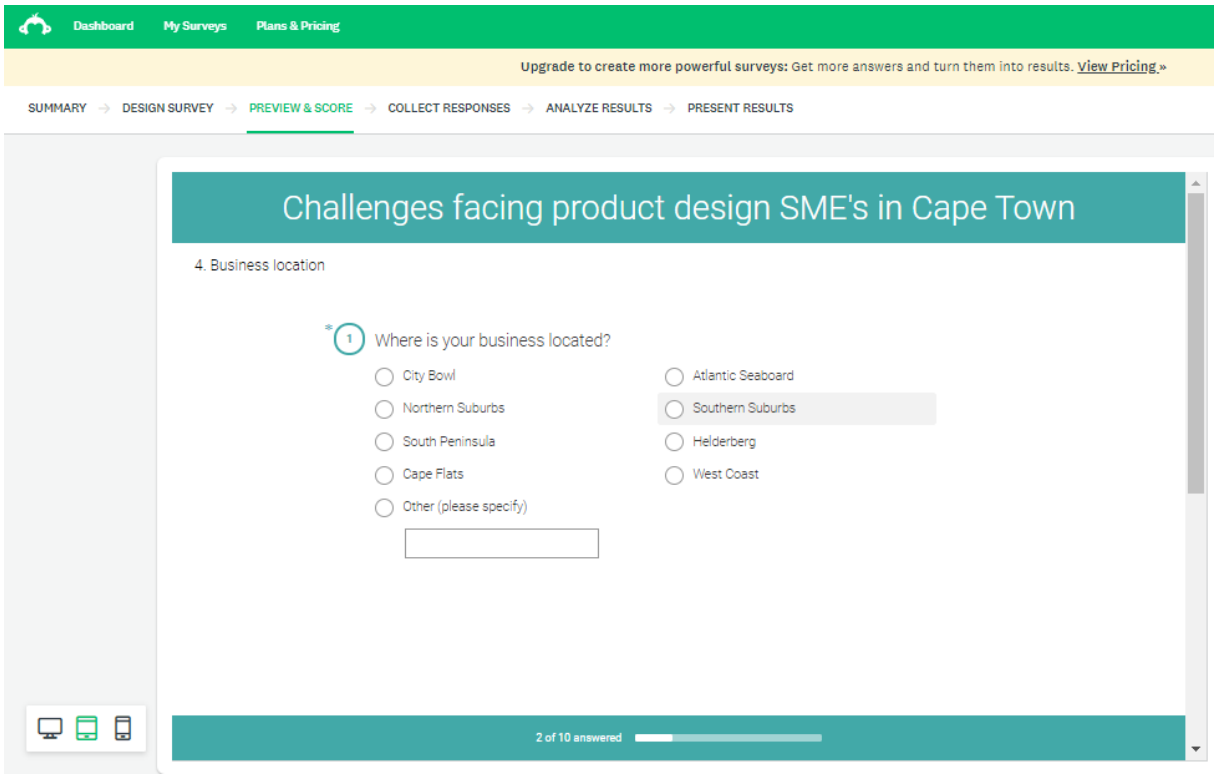
Thank you for taking the time to learn more about my project. Please do not hesitate to contact me should you need any additional information. This project is supervised by Vikki du Preez (dupreezv@cput.ac.za) and Veronica Barnes (barnesv@cput.ac.za), Cape Peninsula University of Technology.

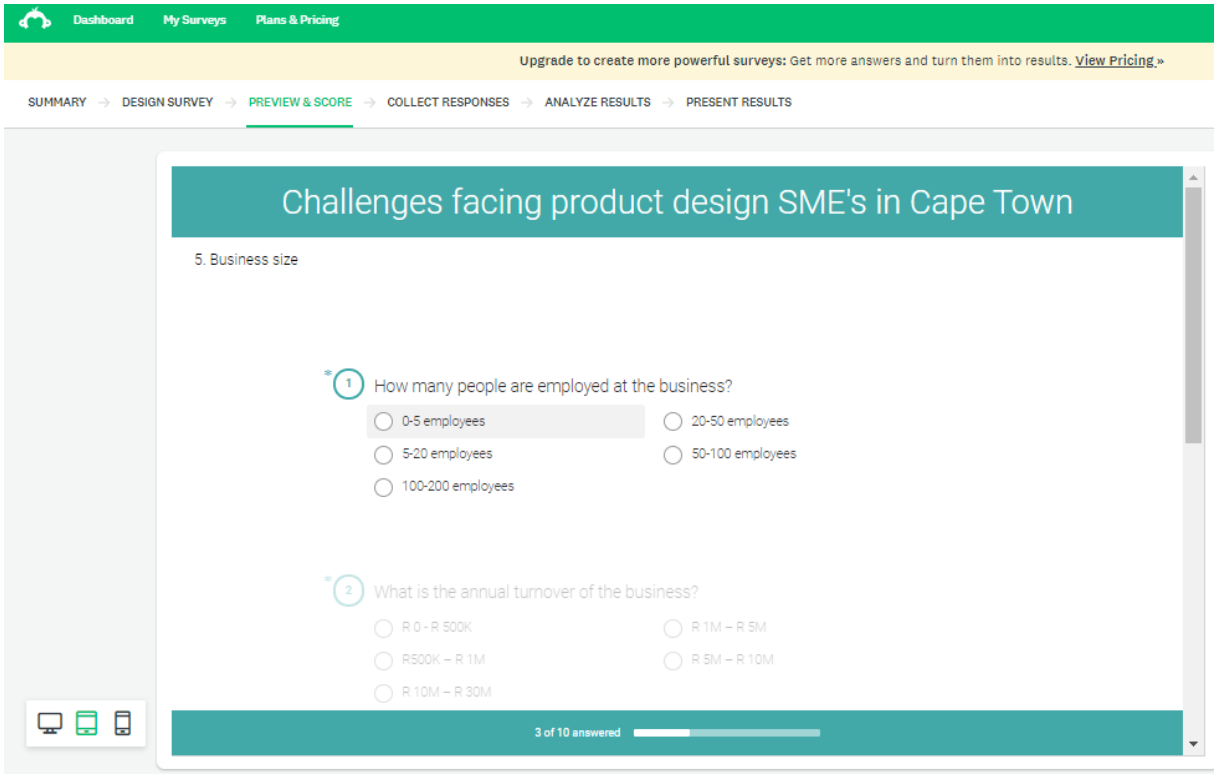
Appendix B: Survey Monkey Survey template






Dashboard
My Surveys
Plans & Pricing
Upgrade to create more powerful surveys: Get more answers and turn them into results. View Pricing »
SUMMARY
DESIGN SURVEY
PREVIEW & SCORE
COLLECT RESPONSES
ANALYZE RESULTS
PRESENT RESULTS
Challenges facing product design SME's in Cape Town
3. Businesses length of operation
* 1 How long has the business been running?
0-2 years
2-5 years
5-10 years
10 years or more
1 of 10 answered


Dashboard
My Surveys
Plans & Pricing
Upgrade to create more powerful surveys: Get more answers and turn them into results. View Pricing »
SUMMARY
DESIGN SURVEY
PREVIEW & SCORE
COLLECT RESPONSES
ANALYZE RESULTS
PRESENT RESULTS
Challenges facing product design SME's in Cape Town
4. Business location
* 1 Where is your business located?
City Bowl
Atlantic Seaboard
Northern Suburbs
Southern Suburbs
South Peninsula
Helderberg
Cape Flats
West Coast
Other (please specify)
2 of 10 answered


Dashboard
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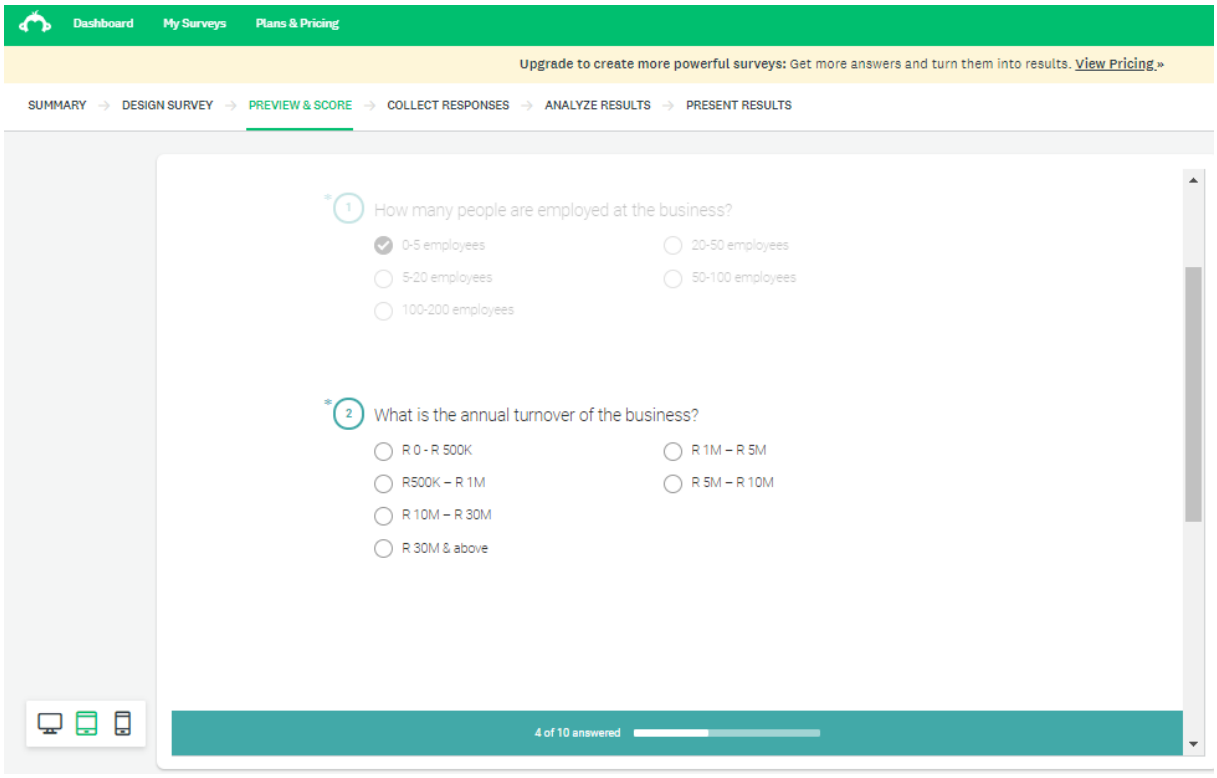
Plans & Pricing
Upgrade to create more powerful surveys: Get more answers and turn them into results. View Pricing »
SUMMARY → DESIGN SURVEY → PREVIEW & SCORE → COLLECT RESPONSES → ANALYZE RESULTS → PRESENT RESULTS
Challenges facing product design SME's in Cape Town
5. Business size
* 1 How many people are employed at the business?
0-5 employees
20-50 employees
5-20 employees
50-100 employees
100-200 employees
* 2 What is the annual turnover of the business?
R 0 - R 500K
R 1M – R 5M
R500K – R 1M
R 5M – R 10M
R 10M – R 30M
3 of 10 answered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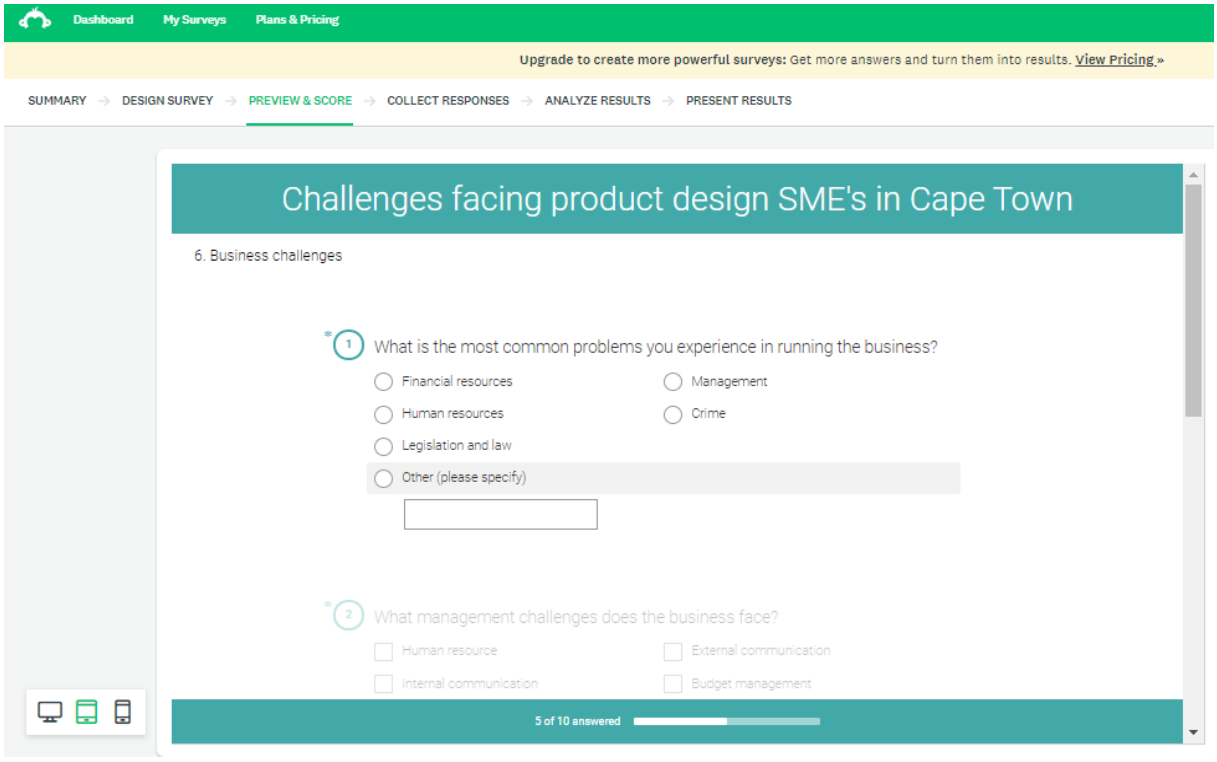
SUMMARY → DESIGN SURVEY → PREVIEW & SCORE → COLLECT RESPONSES → ANALYZE RESULTS → PRESENT RESULTS
* 1 How many people are employed at the business?
0-5 employees
20-50 employees
5-20 employees
50-100 employees
100-200 employees
* 2 What is the annual turnover of the business?
R 0 - R 500K
R 1M – R 5M
R500K – R 1M
R 5M – R 10M
R 10M – R 30M
R 30M & above
4 of 10 answered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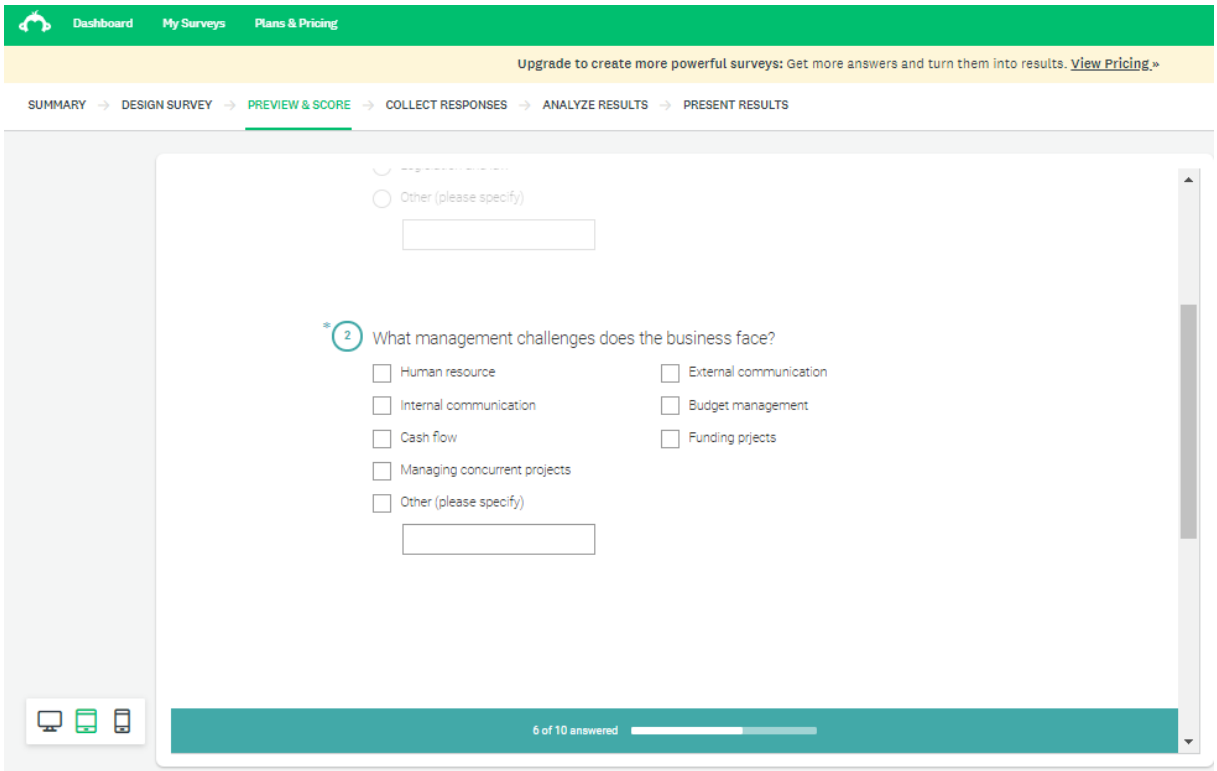
SUMMARY
DESIGN SURVEY
PREVIEW & SCORE
COLLECT RESPONSES
ANALYZE RESULTS
PRESENT RESULTS
Challenges facing product design SME's in Cape Town
6. Business challenges
*1 What is the most common problems you experience in running the business?
Financial resources
Management
Human resources
Crime
Legislation and law
Other (please specify)
*2 What management challenges does the business face?
Human resource
External communication
Internal communication
Budget management
5 of 10 answered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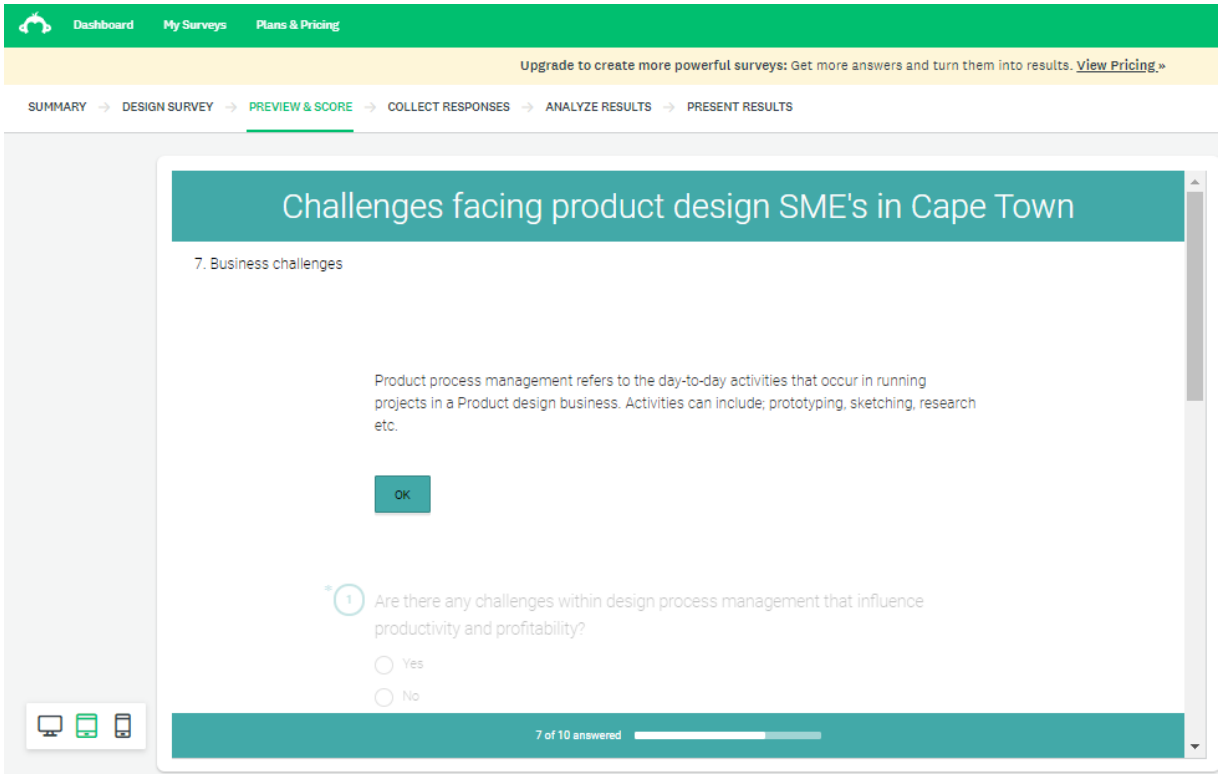
SUMMARY
DESIGN SURVEY
PREVIEW & SCORE
COLLECT RESPONSES
ANALYZE RESULTS
PRESENT RESULTS
Other (please specify)
*2 What management challenges does the business face?
Human resource
External communication
Internal communication
Budget management
Cash flow
Funding prjects
Managing concurrent projects
Other (please specify)
6 of 10 answered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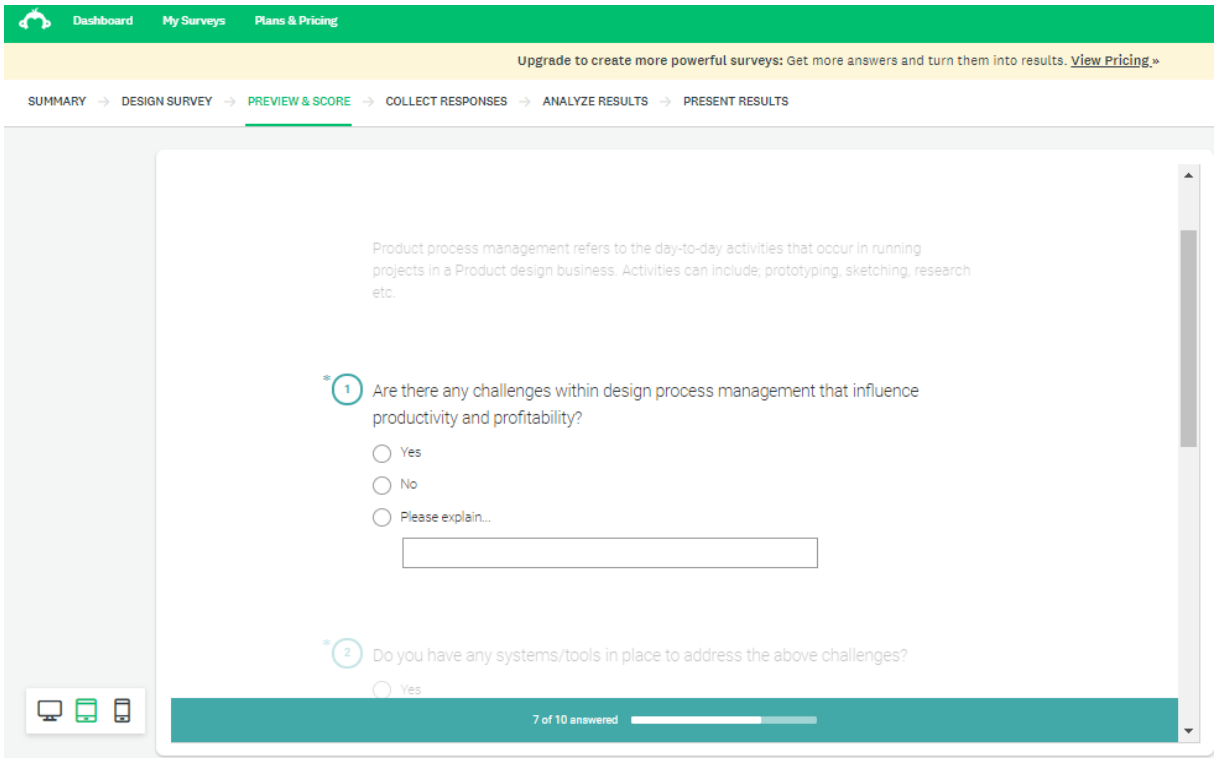
SUMMARY
DESIGN SURVEY
PREVIEW & SCORE
COLLECT RESPONSES
ANALYZE RESULTS
PRESENT RESULTS
Challenges facing product design SME's in Cape Town
7. Business challenges
Product process management refers to the day-to-day activities that occur in running projects in a Product design business. Activities can include; prototyping, sketching, research etc.
OK
* 1 Are there any challenges within design process management that influence productivity and profitability?
Yes
No
7 of 10 answered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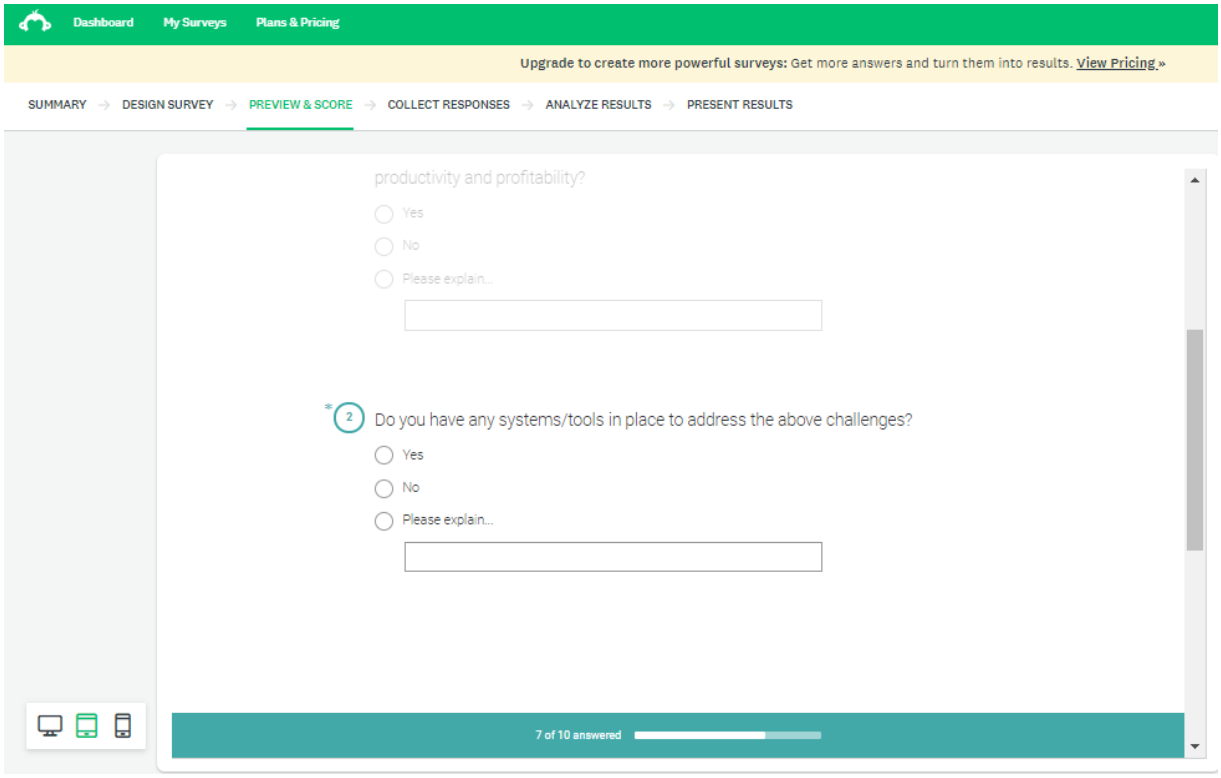
SUMMARY
DESIGN SURVEY
PREVIEW & SCORE
COLLECT RESPONSES
ANALYZE RESULTS
PRESENT RESULTS
Product process management refers to the day-to-day activities that occur in running projects in a Product design business. Activities can include; prototyping, sketching, research etc.
* 1 Are there any challenges within design process management that influence productivity and profitability?
Yes
No
Please explain...
* 2 Do you have any systems/tools in place to address the above challenges?
Yes
7 of 10 answered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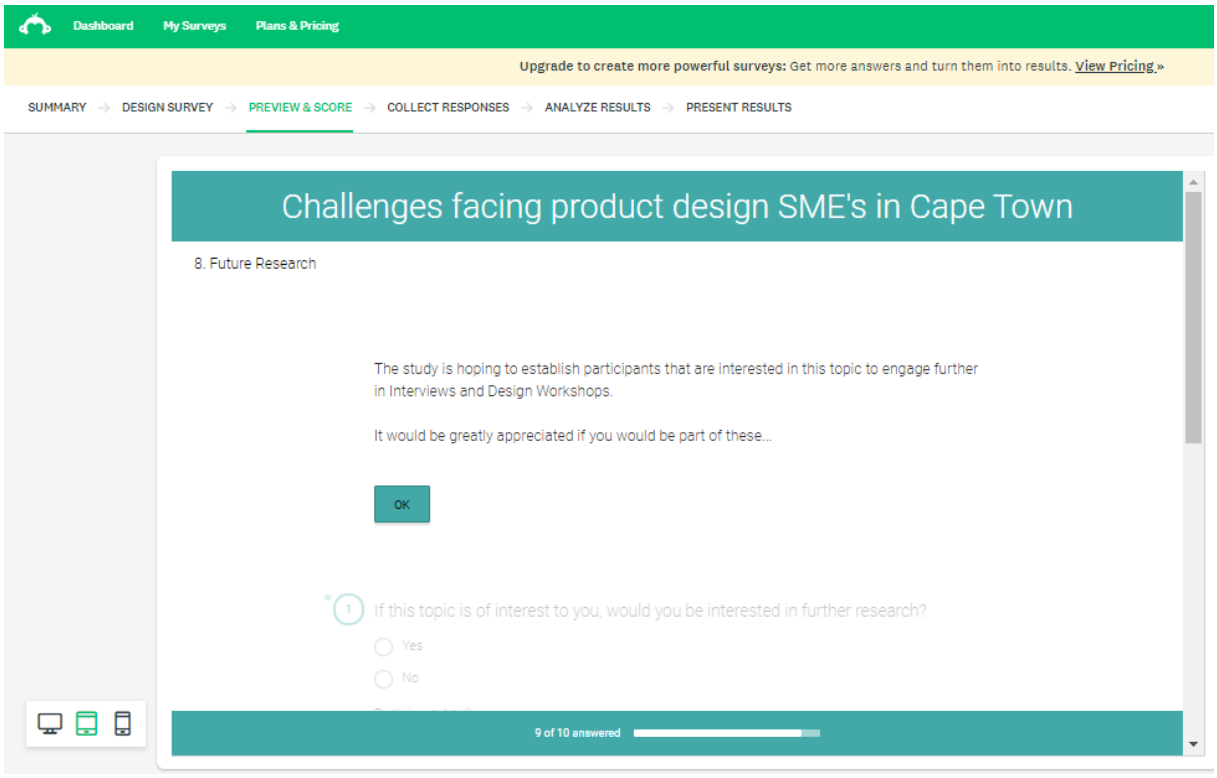
SUMMARY
DESIGN SURVEY
PREVIEW & SCORE
COLLECT RESPONSES
ANALYZE RESULTS
PRESENT RESULTS
productivity and profitability?
Yes
No
Please explain...
* 2 Do you have any systems/tools in place to address the above challenges?
Yes
No
Please explain...
7 of 10 answered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SUMMARY
DESIGN SURVEY
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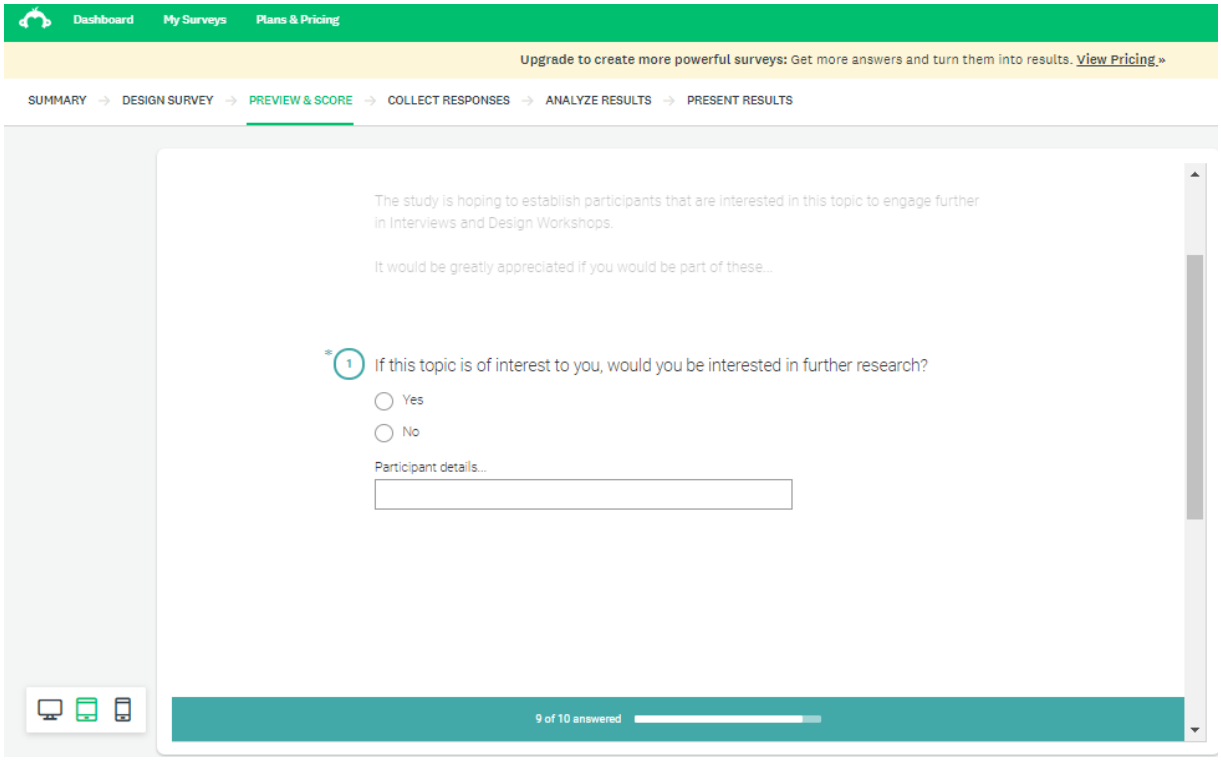
COLLECT RESPONSES
ANALYZE RESULTS
PRESENT RESULTS
Challenges facing product design SME's in Cape Town
8. Future Research
The study is hoping to establish participants that are interested in this topic to engage further in Interviews and Design Workshops.
It would be greatly appreciated if you would be part of these...
OK
* 1 If this topic is of interest to you, would you be interested in further research?
Yes
No
9 of 10 answered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COLLECT RESPONSES
ANALYZE RESULTS
PRESENT RESULTS
The study is hoping to establish participants that are interested in this topic to engage further in Interviews and Design Workshops.
It would be greatly appreciated if you would be part of these...
* 1 If this topic is of interest to you, would you be interested in further research?
Yes
No
Participant details...
9 of 10 answered

Appendix C: Design Thinking workshop details

Date: *October 2018*

Time: 17:00

Duration: 2 hours and 30 minutes

Location: *198 Buitengracht Street , Cape Town, Western Cape, South Africa.*

Facilitators: *Matthew Greeff*

Participants: Participants and their profiles can be found on pg. 38 under heading 3.4.2.1. Participant profiles: semi-structured interviews and design workshop.

Process:

Each participant was given a specific coloured post-it and pen to track individual data between participants. This was done to easily track participants input.

Workshop activity breakdown:

- Co-defining key challenges within product design businesses
- Co-defining existing key tools or systems used within product design businesses

For the above 2 activities the same method was used and was as follows.

A4 pieces of paper were printed and placed up on a board, each with a different aspect of the main activity at hand. Participants then were asked to discuss and co-define each point on the different pieces of paper, placing respective post-its with data written on it that was decided by the group as to be valuable. Participants were also able to collectively add more points under each of the activity topics. These were photographed as well as an audio recording. Refer to Figure.19 on Pg. 72.

- Defining the key challenges as well as existing tools and systems hierarchy

Participants were individually handed out 2 pieces of paper with ascending numbers, one to document key challenges hierarchy and another to document existing tools and systems hierarchy. Participants were then asked to individually write down the order of importance of the key challenges as well as existing tools and systems previously discussed in the first 2 activities. These were then collected and translated into a table.

Once the above individual activity was completed the participants were ask to collectively place the key challenges as well as the existing tools and systems on the A4 pieces of paper in a hierarchy, this was photographed for documentation and translated into a table.

- Ideating fundamental parameters that solutions need to address in order to promote and sustain successful product design SMEs.

The top three main challenges, co-defined and collectively placed in hierarchy by participants, were then discussed individually. Each challenge was addressed and parameters for solutions revolving around the challenges were discussed as well as mind-mapped onto sheets of A1 paper. This was repeated for all three main challenges. This was then photographed and translated into figures.

Appendix D: Western Cape Product Design Companies

1. Denka Design
2. Skeg
3. Crib creations
4. Plus Minus Zero
5. XYZ
6. Xcylabs
7. JesseJames Design
8. Rocketfuel
9. IDESO
10. Jared Mark Vorster
11. Yugen Design
12. Chrome Cherry Design Studio
13. Voltronics Cape
14. ART Mechatronics LAB
15. Design2rise
16. Kyta Industries
17. G and A Electrical Contractors
18. Retief Krige Industrial Designers
19. Olopsant Design
20. Headstrong Steel Studio Pty Ltd
21. Africanpix.com
22. Technimark
23. Think Design
24. Bravo Design
25. Carrol Boyes
26. Cecile & Boyd
27. Formula D
28. Terrestrial
29. Fox & Wolf Creative