

**Loughborough University  
Loughborough Design School**

**Investigation of user-centred approaches to design  
practice in Botswana**

By

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## **Abstract**

Increased competition of product offering has led to the need to better understand the end-user, in order to create a more appropriate product. Furthermore, the ever increasing individualistic culture has led to the need for more customised products; where a New Product Development (NPD) team has to balance user needs and wants. Initial study assumptions were that the more the user involvement the better the product outcome.

The aim was to investigate design awareness and use of User-centred Design (UCD) practices in full in the design industry in Botswana; and the training needs of the design industry in relation to UCD. Literature review determined the study focus areas; design awareness (DA), design practices (DP) and UCD. Best global practices were identified since there was little to no literature on UCD practice in Botswana and the researcher investigated products developed for the Base of the Pyramid (BoP). This study has been carried out from the NPD team's perspective.

Data collection began with the scoping study, which provided an early overview of UCD practice utilisation in NPD; it also provided a guideline to data collection in Botswana. The survey study provided a broader overview of the use of design and UCD practices within the design industry. The interviews provided a follow-up to questions arising from the survey study and are focused on the Graphic and Advertising (GA) and Furniture and Interior (FI) industries for more in-depth analysis. The case studies were conducted to better understand how specific projects were conducted in relation to UCD practices; they also provided an evaluation mechanism for findings from previous studies. The results show case study findings correlating with findings from previous studies; the lack of documentation, heavy user involvement at the "start" stage of the PDP followed by the "end" stage. The vast majority of the participants failed to obtain product needs directly from the end-user and instead used the client as a proxy for the user.

Design is viewed as an act of planning; user reaction was also viewed as the most important measure of design effectiveness. The majority of participants reported educational institutions not offering the needed skills. Two thirds of the participants did little market research; but the majority agreed user involvement in the PDP was important and that the user can effectively share ideas with the NPD team. The data was not clear as to whether, user involvement helped or hindered NPD team's creativity. The researcher's views on the user involvement in NPD have evolved to the need of an organised way for obtaining and documenting user and product needs, instead of treating the user like a co-operation partner. More case studies are expected to evolve case study questionnaire to, a tool for facilitating UCD practice use in Botswana's design industry.

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CHAPTER ONE

# **INTRODUCTION**

# 1 Introduction

## 1.1 Background

This research compares the application of a User-Centred approach to design with the methods used in Botswana's industry. The need to investigate this area of design was highlighted from the researcher's experience of being a design student (bachelors and master's degree levels) and a design lecturer. Given this experience the researcher realised that a product is only useful if it has a potential user.

Furthermore, product development failures are more expensive when more time and resources are already invested in a project. Successful product development processes depend on early identification of a product's faults and getting the product right the first time. Additionally, Rogers (2003) as quoted in Veryzer and Borja de Mozota (2005, p138), points out that 49–87% of the variance in the rate of adoption of innovations are explained by 5 attributes; relative advantage, compatibility, complexity, trialability and observability. All these attributes can be associated with the user's perception and interaction with a new product, therefore, highlighting the need for this research project; Investigation of user-centred approaches to design practice in Botswana. More than half of the Botswana's GDP comes from diamonds and the country has been trying to diversify the economy towards manufacturing and services.

With aspirations of continuing being a lecturer and an entrepreneur; the researcher realised the importance of understanding user wants, needs and aspirations. Instead of making a product that the designer thinks the user needs, this research is carried out on the assumption that more user involvement in the new product development process will lead to a more appropriate product.

This research will enable the researcher to attain and share an in-depth understanding of Botswana's product development processes (PDP) and the involvement of the user in industry and industrial design training. The aim of the research is to investigate user involvement in design practice in Botswana.

## 1.2 Botswana

Botswana is a landlocked country situated in Southern Africa; its land area covers 581 730 sq. km, about the size of France. It borders South Africa, Zimbabwe, Zambia and Namibia (see Figure 1). The population of Botswana is estimated to be 2,065,398 (July 2011 est.) and it is concentrated on the eastern part of the country. The capital city is Gaborone, with a population of 196,000 (2009) and the total urban population accounts for 61.6 % of the population. 62.2 % of the population is aged between 15-64 years, thus the majority of the population is of a working or employable age. 97.7% of the eligible population is enrolled in primary and secondary education, and the total adult literacy rate is 83% of the population. The country has a substantial and literate working population. Sources: World fact book [online] (2011), Statistics (UNICEF) [online], 2010, and World Statistics Pocketbook [online], 2012. Most of Botswana's population is along the border with South Africa which explains the close ties between the two countries (see Figure 2).

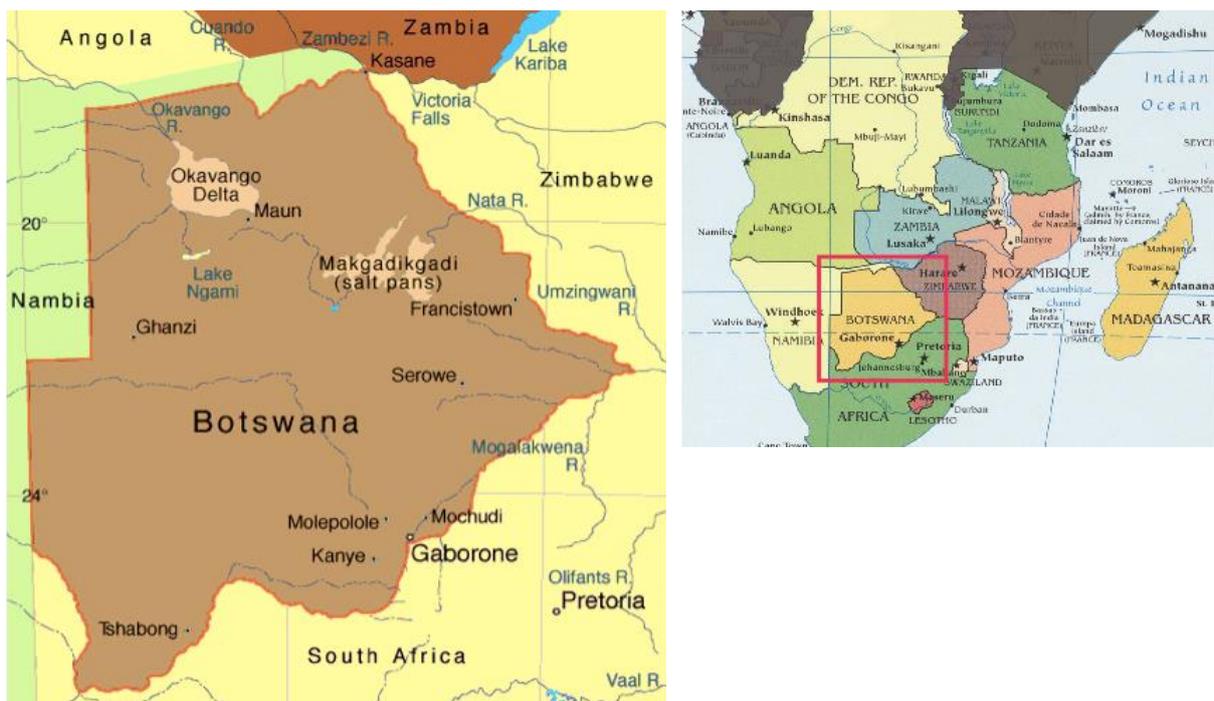


Figure 1: Map of Botswana. Source: Infoplease [online] (2011).

Botswana's economy is based on mineral extraction, particularly diamond mining, however tourism is a growing sector, with 38% of total land area devoted to national parks, reserves and wildlife management areas, Travel Companion (2008). There

are attempts to diversify the economy away from just mining (raw materials) to a more knowledge-based manufacturing. Additionally, the country is also weaning itself from exporting raw materials by adding value to these raw materials prior to export.

### 1.2.1 Botswana population Distribution

The darker coloured areas on the map show areas of high population density (>20 persons per km<sup>2</sup>) while the lighter coloured areas represent the lowest population density at (<1 person per 10km<sup>2</sup>). It is evident that Botswana's population is concentrated on the eastern part of the country, mostly along the border with South Africa.

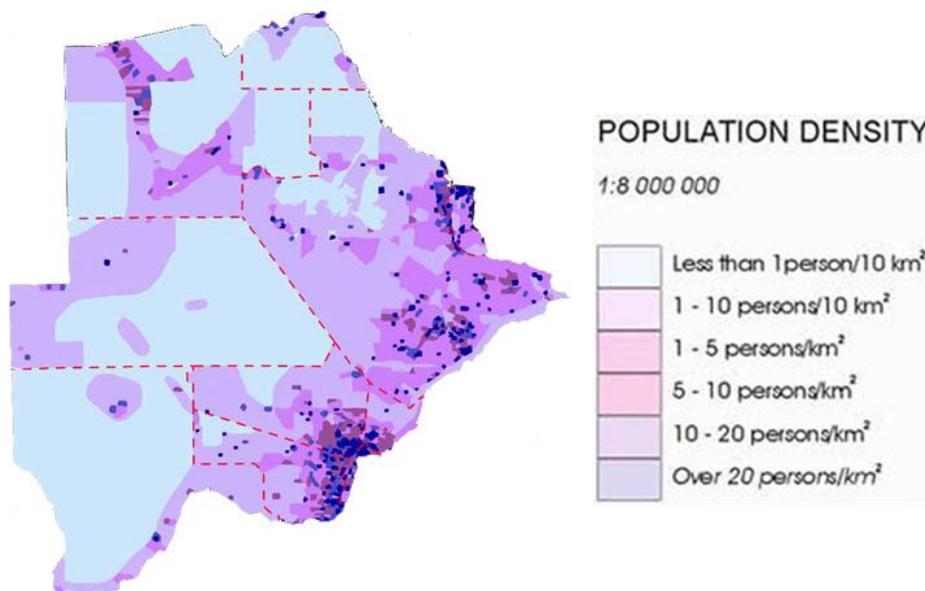


Figure 2: Botswana Population Density. Adapted from: Population Density Map (2010).

Physical borders with the neighbouring countries cut through cultures and tribes along the border areas. For example, tribes along Botswana's southern border are in both Botswana and South Africa; while the ones in western Botswana are in both Botswana and Namibia. Having most of the Botswana population along the south-eastern border with South Africa explains the closer similarities between the two cultures (see Figure 1 and Figure 2).

The tables and graphs generated on the International Monetary Fund (IMF) data mapper are a comparison of Botswana and fellow Southern African Development

Community (SADC) member states namely: Angola, DRC, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. IMF is a group of 187 countries working to encourage global cooperation, financial stability, and sustainable growth and reduce poverty around the world, IMF Data Mapper [online] (2010).

Given Botswana’s small population, trade agreements between the SADC member states presents a potential market for Botswana produced products. Figure 3 shows Botswana’s population compared to the SADC region plotted against the country’s GDP. Botswana has the fourth lowest population size, below the region’s average, with the highest population size being DRC, South Africa and Tanzania in that order. Of these three, South Africa’s cultural ties with Botswana, its proximity and the high GDP make it an attractive market for Botswana produced products.

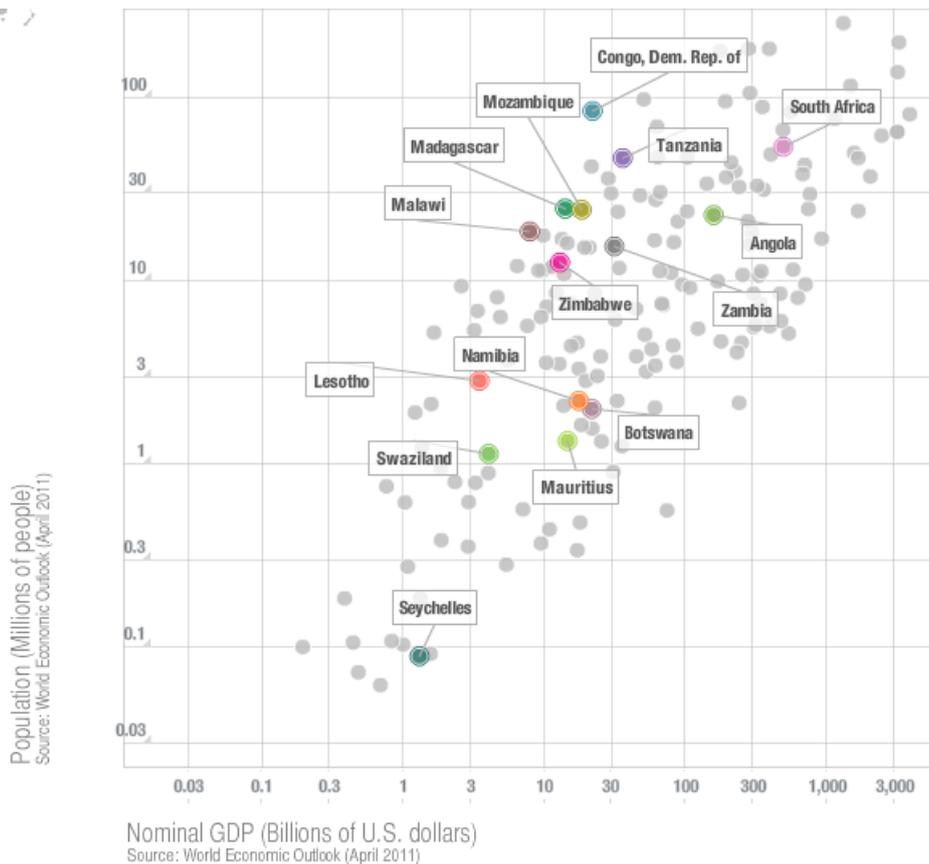


Figure 3: Nominal GDP vs. Population of SADC member states. Source: IMF Data Mapper [online] (2010).

### 1.2.2 Vision 2016

Vision 2016 is Botswana's national strategy developed in 1997, to propel the country into a competitive, winning and prosperous nation by year 2016 (Vision 2016, 2010).

The vision is based on the following objectives;

- An Educated, Informed Nation
- An Open, Democratic and Accountable Nation
- A Moral and Tolerant Nation
- A United and Proud Nation
- A Safe and Secure Nation
- A Prosperous, Productive and Innovative Nation
- A Compassionate, Just and Caring Nation

## 1.3 Research overview and structure

### 1.3.1 Definitions

- Creativity: Papanek (1984), describes creative thinking as accruing in different ways; there is a sudden, momentary insight –the “spark of genius” –that sometimes comes to us in a binding flash of revelation. No one has a clear explanation of this process.
- Industrial Design (ID): Cliver (2010, p1) describes “design [as a] professional service of creating and developing concepts and specifications that optimize the function, value and appearance of products and systems for the mutual benefit of both the user and the manufacturer.” Similarly, Veryzer (1995) as quoted in Hertenstein et al. (2005, p5) refers to design as “process of enhancing the value, utility, appearance, and manufacturability of a product/ [service].” Designers often find themselves being part of a team consisting of several individuals belonging to different professions. Furthermore, Papanek (1984, p28) points out “besides fulfilling their normal design function, they must act as a communication bridge between other team members.”
- Persona: “Representations of behavioural and motivational aspects of target users,” explains Veryzer and Borja de Mozota (2005, p134).

- Scenario: Park (2011) describes a scenario as a short story describing a product concept, and its use; can be generated using five parameters people, time, space, objects, and circumstances. The use of scenarios may also help focus the design process through putting a face and context on to the 'user'; thus the 'designer' is in a better position to empathise with the user.
- Tacit Knowledge: "It is the ability of a competent practitioner to understand how to produce or accomplish something – a craftsperson or one with habituated skills," points out Poggenpohl (2009, p4).
- Explicit Knowledge: This is the knowledge that can be taught or learned; usually there are methods which then allow the explicability of the product process.
- Integrated design: Integrated Design is not a set of skills, techniques, or rules but should be thought of as a series of functions occurring simultaneously rather than a linear sequence," Papanek (1984, p295).
- Integrated Innovation Process: It attempts to take into consideration all the factors and modulations necessary to a decision-making process, Papanek (1984).
- Research: Strives towards development of knowledge that may apply in several contexts, De Jong (2002).
- Westernisation: Is described by Leong (2003) as a home to science, democracy, rationalism, freedom, and individuation; and poses universalism as a value that has become identified as the "social solvent" of most developed countries today.
- Usability: "extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use," ISO 9241-11 (1998) as quoted in ISO 9241-210 (2010, p3).
- Lead User: These are potential users likely to be the first to adopt a new product; they are usually technology knowledgeable and more likely to modify a product to suit their needs. To optimise a new product a mix of lead and normal users is usually necessary. Lead users are involved to make the product technologically relevant to the competition and then normal users are necessary to ground a product to reality, Sandmeier, et al. (2010).

- Emerging Markets: Arnold and Quench (1998) as quoted in Luiz et al. (2010) describe “emerging markets” as countries that have put in place government policies favouring economic liberalisation and the adoption of free-market system and are achieving a rapid pace of development.
- Developing World: has been described as a region of the world where laws are still at their infancy and the accompanying enforcement programs are far from effective, Hilson and Marck (2000) quoted in Kumah (2005).
- Third World: Kamrava (1995, p700), describes “Third World” as political cultures that “tend to be tenuous, impermanent, fragmented and even if recently democratised, still without social resonance”.

### 1.3.2 Abbreviations

- NPD: New Product Development
- R&D: Research and Development
- PDP: Product Development Process
- UCD: User-centred Design
- DA: Design Awareness
- DP: Design Practice
- FI: Furniture and Interior design
- GA: Graphic and Advertising design

### 1.3.3 Initial aims and objectives of the project

The aim of this research is to improve design effectiveness in Botswana’s industry by encouraging a user-centred approach. To achieve this aim, the following objectives were formulated;

1. Ascertain current understanding of UCD globally and in Botswana.
2. Explore the teaching of UCD in industrial design training institutions in Botswana.
3. Explore the training needs of companies in Botswana in relation to UCD.
4. Identify interventions to improve design performance.

The research begins with the investigation of UCD practices around the world. Exploring how a range of experts understand the following terms UCD, design

practice and product design. These are then compared for similarities or repetitions and the best practice(s) are identified as global practices.

The research then proceeds to identifying current product design practice and design processes in Botswana's industry, education and government policies. These areas are also explored to identify evidence of UCD being practiced in new product development, how they are influenced by cultural influences, environmental, material availability and the country's target goals.

The best global practices are in turn compared to Botswana's practices, with an aim of improving the design practice in Botswana. It is proposed that Botswana's best practices would be kept and then enriched through the incorporation of the relevant best practices from around the world.

CHAPTER TWO

# **LITERATURE REVIEW**

## 2 Literature Review

The researcher approached this research with the aim of finding the best way to make a more appropriate product for the user and at reasonable price. Botswana has a very small market and design companies are forced to target the region (Southern Africa) in order to grow. These companies have to be able to understand the potential user and these different cultures; and UCD process (ISO 13407) provides a method for making a more appropriate product. UCD process was selected as it targeted the reason why any product is made, the user. The researcher believed it was essential to make a product right for the user for a product to be successful. Furthermore, a PDP can be followed successfully, but if is based on faulty user information the product has lesser chances of succeeding on the market. Thus, UCD was viewed as essential for product success on the market.

### 2.1 Scope of the research

The principal function of problem framing is to elicit, capture and interrogate knowledge about the problem. Furthermore, “to agree on the boundaries of discussion, achieve shared understanding and facilitate mutual commitments among a heterogeneous decision making group,” Rosenhead (2001, p154).

#### 2.1.1 Literature review of areas of interest

Figure 4, depicts the relationship between the different areas of interest and their relationship to the literature review. It also shows literature review areas of interest to gather information on global best practices and Botswana’s best practices. Literature areas of interest include, *design awareness* (DA), *design practice* (DP) and *user-centred design* (UCD) data.

The literature review will focus on references in the period 1980’s–2014. This is because this is when participatory, co-design, and other related concepts started to emerge. By the 1980’s intense competition had forced organisations to seek ways to gain a competitive edge on rivals. With the user having more choices, knowing what the user wants was increasingly seen as an avenue towards making desirable products. The review is also looking at material written in or translated into the English language only.

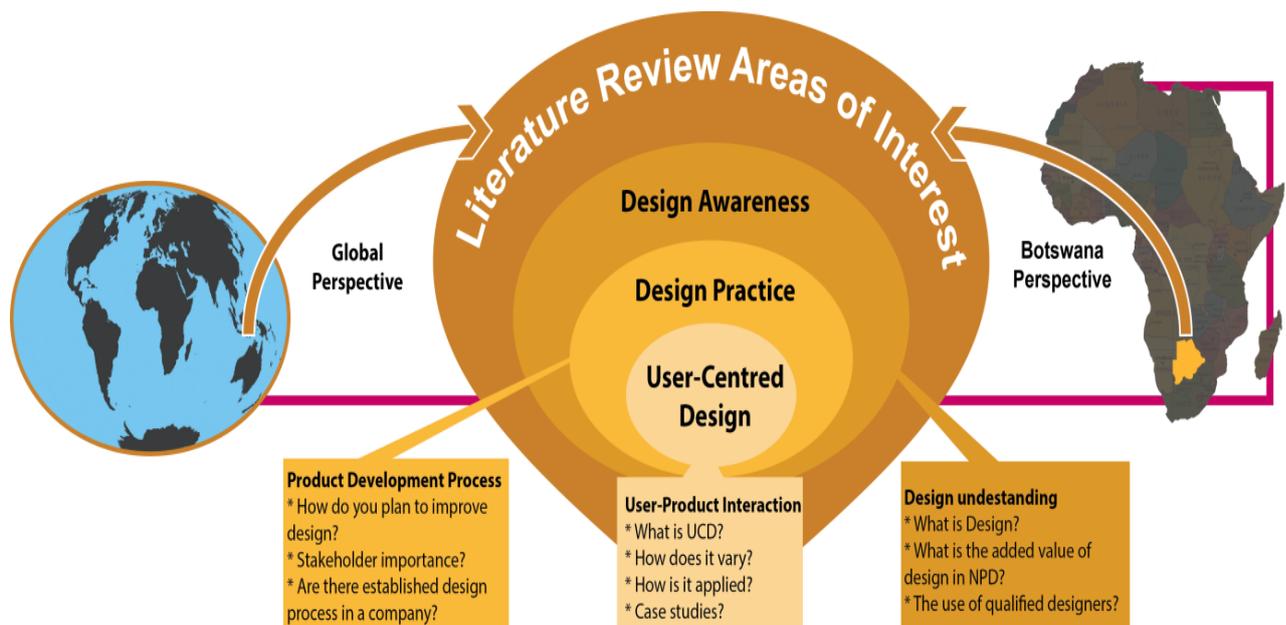
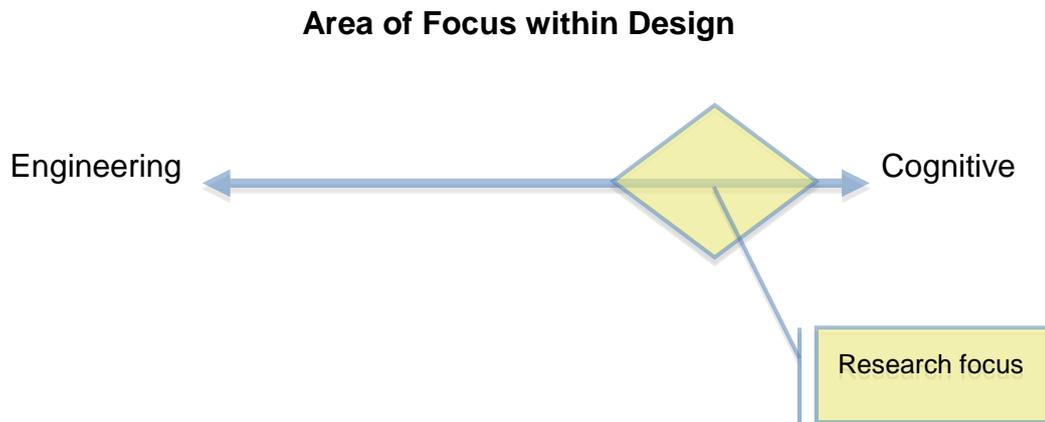


Figure 4: Represents research areas of interest.

### 2.1.1.1 Engineering or cognitive design focus

Engineering (technology driven) design in this context refers to the product development process i.e. product architecture and hardware and cognitive (user-orientated) design refers to the user-product interaction i.e. emotionally and tacitly. Both engineering and cognitive driven product development approaches can lead to successful products. Veryzer and Borja de Mozota (2005) also see addressing NPD problems as requiring a process that benefits from interplay between user-orientated and technology-driven forces as shapers of products.

The focus of this research is much closer to the cognitive aspect of design since this research is focused on UCD and the needs of the user. Also, NPD in Botswana is still in its infancy, thus much less engineering intensive (see Figure 5). The cognitive focus allows the research to be applicable to a wider number of industries, leaving options to focus on any industry of choice. Therefore, the research will have to be qualitative as it involves sociocultural behaviour, the interaction between the product, user/customer and the design team.



**Figure 5: Research focus area with respect to Engineering and Cognition aspects**

### **2.1.1.2 Key Words**

Key words were noted to keep track of the library search areas. Some of the key words used in this research included; design, design practice, inclusive design approach, evidence based, user-centred, solutions focussed, user design, user participation, experience design, user communication, etc.

### 2.1.1.3 Information Sources

Information was collected from multiple published and unpublished sources; see Table 1 for research information sources.

Table 1: Research information sources.

<b>Information Sources</b>	<b>Format</b>
<b>Text books</b>	Paper and Electronic
<b>Reports</b>	Paper, spread sheets and Electronic
<b>Electronic Journals</b>	Electronic
<b>Promotional company publications</b>	Paper and Electronic
<b>Official government publications</b>	Paper and Electronic
<b>Electronic databases</b>	Electronic
<b>On-line retrieval systems</b>	Electronic
<b>Academic Journals</b>	Electronic
<b>Thesis/ dissertations</b>	Paper and Electronic
<b>Conference proceedings/ Paper</b>	Paper and Electronic
<b>Patents and standards</b>	Electronic
<b>Trade and technical journals</b>	Paper and Electronic
<b>World Wide Web</b>	Electronic and Spread sheets
<b>Zetoc Alerts, Design Observer</b>	Electronic

### 2.1.2 Review Areas and Authors

Table 2, represents areas of interest to this research and some of the key authors associated with each area. It gives an overview of the reviewed material to the reader. Since the research area is common to the review areas, some of the authors cover more than one review area.

Table 2: Review areas and some of the key authors involved.

Review Area	Authors and year
<b>UCD</b>	Amir, 2004; Baker and Hall, 2011; Balke-Schaub et al., 2010; Cain, 2005; Oosterlaken, 2009; Park, 2011; Papanek, 1984; Redstrom, 2005; Righi and James, 2007; Riley, 1993; Sandmeier et sl., 2010; Sato, 2009; Van Boeijen, 2009; Veryzer and Borja de Mozota, 2005.
<b>Design Practice</b>	Balke-Schaub et al., 2010; Bush, 2003; Cohen & Manion, 1989; De Jong, 2002; Hart, 1998; Leong, 2003; Papanek, 1984, Park, 2011; Poggenpohl, 2009; Pugh, 1990; Redstrom, 2005; Riley, 1993; Sato, 2009; Sudjic, 2008; Tomiyama, 2009; Veryzer and Borja de Mozota, 2005; Visser, 2009.
<b>Design Awareness</b>	Brown, 2009; Cliver, 2010; Franscara, 1997; Julier, 2008; McCoy, 2003; Norman, 2003; Papanek, 1984; Redstrom, 2005; Southoff, 2004; Sense, 2003; Sandmeier et sl., 2010; Sato, 2009; Sudjic, 2008; Tomiyama, 2009; Veryzer and Borja de Mozota, 2005; Vienne, 2003; Visser, 2009.
<b>Design Application in the Developing World</b>	Amir, 2004; Baker and Hall, 2011; Bottema, 2009; Chang, 2009; Diehl, 2009; Findlater, 2009; Hofstede, 2005; Kandachar, 2009; Leong, 2003; Oosterlaken, 2009; Rocchi, 2006; Semanis and Hart, 2006; Sutherland, 2004; Southoff, 2004; Thomas, 2006.
<b>Botswana</b>	Moalosi, 2010

## 2.2 Research Procedure

The literature review involved making sense through discussing (agreeing or disagreeing) with the gathered data and getting consensus from the reviewed material. Consensus was not always possible, but it was important to recognise the arguments arising from different points of view.

The method followed to analyse the data was adapted from Ridley's (2008) system of note cards. The reviewed literature was summarised on a Word document. This

consisted of summaries of the read material (i.e. chapters, journals). The word document was printed, colour coded and then cut into strips of individual statements. These strips were used instead of note cards described by Ridley (see Figure 6).

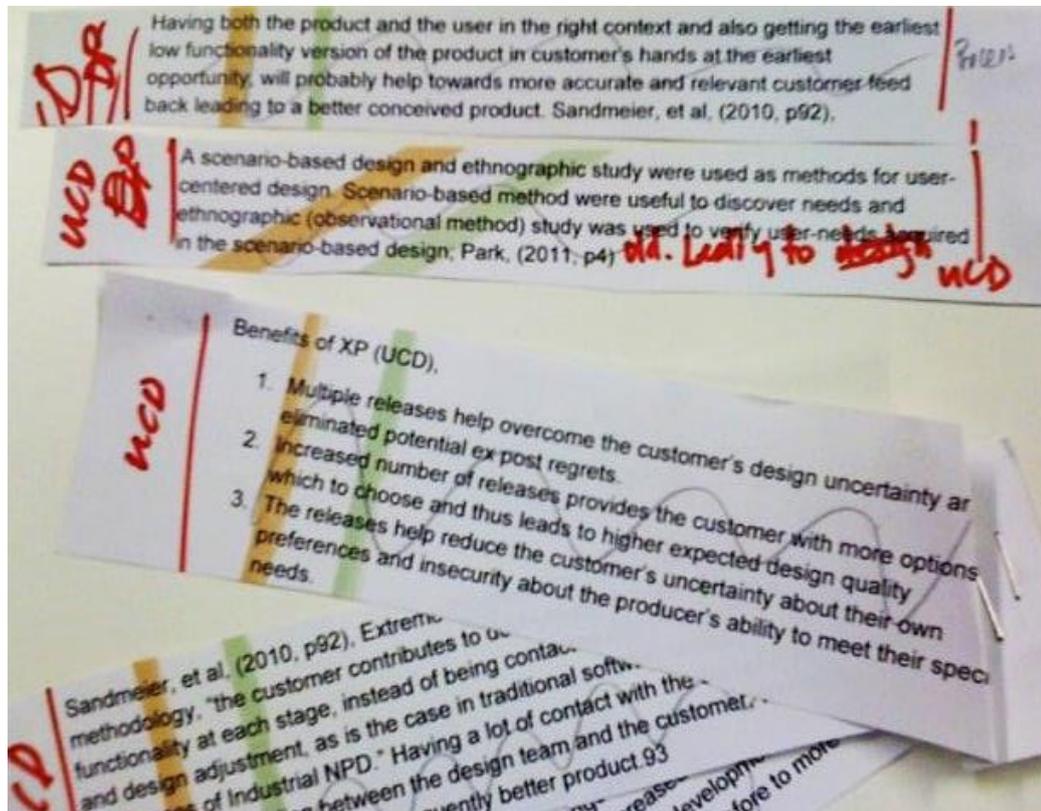


Figure 6: Cut-outs of literature review summaries.

The colour coding was necessary in re-tracing each statement to the reference. The cut-out information from different sources was grouped into clusters (i.e. UCD, DP, and DA) of similar information on a wall. Cluster analysis began with summarising groups of statements onto statements representing the individual groups onto Post-it Notes to reduce the clutter and have a better overview of the data (see Figure 7). This process was based on identifying repetitions/synonyms, similarities and differences in each of the clusters.



Figure 7: Post-it Notes summarising cut-outs from Figure 7.

Cluster analysis allowed the most important areas within each cluster to be revealed therefore giving more clues to where data collection should focus. Analysis of data on a table top instead of a computer provided a better overview of the data collected and made the experience more tangible. Initial clusters were more abstract (of a general area), and become more specific as the data was refined. The main clusters of interest included; Design Awareness (DA), Design Practice (DP), User-Centred Design (UCD), developing world (Case Studies) and Botswana. In addition to the main clusters the analysis process revealed the sub-topics within each of the mentioned clusters.

### 2.3 Design Awareness (DA)

All design should “start with a need, that when satisfied will fit into an existing market or create a market of its own,” Pugh (1991, p5). Design is increasingly interested in user-product interaction, i.e. how the user wants to be perceived? How a product is perceived by the user? Is the product usable? Design is increasingly attempting to answer these questions. Franscara (1997, p23) corroborates these assertions, “in addition to projects meeting their specific functions, we choose our objects to help us

communicate with others, to show aspects of ourselves.” Moreover, “prospective innovators need to carefully cultivate designs that assimilate some elements of the familiar, along with novel features, into new product embodiments that can be readily interpreted and willingly embraced [by prospective users],” Veryzer and Borja de Mozota,(2005, p138). It is evident that just knowing the user is not enough. It is important to also be aware of the broader context within which the user exists.

Sudijc (2008, p6), describes design as having grown around the two fundamental ideas;

- One is that a design is a response to a brief. Designers are posed with a problem, and find a way to solve it. However, design as a response to a brief, gives a narrow view to how designers find problems; a designer has to also have an ability to identify problems around their communities and then find ways to solve them.
- The other is that design is essentially democratic as it aspires to mass production and affordability. Despite the difficulty in making such a product, the economies of scale may mean a faster return on investment.

Design “contributes to improved profit margins relative to sales through its impact on selling price, demand, product costs, and other expenses,” Hertenstein et al. (2005, p7). It is also important to understand that the intended product message (e.g. what it means to the user) does not always align with the user’s perception; also the intentions of how the product ought to be used may not always transfer to how it is actually used. Therefore it is important for the designer to work closely with the user. It is also important to have an ability to anticipate what other ways (unconventional) a product may be used and then build in contingencies to such scenarios (especially true for children’s toys). The product gets to the market quicker and at a lower price. The designer’s intuition helps avoid law suits emanating from unconventional product use.

### **2.3.1 NPD Process Models**

Design processes offer a structure to be used in NPD processes. This is an effort to further develop the product design field, by establishing reliable, predictable and efficient processes for NPD. Hsu (2013), classifies measuring NPD performance in

terms of financial and non-financial aspects. Furthermore, Hsu (2013, p66) describes six criteria used to measuring NPD performance namely; “reaching the sales volume goal for new products by percentage; financial percentage of reaching the sales return goal for new products; technical ability promotion of new products; company brand image and promotion by new products; and customers’ non-financial appraisals of new products.”

Therefore, to better understand the NPD process, it is essential to understand how design models were derived and how they relate to other methods. The empirical cycle and Hall’s cycle were investigated to understand origins of creative ‘practical’ process models. Furthermore, a basic design cycle and the engineering design model (Pahl & Beitz (1984)) are compared to better understand NPD process models (see Figure 8).

### **2.3.1.1 Empirical Cycle**

This is a cycle by de Groot (1969) as cited in Roozenburg (2008). The cycle begins with the *observation* of the situation, on which a problem solver has to act. The problem solver then explores possible solutions (*suppositions*). *Expectations* from possible solutions are envisioned. Followed by *testing*, thus comparing expectations with desired effects from the observation stage. The final step involves using what was learnt from this cycle.

The development process will involve several cycles, each implementing what was learnt from the previous cycle. The empirical cycle gives structure to the ‘trial and error’ process making it a conscious and purposeful form of a thought process. De Groot describes the empirical cycle as a very general model, the actual implementation of which can be different in different fields.

### **2.3.1.2 Hall’s Cycle**

Roozenburg (2008) describes Hall’s cycle as applicable to complex practical problem solving in general. It is a specific use/adaptation of the empirical cycle to the field of systems engineering. Therefore, this model can be viewed as a link between the empirical cycle and the basic design cycle. The description of the steps is as follows;

The first step *problem definition* involves studying whether a need is real. *Value system design* involves planning on how to find a solution to the identified need and

set the evaluation criteria. *System synthesis* is a 'trial and error' process aimed at implementing the value system design. *System analysis* involves the evaluation of the alternative solutions generated in the system synthesis phase. *Selecting the best system* is the process of comparing the alternative solutions to the evaluation criteria formulated during value system design. Finally, the *planning for action* stage is the implementation of the of the chosen solution

### **2.3.1.3 The Basic Design Cycle**

The basic design cycle is a more specific form of a problem solving model, derived from Hall's cycle; also considered the most fundamental model for designing. Roozenburg (2008, p58) points out that "someone who claims to have solved a design problem must have gone through the design cycle at least once." The steps of the design cycle as described by Roozenburg (2008, p59-60) are;

Analysis involves outlining the intended functions of a new product. The designer predicts problems associated with such an envisioned new product. The step concludes with the formulation of the 'problem statement' and the criteria to be met by the solution. Synthesis is the least tangible step of the design cycle and therefore the least understood as it has to do with the thought process. The result of the synthesis step is the tentative design, the externalization of an idea, i.e. written/verbal statement, sketch or model. Simulation is the envisioning of the proposed product's behaviour. The process can be based on the designer's experience or on scientific evidence. This step results with the expectations about the properties of the proposed new product. Evaluation involves the value of a proposed design. The proposed design is compared to the evaluation criteria, developed in the analysis step. The closer the proposed design is to the evaluation criteria the greater the acceptability chances. Decision step, involves a "go" or "no go" decision on the proposed design. If it is accepted then the proposed design is developed further; if not, the design cycle is repeated to come-up with a better idea.

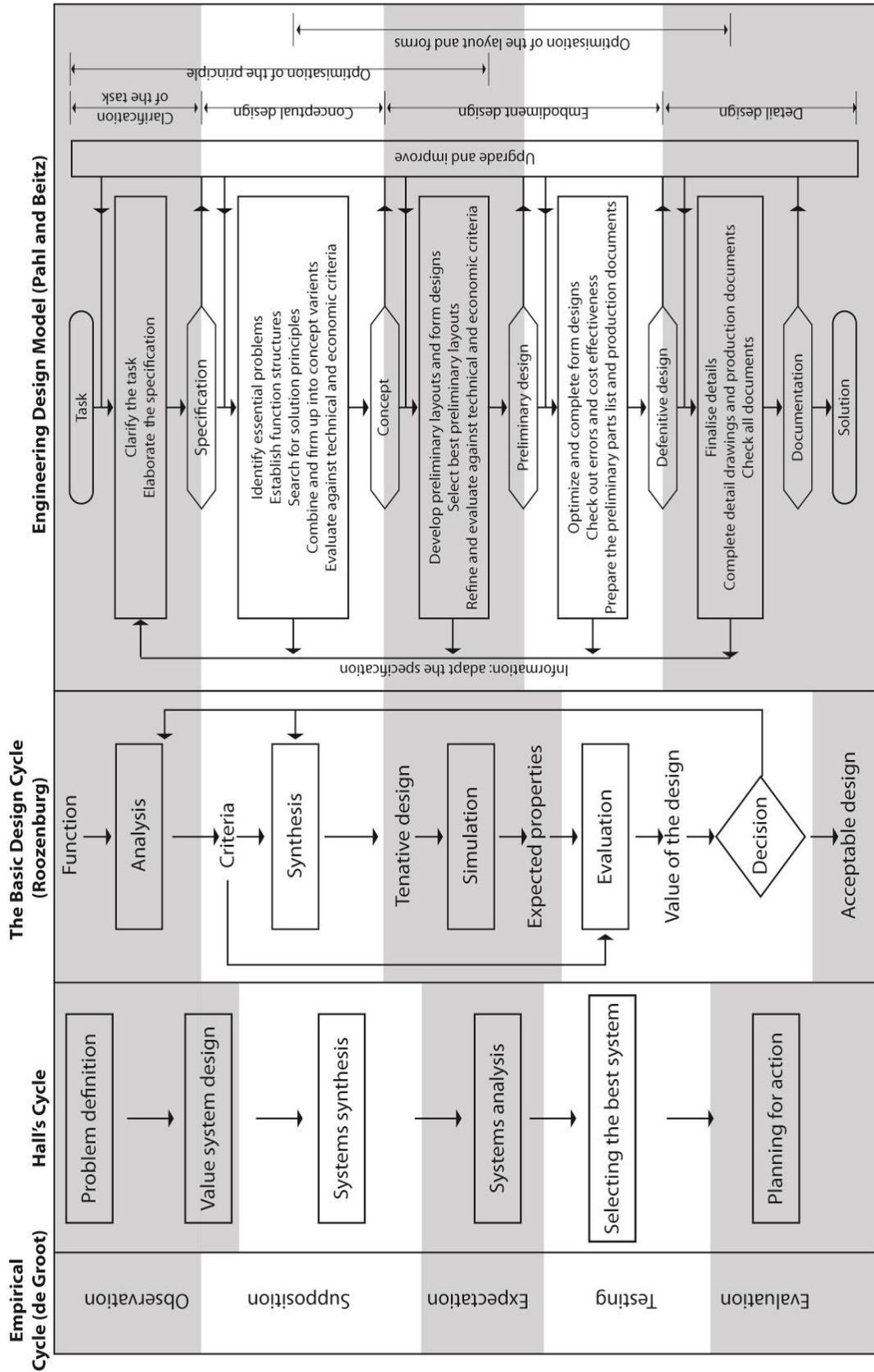


Figure 8: Design model origins and relationships: Adapted from De Groot, Hall, Rozenburg and Pahl & Beitz.

#### 2.3.1.4 Model of Engineering Design (Pahl and Beitz)

As described in Roozenburg (2008, p64-67), this is a more engineering inclined design process, thus more product development process inclined and detached from the user-product interaction. The model is made up of the four phases, clarification of the task, conceptual design, embodiment design and detail design.

*Clarification of task*, involves gathering information on the problem and product requirements drawn-up. As the work progresses the problem is understood better and the product requirements evolve accordingly. *Conceptual design*, begins with the implementation of the products requirements. This is followed by determining product overall function and important sub-functions to be fulfilled and establishing their interrelationships. “Conceptual design is commonly seen to be the most important phase of the design process, because the decisions made here, will strongly bear upon all subsequent phases of the design process,” argues Roozenburg (2008, p66). *Embodiment design* is the continual refinement of the concept into the definitive design. The layout, form and material of the proposed design are determined; functionality, consumer preference, reliability and manufacturability are also evaluated. *Detail design* involves finalising the product dimensions, materials to be used and the production plans.

Figure 8 shows the relationship between the NPD process models, empirical cycle, Hall’s cycle, the basic design cycle and the model of engineering design. It is evident that despite the models being designed for different fields of study, the primary process is essentially the same.

Design models consist of a structure that continually collects information (from user and context), utilizes the information and then gets back to the user and context for evaluation. Similarly, Sandmeier et al. (2010, p93) in their study describe “the foundation of XP’s [Extreme Programming] product development process is provided by short, highly efficient cycles of **accessing**, **releasing** and **absorbing** customer contributions.” For purposes of this research, the Basic Design Model has been simplified for easier understanding during data collection (see Table 3).

**Table 3: The Basic Design Cycle simplified: adapted from, Roozenburg (2008).**

Product Development Process				
	Analysis	Synthesis	Simulation	Evaluation
<b>Activity</b>	Task clarification and product requirements.	Establishing function structures and search for solution principles.	Develop preliminary layouts and form designs. Refine and evaluate against technical and economic criteria.	Optimise and complete form designs. Check out errors and cost effectiveness. Prepare part list and production documents.

### 2.3.2 History of Design

The historic review approach starts in the 19<sup>th</sup> century to the recent time. Julier (2004), has described teaching of design history as a recent activity; and it has only been taught in schools internationally since the late 1960's. Design history in this context helps better understand product development and how it evolved towards the need to better understand what the user wants out of a product. Individualistic culture and increased competition within the design industry drives the need for custom products; individualistic culture refers to the need to look apart from anyone else. Since design is a multi-disciplinary activity, design history has been taught from all these disciplinary perspectives. E.g., anthropometry, geography (location), marketing, and design process. The multi-disciplinary approach attempts to look at the origins of ID and the major milestones of user's influence on NPD. Thus the focus on the Industrial Revolution, Mass-production and The Consumer Society.

#### 2.3.2.1 Industrial Revolution: 1830 to date

"With the coming of industrialization, the history of industrial revolution also begins-around the middle of the 19<sup>th</sup> century" Hauffe (1998, p10). This is when products were in transition from being produced by hand (craftsman) and labour intensive to being done by machines, which are less labour intensive and more

efficient. Hauffe (1998) describes this period as from workshop to factory, where expensive and time consuming human labour was replaced by machine work.

The craftsman and some in the public saw this change as a threat to their way of living; and were keen to demonstrate the need for skilled workers. However, the machine could not reproduce products the public was accustomed to (ornamented and personalized); but on the contrary products were now becoming affordable. Electricity and the availability of chemicals lead to the establishment of industry. The user was barely involved or consulted (product features and functionality); NPD was mainly influenced by current trends and machine capabilities. With the help of new technologies industrial revolution keeps evolving to this day.

### **2.3.2.2 Mass-production: 1850 to date**

Hauffe (1998, p39), “mass production certainly enabled the production of modern utensils and furniture, but the products were often covered with ornaments, emblems and decoration.” The ability to mass-produce and to make profit is an integral part of product design; and it is what differentiates it from art (and possibly craft). “Fordism” is synonymous with this period of mass-production. Julier (2004, p87) describes Fordism as “a method of manufacture that has dominated economics in much of the developed world during the 20<sup>th</sup> century, namely mass production” developed by Henry Ford.

The main feature of this method was a move to make the industrial revolution more efficient through the introduction of a moving production line. Another feature of Fordism was the standardisation of components; economies of scale were now used to reduce component cost. User needs and societal needs were inseparable; the main objective of product development was making a product that was acceptable to the society at large. Mass production also continues to this day, new technologies have allowed mass-customisation to be more feasible. Instead of large volumes of the same product, customers/ users are offered a variety of products to choose from.

### **2.3.2.3 The Consumer Society: 1945 to date**

The development of plastics after World War II meant that products could be made cheaper and in a much greater variety of form than had been previously achievable. Competition within industries had now shifted from functionality to

using aesthetics (product look and appeal) as a source of competitive edge. Brown (2009) points out that, the primary goal of design thinking is to use aesthetics to gain competitive advantage on the global market. Hauffe (1998, p107) described the trends showing “little interest in severe geometrical forms of functionalism, but in flowing light lines that bore some relation to the human body”.

The 1990's saw organisations attempting to sell the product experience instead of just better product aesthetics. Furthermore, Julier (2004) observes, branding and cultivation of brand loyalty taking a more central role in organisations. Visser (2009, p30) describes the end of the 1990s, design activity as “mostly opportunistically organised: designers proceed in a non-systematic, multidirectional way.” With the incorporation of virtual 3D modelling into NPD; suddenly a product could be designed and tested/ simulated with accuracy prior to building a physical model. Likewise, Veryzer and Borja de Mozota (2005, p129) view NPD as driven much by technological innovations and R&D labs that are in search of product application as it is by desire to satisfy established user needs. The new capabilities offered by 3D modelling, have played a major role in what is now known as mass-customisation.

Only the start dates of the design history era are given as the researcher understood these different eras continue to contribute to how products are currently produced. Sudijc (2008) describes design work at the Milan Design Fair 2007, products were observed to be getting more artistic while maintaining some form of functionality. This trend can also be viewed as design re-incorporating its artistic origins to NPD. This trend is mainly influenced by greater product competition, thus an avenue to gain a competitive edge. In order to gain this competitive edge organisations are increasingly involving the user in their PDP.

Veryzer and Borja de Mozota (2005) and Balke-Schaub et al. (2010), describe the traditional role of design as having been mainly focussed on the design of products and viewed as a service within an organisation or as a contracted consultancy rather than a strategic business resource. Further, the designer has to take a bigger role in an organisation and understand the broader context of product development. Also, with branding becoming more prevalent with organisations, products, services and systems need to reflect the organisation's

image. The process of designing has to be informed by past experiences, thus continuous improvement.

Julier (2004, p11), further attributes the main difficulty in teaching design history to “the continued struggle to make the subject, ‘relevant’ to the student’s studies as a practicing designer.” However, this problem is not only in design history; it seems to be a problem associated with the field in general. The lack of cooperation between design academia and design profession has been blamed by some for the profession’s slow growth, Balke-Schaub (2004, p44).

### **2.3.3 What are designing, designer and design?**

#### **2.3.3.1 Designing**

Early stages of the design process can be described as involving extensive use of pen and paper in exploring the initial ideas; thus a cheaper and efficient way to explore a large number of ideas. As an idea gets refined the risk of developing the product is reduced; thus enabling more investment towards exploring the idea. Risk and investment can be viewed as having an inverse relationship; the higher the risk the less investment made and vice versa.

Ultimately the aim of designing is to transform man’s environment and tools, Papanek (1984). Design problems are often described as complex problems; thus there is no clear path towards the solution. “Design activity is not only a distinctive process, comparable with but different from scientific and scholarly processes, but also operates through a medium, called modelling, that is comparable with but different from language and notation,” explains Archer (1979, p18). Prior to starting the design process there has to be a problem in need of a solution and to identify the problem the designer has to understand the user needs and the context in which the product will exist. Thus involving the user in the design process may reduce the odds of straying away from an acceptable solution space.

Szenasy (2003) describes good design as responsible design – addressing a need and sustainable - and that this definition eliminates the need to rely on clumsy, descriptive words to justify a design. Responsible design may also mean the designer is accountable for the user-product interaction and the product’s environmental impact. Furthermore, Redstrom (2005) suggests that designers

need a foundation based on an understanding of product's use/ experience as an achievement rather than as reproduction of the object. Achieving product experience objectives may positively impact the profitability of a product. Designing can be described as a process leading to a new product or service.

### 2.3.3.2 Designers

Hauffe (1998, p13) explains "the term 'designer' is of course not copyrighted; in principle anyone who plans and makes something can call him or herself a designer." Designers have the responsibility to create desirable, useful and usable products that we surround ourselves with. Papanek (1984, p228) suggests, "designers help to wield power to change, modify, eliminate, or evolve totally new patterns." Similarly, Wolfe (2003, p49) argues that, "anyone on the production end of the cycle has to recognize that his or her actions will be multiplied and whatever effects resulting from those actions are going to be manifold." Therefore, material or manufacturing process choices have to be carefully thought. The user is increasingly aware of the importance of usability, functionality and sustainability issues; and the user rewards companies that follow this path.

Southoff (2004, p46), suggests that "designers have to move away from the focus on very narrow portions of organisations, and to develop a comprehensive understanding of the workplace and how it is changing." In the age of corporate strategy and branding, where everything associated with an organisation has to reflect organisational image and ethos; designers and products have had to adjust how they fit within an organisation. Thus the importance of understanding a product does not exist in isolation and that it exists within the context of an organisation.

### 2.3.3.3 Design

"Today we normally use the term design in general for the drafting of planning **industrial products**," Hauffe (1998, p10). Julier (2004, p12) describes design as "the creative invention of objects destined for **serial reproduction**." Likewise Sudijc (2008, p4), argues that design "is about the material, commercial, useful world of **mass produced** objects." Papanek (1984, p4) describes design as, "the **conscious** and intuitive effort to impose **meaningful order**." Moreover, Visser (2009) and De Jong (2002), argues design as a **satisfying activity**; settling for a

good enough representation of a possibility if it is not a likely one. Additionally, Franscara (1997, p11), describes “**the information available on which to base decisions is always insufficient.**” Therefore, design decisions made based on the information available at that time.

“Vladimir Hubka and Ernst Eder defined design science in the same book as: “The term ‘design science’ is to be understood as a system of logically related knowledge, which should contain and organise the complete knowledge about and for designing,” as sighted in Bayazit (2004, p26). Szenasy (2003) describes good design as responsible design – addressing a need and being sustainable - and that this definition eliminates the need to rely on clumsy, descriptive words to justify a design. Papanek (1984, p297) points out that any design, “must be recognizable and not only be usable by the so called five senses but also by the inner senses, both psychological and kinaesthetic.” Thus, design must be much more than a functional or physical aspect of the product. How a product is to be perceived by the prospective user must be incorporated in the design process.

From the definitions in (2.3.3.3); for this thesis design can be described as;

*A satisfying and planning activity towards a desirable product or outcome aimed for industrial production.*

#### **2.3.4 Design Education**

The role of design education is to make the tacit/ implicit in the design profession more explicit. Thus documenting the design profession and making the practice more predictable; bridging the gap between design educators and professionals. Bush (2003, p30) points out that design education “means studying the actions and interpretations of audiences as those of designers, potentially finding ways in which both sides of making becomes more consciously integrated.” Design education has to be responding to the industry needs. In this case, industry is the user of design education, thus involving the user in design education could lead to a more appropriate education for the industry.

Design education is heavily involved with teaching the basic design skills and the problem is often assumed to come from elsewhere; and problems often brought to the students are seldom-real problems. Papanek (1984), contends that schools

often fall short and often provide no-practice for the student in the area of locating, isolating and identifying problems. Further, Vienne (2003) suggests that students must develop personal content and subject matter, executed independently of client assignments. The reward is the expression of personal concerns and also encourages the design student to determine what matters at a personal level. Therefore, a design student needs to learn how to probe the problem-owner for the real problem.

### **2.3.5 Relationship between PDP and design research**

Sato (2009, p30), describes the commonality between design and design research as the “study of users and usage of artefacts in order to develop better products and generate knowledge to be embedded onto artefacts.” Design research is usually conducted prior to the PDP; they are both used to gather more information on the subject matter or the problem being resolved. In addition, both processes start with little knowledge of the subject and learn more about the problem as the process proceeds.

The outcome of PDP is an object/ or service; usually guided by value orientation, cultural cognition and strategic integration, Leong (2003). Furthermore, Sudijc (2008) points out that these works of design (objects) carry a burden of utility and that is what differentiates them from art. Similarly, Tomiyama (2009, p49) describes an “understanding of the design processes, design activities, design knowledge, and designed objects, contributing to further development of design theory and methodology.” PDP “can be applied to all types of creative activity, whether individual, or as part of a design team or as part of the commercial organisation,” Moultrie et al. (2006, p189). This information can further be used to support NPD; likewise NPD can be a source of data necessary in developing design research.

“Designers, as professionals are guided by their awareness of obligations to fulfil contractual responsibilities to clients, protect the public safety, respect the environment and observe ethical business practices,” Cliver (2010, p1).

## **2.4 Design Practice (DP)**

Papanek (1984), defines design practice as the job of form giving and reshaping of the built environment. Furthermore, Papanek describes DP as based on the

following five myths; The myth of mass-production; The myth of obsolescence; The myth of peoples “wants”; The myth of designers lack of control; and The myth that quality no longer counts. However, three of these myths are not relevant to today’s design practice. The myth of obsolescence is now viewed as encouraging a throwaway society where products end-up in a landfill instead of being repaired. Designers now have a lot more control of design practice as a field has grown and better understood; further product quality is one of the determinants of product success on the market. To make new processes work, Hammer (2007) suggests some of the following steps; redefine jobs more broadly, give more responsibility, redirect reward systems to focus on processes as well as outcomes, emphasize teamwork, personal accountability, and the customer’s importance, managers oversee processes instead of activities.

Bush (2003, p26) argues that, “design has an important social role, and that design practice should be anchored in the very reality of its consequences.” The main focus of the NPD process has shifted from being function focused; to how the product is perceived by the user and the environmental impact associated with the product. Moultrie et al. (2006, p190) views NPD process as aiming “to ensure the appropriateness of these solutions to the business.” Moreover, Redstrom (2005, p127) argues, “if design used to be a matter of a physical form, its subject matter being the material object, it now increasingly seems to be about the user and her experiences.” Therefore, more user involvement in the design process may result in better understanding of the user and his/ her experiences. Likewise, Riley (1993) points out that, the modern consumer adds a product’s environmental impact to the perceived cost of consumption and rewards companies that follow this path.

Furthermore, Papanek (1984, p234) suggests designing for “people’s needs rather than their wants, or artificially created needs is the only meaningful direction.” Technology capabilities and the prevailing individualistic culture can be viewed as the factors reversing the trend. Leong’s (2003) and Sudijc’s (2008) work suggests a move towards individualized consciousness; where products need to be unique to an individual and the willingness to pay a higher price for such a product. However, DP continues to support and develop products with the primary focus being profit instead of being need based.

### **2.4.1 Design Thinking**

“Design thinking is fundamentally an exploratory process; done right, it will invariably make unexpected discoveries along the way, and it would be foolish not to find out where they lead,” Brown (2009, p16). Balke-Schaub et al. (2010, p48), describes “Design thinking as a complex behaviour with a complex context and as such hardly decomposable into independent sub-problems.” Likewise, Steen (2013, p18) sees design thinking as where “problems and possible solutions are explored and developed and evaluated simultaneously in an iterative process.” Cross (2011, p10), design thinking is described as providing “the means to shift and transfer thought between the required purpose or function of some activity and appropriate forms for an object to satisfy that purpose.”

### **2.4.2 Implicit/ Tacit knowledge**

Balke-Schaub et al. (2010) recommends, better understanding the relationship between the design problem, and the resultant solution (product) may lead to better understanding of the thought process involved in the NPD process. Further, De Jong (2002, p23) suggests, “one should also distinguish between evaluations of an actual design related study and a proposal for such a study to that effect before the design has been made.” Thus the disparity between the actual study and the proposed study can be seen as a measure of product development success. The more similar the actual and the proposed product are the more successful the NPD is and vice-versa. However, understanding this relationship alone, may not lead to a clear picture of the thought process as memory, motivation and knowledge may greatly influence the output (product). Increased global product competition has forced organisations to be more creative in grabbing the consumer’s attention. Also, the current mass-customization era requires organisations to know more about their customer than ever before.

### **2.4.3 Integrated NPD teams**

The designer seldom works in isolation from other disciplines, thus a design is almost always practiced within a multi-disciplinary team. Further, Sato (2009, p30) suggests, “in order to establish the concept of HCD [human-centred design] in the development process, design needs to offer perspectives and methodologies that interconnect rationales from different disciplinary viewpoints.” Design profession still needs credibility for designers working within a multi-disciplinary team to justify

their design views and solutions. HCD is an approach to systems design and development that aims to make interactive systems more usable by focussing on the use of the system and applying human factors/ ergonomics and usability knowledge and techniques, ISO 9241-210 (2010) and ISO 13407 (1999).

#### **2.4.4 Design as a science: validity**

The reliability aspect of the design process is difficult to achieve; there are a great number of possibilities of use and the freedom to choose between them. Also, it is vital to understand that the design field is highly subjective; therefore for validity, what works in one special, ecological, technical, economic, cultural and political context may not work in the same way elsewhere, De Jong (2002). Therefore documentation of the PDP and the dissemination of the academic research are vital to the improvement of design practice as a science. In this study, PDP in this study is a simplified version of the “The Basic Design Cycle” by Roozenburg, it was simplified for easier understanding by participants that were not formally design trained. It also provides a common design process and therefore easier comparison for the researcher.

Visser (2009, p33), describes “science as a design activity, with the artefact aimed here being a theory.” However, De Jong (2002) attributes the lack of science in design to the fact that a lot of design related study is being done by social scientists, organisational experts, historians and technicians, and not by designers themselves. Poggenpohl (2009) suggests extensive research and collaboration are important towards consolidating the use of these borrowed methodologies to come up with a generic design methodology. Furthermore, Poggenpohl (2009) suggests the identification of recurrence within these methods as an important step towards building theories for the design practice. Park (2011), believes that in order to re-use design process in practice, more attention needs to be directed to understanding the design process. Adding validity to design practice begins with documenting what design practitioners are already doing to build a methodology unique to design. However, Verryzer (2000, p68) cautions against over simplification of DP as it may take the joy out of NPD; “But that will not happen! “Design” is too varied, too dynamic, and too inherently complex to be reduced to a sterile mindless activity.”

Design is a highly subjective field, thus making it harder to re-use methodologies from past projects as every project has its own unique problems. However, Tomiyama (2009, p49) makes a point that designers can design without explicitly using any so-called design theories and methodologies. Solutions are seldom compared to the method followed.

Leong (2003, p58) “sees potential in cultural research and cognition [inner ‘intangible’ knowledge] for the development of new design theories and models.” Conversely, Poggenpohl (2009, p4) points out that “design in its craft configuration has limited reach and limited authority among practitioners and marketplace,” thus the need to apply scientific rigor to the design process. The push for design to be recognised as scientific work is an effort to give design methods some degree of reliability and validity.

## **2.5 User-Centred Design (UCD)**

UCD, user-orientated design, Human-centred design, UX, users as co-designers, user participation design, users as designers, collaborative design are all terms used to describe some form of user involvement in the product development process. Saeed et al. (2013, p1259) suggests that “organisations should focus on the concept to understand customer and in turn develop product or services that meet customer needs and wants better than competitors in resulting they will earn greater revenue. For purposes of this study UCD will be used in place of all these other terms.

Riley (1993, p76) observes, “consumers no longer accept cultural autism of corporate brands. They want a conversation about where we, as designers, stand, what we are doing, and how we can do it better.” “Although designers have always had a user focus, there is need to better formulate and more clearly articulate this emphasis,” Veryzer (2000, p67). Further, Sato (2009, p31) reports “traditionally product developers considered users only as data collection resources instead of knowledge-generating agents.” Product competition has meant a lot of choices for consumers; thus the need for an appropriate product a necessity to gain a competitive edge. Moreover, Oosterlaken (2009, p98) observes, “the degree to which the product satisfies customers and users is regarded one of the most critical factors in product development.” The effectiveness of the design process

can be observed through the degree of similarity of the design intentions to the user perception of the product.

Papanek (1984, p18) states “it is not possible to just move objects, or artefacts from one culture to another and expect them to work.” Furthermore, Veryzer and Borja de Mozota (2005, p129) contends, “the challenge of developing successful products, embodied so as to enhance user’s experience, requires an interrelation approach across all the key disciplines involved in NPD.” Thus, products are context specific; affected by the target market, culture (norms, perceptions), and climate and material availability.” Hammer (2007) asserts that in order to achieve cost, quality, speed and profitability; companies focus on measuring and improving user focussed and internal processes. Furthermore, ISO 13407 (1999, p4), “Design organisations should incorporate human-centred design into their existing internal procedures and development standards.” Products that communicate the best with the users are more likely to reward.

### 2.5.1 Definitions of UCD

Van Boeijen (2009, p76) argues, “Designers need to understand how intended users will give meaning to the product, and how the product will influence their social system.” For these reasons, NPD organisations are looking to the user to guide product development efforts as a means to improve the odds of product’s success. Tu et al. (2011, p1) points to functionality testing and usability testing as essential to product improvement during the iterative process. Table 4 shows the comparison of summaries of UCD meanings.

- Redstrom (2005, p129) defines “user design in the sense that it is design where **the process through which people are turned into users** is the focus and the explicit aim is to work with the results of this process.” Moreover, Redstrom contends that people are not users until a prototype or product (thing to be used) is presented to them by means of our designs. The researcher is of the view that, during the design process, there are drawings, models, discussions that allow the user to have contribution to NPD.
- Balke-Schaub et al. (2010, p45), define UCD as based on an assumption that “**designing can be done by everybody**; thus also design thinking is not an activity reserved to the designer but can be or better needs to be done also by

other people involved in the product and service development process.”

Further, Balke-Schaub et al. (2010), argue that most of the time users do not know what they want and therefore designer’s empathy does not advance the cause much. Users do not necessarily have to be at the same level as designers within NPD teams; they may be given product options to choose from and user suggestions will always be better than the designer’s empathy.

- Poggenpohl (2009, p19) suggests UCD is “**understanding and investigating what people actually do**, how they understand things, what features are desired in what context of use, becomes part of the designer’s activity as they become advocates of the users.”
- In her study, Cain (2005, p27) defines “User-involvement” as, “**Involving users in the design process**, and is part of the wider field of knowledge called UCD.”
- User-orientated design, “**refers to the sensitivity toward user/consumer design considerations** in the context of extreme technology based genesis and functional multiplicity/complexity of products” states Veryzer and Borja de Mozota (2005, p129).
- Hsu (2013) views [UCD as enabling] market places as **forums for firms and active clients to talk** about, mix and review each other people’s asserts and abilities to produce value through new types of interaction, service and learning systems.
- Tu, et al. (2011) describe UCD principles and **techniques as user studies and usability testing**; further, they see UCD as originating from software and interactive design principles. This definition omits the importance of the user whilst the product is being developed. Continuous user involvement is important as it reduces the cost of product optimisation during usability testing as some of the product short-falls would have been detected earlier in the PDP.

Table 4: UCD taxonomy

User-centered design views	
Author(s)	UCD Definition
Redstrom (2005)	Process through which people are turned into users is the focus.
Balke-Schaub et al. (2010)	Designing can be done by everybody.
Poggenpohl (2009)	Investigating what people actually do and being advocates of the users.
Cain (2005)	Involving users in the design process.
Veryzer and Borja de Mozota (2005)	Sensitivity toward user design considerations.
Hsu (2013)	Produce value through new types of interaction, service and learning systems.
Tu, et al. (2011)	User studies and usability testing.

From the definitions in (2.5.1); for this thesis UCD can be described as;

*UCD is the involvement of users in product development process; therefore bringing the experience from using the product and the much needed diversity to the design team.*

### 2.5.2 ISO Standards and recognised best practices

For an ISO standard to be adopted it requires approval of at least 75% of member bodies casting a vote, ISO 9241-210 (2010); therefore expert consensus on what can be described as recognised best global practices. They are also thought to help the efficiency of processes and can help in participating in global supply chains, ISO13407 (1999). "Evaluation is an essential step in human-centred design and should take place at all stages in the system lifecycle", ISO13407 (1999, p8). The use of "Human" instead of "user" is said to have been used to be inclusive to other stakeholders involved in the project.

For this study ISO 9241-210 (Human-centred design for interactive systems) and ISO 13407 (Human-centred design for interactive systems). However, there are

more similarities between the ISO standards than differences.” ISO 9241-210 (2010, pVI) describes its relationship with ISO 13407 as “have not changed substantially since ISO 13407 was produced and have been validated by ten years of application. This part of ISO 9241 reflects this by making requirements as well as recommendations.” ISO 9241-210 was essential in making recommendations to what was not being done well on the case studies; it is intended for use by those responsible for planning and managing projects that design and develop interactive systems.

### 2.5.3 Levels of User-involvement

The major differentiating factor between these terms is the level of user involvement/ contribution to the actual product development, see Figure 9;

- Are they **subjects** which a designer can empathise without interaction?
- Are they **informants** that a designer constantly consult for input and/or validation?
- Are they **cooperation partners** working with the designer side by side?

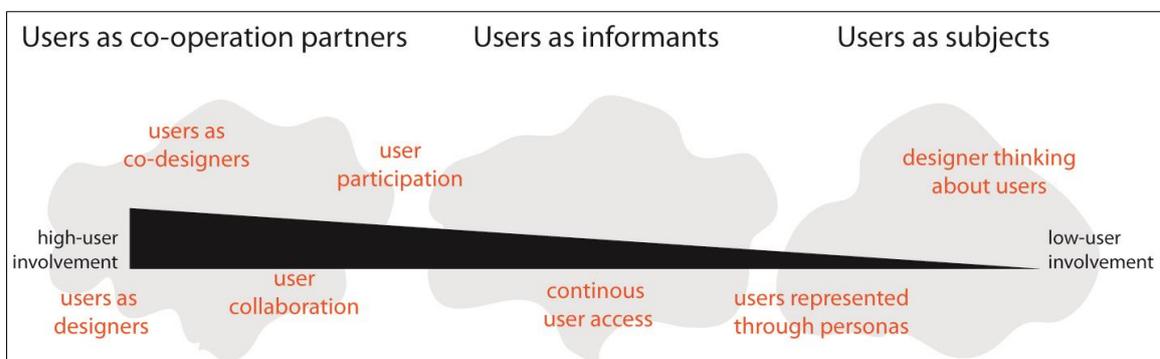


Figure 9: Different degrees of user involvement in the PDP. Adapted from: Cain (2005, p40).

Sandmeier, et al. (2010, p90) argues that “the question of how customers can contribute to product innovation activities and how and where their contribution can be built into the NPD process.” Moreover, Veryzer and Borja de Mozota (2005, p138), view UCD as “suited to help create new products that will reconcile the paradox of the necessity for arousal and pleasure with peoples’ need to relate the products they encounter to existing brain patterns so that they may be comfortable

with an innovation.” Therefore, justifying this study, how and when to involve the user in the NPD process. However, given the subjectivity within the design field, thus the level of user integration will also be subjective to the problem being solved.

Redstrom (2005, p130) asserts that “the ‘use’ we aim to design for cannot exist until we present the design itself”; therefore, suggesting we cannot call anyone a user until they are using the actual product. However, most new products are modifications of existing products; thus users already exist for most product development. Further, Papanek (1984, p246) describes “incremental re-designs, where more features are added to the product instead of analysing the entire product.” Thus in contrary to Redstrom’s argument the ‘user’ in UCD is relevant to most of product development. Tu, et al. (2011) argues the UCD process as having two stages; user studies, design (preliminary design and detailed design) and user testing (iterative process).

ISO 9241-210 recommends that UCD practices should follow the following principles, for whatever the design process and allocation of responsibilities;

- a. The design is based upon an explicit understanding of users, tasks and environments.
- b. Users are involved throughout the design and development.
- c. The design is driven and refined by user-centred evaluation.
- d. The process is iterative.
- e. The design addresses the whole user experience.
- f. The design team includes multidisciplinary skills and perspective.

#### **2.5.4 User-NPD team Communication**

Increased competition between different companies has led to the necessity, “to understand just what customers want in terms of product attributes and to ensure that these are carefully translated into [product] specifications” Cross (2000, p107). Sandmeier, et al. (2010, p103), also discovered that “early involvement of typical users at a very early stage can leverage the contribution from lead users by making explicit the innovation potentials that lie in the discrepancies between lead and typical users” this without lowering the innovativeness of the product under development.

Communication between the user and the design team is important for team functionality and the PDP in general. Common communication methods within design teams include, talking, writing, drawing and modelling/ prototyping; in their order of effectiveness. Veryzer and Borja de Mozota (2005, p134) observes the use of “visualizations [as having] become a valuable tool for communication between project team members and for coordination as well as decision making.” The visualisations are more effective as they are easier to understand and they allow both the design team and the user/customer to confirm they are talking about the same thing.

Getting the earliest low functionality version of the product (visualisation) in customer’s hands at the earliest opportunity will lead towards more accurate and relevant customer feedback, hopefully leading to a better conceived product, Sandmeier, et al. (2010, p92). Furthermore, Veryzer and Borja de Mozota (2005, p137) argues that, “product appearance helps the selection process during the act of purchasing; it also helps in product categorization.” Hence, the need to have the user as a part of a NPD team and the use of product forms (models) as a means of communicating product ideas between the user and the product development team.

#### **2.5.4.1 Use of Scenarios**

Sandmeier, et al. (2010, p94) and Park (2011, p4), suggest extensive use of scenarios to aid the NPD team focus on the user prior to the introduction of UCD. Actual users were reigned-in for validation at different stages of the product development process; thus lacking continual user involvement which offers the user ample time to contribute to PDP. However, “the inability of potential customers to articulate the required functionality and benefits of a proposed new product creates uncertainty” Veryzer and Borja de Mozota (2005, p137). Given the inability of the user to articulate what they want in a product; the use of scenarios helps the design team empathise with the user and acts as constant reminder of what needs to be done. However, having the user as part of the design team helps build trust and allows information to be shared over-time without pressure. Veryzer and Borja de Mozota (2005, p135) argues that having the user as part of a NPD team, “promotes cooperation and information integration” thus better communication.

#### **2.5.4.2 Quality Function Deployment (QFD) Method**

Cross (2000) describes quality function deployment (QFD) as deriving appropriate product characteristic from customer demands to come up with a better product. Similarly, Tu et al. (2011, p1) describes QFD as “a method which is used widely in quality improvement and NPD area is used to translate the user requirements into technical requirements and design specification.” QFD method recognises the person, who influences the buying decision the most as the most important person in determining the commercial success of a product. QFD procedure involves, Cross (2000, p113-114) in this order;

1. Identifying customer requirements in terms of product attributes.
2. Determining the relative importance of the attributes.
3. Evaluation of the attributes of competing products.
4. Drawing a matrix of product attributes against engineering characteristics.
5. Identifying the relationships between engineering characteristics and product attributes.
6. Identifying any relevant attractions between engineering characteristics.
7. And, setting target figures to be achieved for the engineering characteristics.

#### **2.5.5 Benefits of UCD**

Any project that utilises the user in the PDP aims to make sure the product is appropriate, has shorter development time and that there is market potential for the product. Saeed et al. (2013, p1256) asserts, “the voice of the customer can be used for any improvement and modifications in the product service.” Furthermore, UCD offers “sensitivity to aspects underlying customer/ user reactions to products can have a significant impact on both the direction that the product development takes as well as the eventual success of the final product” Veryzer and Borja de Mozota (2005, p132). In addition, to having a lot of contact with the consumer also means a better collaboration and create new products that can truly satisfy the user requirements, Sandmeier, et al. (2010) and Tu, et al. (2011).

As part of a design team, the user is able to provide restrictions on what is important or needs of a product being developed early in the process. Veryzer and Borja de Mozota (2005, p136) further points out that UCD, “can enhance idea

generation in three important ways: visualization/conceptualization, form alignment, and transmutation of the design challenge.” Furthermore, Sandmeier, et al (2010, p103), study suggests, “that the method of continuous integration of customer contributions leads to an increased likelihood of improved project profitability through continuous guidance of the development process by customer requirements and through relevance checks.”

However, Redstrom (2005) argues that the movement towards the user as being problematic since it leaves no room for improvisation (non-intended use). The product improvisation is viewed as important to additional products or product variations. Therefore a product should not have a narrow focus of use; rather it must be more ‘open’ to user’s creativity and innovation. The ability to improvise sheds light to other possibilities and can play a crucial role in NPD.

Borja de Mozota (2006, p4) describes “design value [as] foremost perceived value or aesthetic value, [and that] perception value translated into management jargon is building a competitive advantage through differentiated offering perceived on the market.” Value is co-created with clients assuming a person has the capacity to personalise their experience utilizing a firm’s product-service proposition [thus enabling] the firm to derive greater value from the product-service investment by means of new understanding, greater revenues/profitability and/or superior brand value/loyalty (Lehrer et al. 2012) as quoted in Hsu (2013). Norman (2003, p131) suggests that “if usability and functionality are to be legislated, it should be in the form of performance requirements.” Thus, most governments and industries have some kind of product standard rule; aimed at regulating industries and protecting the user.

Veryzer and Borja de Mozota (2005, p134) suggests UCD “promotes information integration by providing a crucial fixed point toward which the efforts of each of the professions contributing to product development focus.” Having the user as part of the design team enables prompt design decisions and immediate validation.

Papanek (1984, p15) observes that designers avoid excessive user participation because of, “the economic, psychological, spiritual, social, technological, and intellectual needs of a human being are usually more difficult and less profitable to satisfy than the carefully engineered and manipulated “wants” inculcated by fad

and fashion.” Also, “the inability of potential customers to articulate the required functionality and benefits of a proposed new product [makes NPD much more expensive and time consuming]” argues Veryzer and Borja de Mozota (2005, p137). It is important to understand that the user is not a designer; thus, the user’s contributions are add-ons to an ongoing PDP.

## **2.6 Design Application at the Base of the Pyramid (BoP)**

Developing world, emerging markets, third world and Base of the Pyramid (BoP) are often used interchangeably despite differences in the meaning of these terms. This report will adopt the term BoP in place of all these terms.

BoP is described as “the 4 billion plus poor mostly in non-western countries in Asia, Latin America & Africa, living on incomes less than \$3260 per year.” Moreover, a small part of this group resides in the developed world. This market represents a significant portion of the global population; despite this fact this market is still being neglected by the design world. Furthermore it is an opportunity for design entrepreneurs provided an appropriate product is offered, observes, Kandachar (2009).

The BoP have been found to lack stable or mature markets, and the existing market structures are alien to western entrepreneurs; therefore making it harder to identify design opportunities. On the other hand, BoP entrepreneurs understand the market much better, but lack capital and NPD expertise to exploit these opportunities. Kandachar (2009) argues that opportunities and needs in need of solving are much more widespread. Thomas (2006, p54) sees the role of design at the BoP in two parts, “the production of goods that provide income & generate wealth for poor producers, and the consumption of goods in poor markets.” Therefore, collaboration between western entrepreneurs and the BoP entrepreneurs is necessary to satisfying this market; after all, they both possess what the other one needs.

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### **2.6.1 Design Awareness (DA) at the BoP**

The target market for most BoP products is the international market specifically the developed world, at the same time neglecting the familiar local market. Moreover, the neglected local economy is a niche market for BoP entrepreneurs as they understand it much more than the western entrepreneur. Similarly, Thomas (2006, p65), argues that “within the context of global capitalism, there are niche markets and means of production that can alleviate a lot of extremely poor.”

Therefore, for design awareness to grow at the BoP product design has to be understood at these levels, individual (user), group, national, and international market. Starting by targeting the well understood individual and then as the capabilities improve move towards targeting the global market.

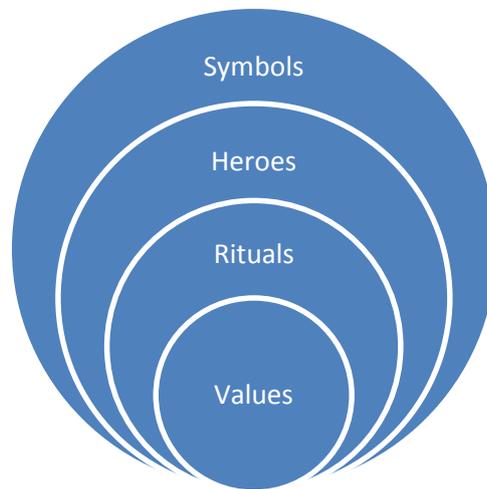
Hofstede (2005) introduces different manifestations of cultural layers (values, rituals, heroes and symbols (products)) subjective to specific cultures, (see Figure 10).

*Symbols:* are described as words, gestures, pictures or objects that carry a particular meaning which is only recognised by those who share the culture. They can be easily developed or replaced; and are regularly copied by other cultures.

*Heroes:* These are people, alive or dead, real or imaginary, who possess characteristics which are highly prized in a culture and thus serve as models for behaviour.

*Rituals*: are collective activities, considered socially essential, e.g. paying respect to others; who starts the greeting process.

*Values*: these are the core of any culture; described as core tendencies to prefer certain states of affairs over others.



**Figure 10: Cultural layers. Source: Hofstede (2005).**

Similarly, Leong (2003, p55) discusses “the spatial perspective of culture” [as] used to provide a manageable framework to visualize and capture the fluid concept of culture, see Figure 11. The model is made up of three levels, Inner “Intangible” level (values), Mid “behavioural” level (Heroes and Rituals) and Outer “intangible” level (symbols). Understanding the inner level is much harder to understand and the outer level the easiest to understand. For a product to stand out of the competition, understanding culture at the inner “intangible” level is ideal for NPD.

Similarly, Moalosi et al. (2008) argues that designers need to recognise that cultural values are the basis of behaviours and attitudes, and product’s success is based on the relation to these values. Cultural behaviours and attitudes are, are part of Leong’s “Inner “intangible” level” shown in figure 13 and the Hofstede’s “values” in Figure 11. Understanding culture at an “intangible” level is much more difficult, but essential to NPD.

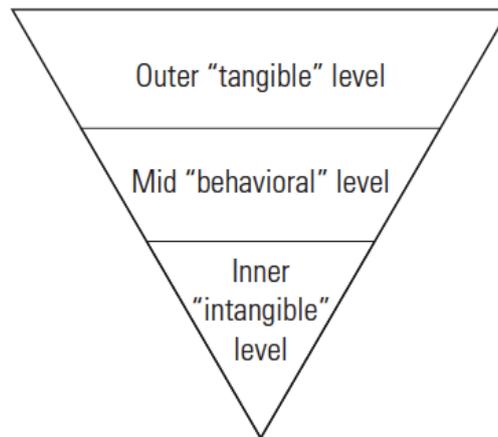


Figure 11: The Spatial Perspective of Culture. Source: Leong (2003).

### 2.6.1.1 Design Application at the BoP

Baker and Hall (2011, p184) points out “design and production in a developing country must be able to address the issues of reduced levels of industrialisation, poor transport and infrastructure and the lack of access to finance.”

For designers to have an impact in reducing poverty in the developing world, Rocchi (2006) and Thomas (2006) suggest that products need to be economically viable, environmentally viable and there has to be accessible solutions. Furthermore, they believe organisations producing these products have to be self-sustaining, therefore less dependent on any particular person, group (government, NGO) for their existence or continuation. Local communities are empowered by involving all stakeholders sharing similar goals; by so doing product’s success chances are enhanced.

It takes much more than minor modifications to existing products to penetrate the developing market, Diehl (2009). Furthermore, Diehl suggests outsourcing some aspects of product development (sales, maintenance etc.), to reduce the risk and spread the wealth across the local community. Furthermore, product developers need to understand local needs, material availability and the context in which the product exists. The planning has to be broader than just the product level; it has to be at the product strategy level, i.e. considering competitors, and product life cycle analysis.

### **2.6.1.2 Design Education at the BoP**

Design is a young field in a process of establishing itself compared to other established fields (civil engineering, psychology etc.). Additionally there are fewer schools offering design education and there exists ignorance by the industry and community at large on design as a profession. Thomas (2006, p59) observes “there is little design education or training available in the BoP, and especially to the rural poor.” Also the costs of studying design are substantially higher than most fields. The study from South Africa by Sutherland (2004, p55) states that, “there is not only ignorance about career opportunities in design on the part of previously marginalised groups, but also access to design education remains limited for educational and economic reasons.” The digitization of the design field has increased costs on an already expensive field for schools and individual students. However, the costs associated with digitization can be expected to go down in the long run.

Southoff (2004, p49) points out “insufficient attention has been directed to establishing a local discourse that allows for deeper engagement with the social context.” The Brazilian projects study cited by Thomas (2006), demonstrates that design academics and students can contribute to the well-being and income-generating capacity of poor people. The study has a potential to contribute to poverty alleviation if poor people’s involvement is managed in an appropriate way. Also, think tanks can also be used to show organisational management the importance of design in the overall running of an organisation and also connects well with involving people from all walks of life in design policy formulation.

### **2.6.1.3 Lessons Learned**

It is important to study and learn from past design implementations in the developing world; this way we can avoid re-inventing the wheel and identify potential solution areas early in the process. Rocchi (2006) considers *deep understanding of the context of application* and *sufficient knowledge of belief systems* as the two milestones of design innovation for the BoP.

- *Understanding of the context of application* – infrastructure, distribution channels and technology in place.

- *Sufficient knowledge on belief systems* – social structure, cultural values and lifestyles.

NPD at the BoP has to be influenced by the environment that the product is to be used and the people who will be using the product (user). Southoff (2004, p34) identifies culture as a differentiating and competitive factor; “the significant role of design can only be actualised through the institution of a unique South African design culture.” Further, Southoff identifies the two challenges confronting design practice in South Africa as being the identification of the South African identity and design’s intersection with corporate organisations. In this case, the design team has to understand culture at its deepest level (inner “intangible” level or values level) and then make sure that within an organisation they are placed where they can be the most effective.

#### **2.6.1.4 Product Character**

Crafting of indigenous design experience and design must look beyond the aesthetics, must consider how the new social, political and is conceptually fixed and visually perceived, Southoff (2004). Similarly, Simanis and Hart (2006, p45) argue the need for income-generating technologies for the poor to be “simple to use and easy to repair, labour and time intensive in their use, priced sufficiently low to allow individual ownership, have low energy (non-human) requirements, and be environmentally sustainable.” The labour and time intensity allow more people to be involved or benefit from such initiatives. However, it is obvious that every person wants and deserves convenient and efficient technologies.

The proliferation of products from western designers to the BoP has had a great influence on products produced in the developing world. Moreover, Southoff (2004, p39) observes that, “few designers question whether the prevalent dialectic of the international and local might signify that South African design continues to be determined by imported models of design models and thinking.” The current globalization trend may be attributed to local design targeting the international market; also being surrounded by imported products can shape what is designed, and how design is approached.

Thomas (2006) has observed that craft production in the informal sector without any donor or NGO support may be economically sustainable if a market is

available. This has a potential to apply to all other products produced both at the BoP and western worlds; thus subsidies are bad for creativity and market development.

#### **2.6.1.5 Design Policy**

Politics are important to the development of the design awareness; they create the awareness and lay the groundwork (i.e. regulation, material availability) for the industry to develop. Amir (2004, p69) argues, “design always is connected to a broader context that includes political systems, economic models and cultural milieus.” Moreover, the findings from Baker and Hall’s (2011) suggests, that design could deliver regional benefits by bridging the gap between policy and implementation.

Baker and Hall point out “although many of the countries on the continent [Africa] are very poor, the last decade has seen economic growth and stability in an increasingly number of states.” The economic growth and more stability in these states, mean the reduction in the risk of return on investment; thus more incentive to invest in product development in this parts of the world.

Amir (2004, p74), observes that the institutionalization of [UCD] policy can be characterised by three principles;

1. A UCD policy is directly oriented towards people’s needs and interests; design is treated as a social and cultural tool for creating a better life.
2. The targeted users of UCD policy, as expressed in its name, are people. The function of design is extended to enhancing sociality and improving equity in Third World societies.
3. Although the role of government in UCD policy remains important, the participation of many stakeholders such as design practitioners and academicians, and local communities, plays a pivotal role in influencing design policy outcomes.

Kandachar (2009) and Baker and Hall (2011) observe that previous attempts to modernise manufacturing in the developing world failed due to, imposing westernised industrial models based on mechanisation of processes and

homogenisation of products. This can be attributed to the lack of understanding of the developing world's context and hinders the implementation success. Moreover, Leong (2003, p50) contends "cultural knowledge could enrich contemporary design theory and underpin innovation in design practice, providing an alternative to western design that would have international application." Therefore, the best universal product design can be considered less culturally specific as they attempt to be relevant to most cultures. In most cases cultural inferences have to be infused to global best practices to make appropriate products for specific cultures. Culturally inspired designs success may be attributed to the nostalgia, familiarity and the sense of belonging they evoke with the target culture.

As observed in the GoGlobal Ghana project striking the balance between cultural focus and the globalization trend is a mammoth task. In an attempt to reduce NPD costs, multi-national organisations have resorted to making products for multiple cultures. However, Baker and Hall (2011) argue that if the product embedded too much culture it makes it more difficult for the product to fit in a different culture; therefore creating additional costs to a multi-national organisation. The product's architecture has to be customizable for most cultures, without substantial cost increase.

Increasing scrutiny of product's carbon footprint has led to the increased use of local raw material; the use of local materials contributes to low operating costs and can be viewed as a niche or competitive advantage. The use of local materials is good for the environment as the amount of fuel used in transporting the material to the factory is minimal; also the local knowledge of local material ensures the availability of employees. Further, Kandachar (2009, p20) observes that "developing countries often have an abundant local renewable materials and the basic expertise" to manipulate it. This abundance in local renewable materials and fair trade initiatives offer potential for NPD projects. Therefore, products that utilise local material bring-forth the most benefits to the local community.

### **2.6.2 Design Practice (DP) at the Base of the Pyramid**

Southoff (2004) observes a rift between design practice and research as inhibiting design acceptance and use; also design credibility is questioned because of poor research basis and lack of relevant data. Further, Thomas (2006, p65) suggests

“value-driven designers need networks and support mechanisms in the design industry so that they can share their ideas more effectively in support of the ideas in which they believe.” A strong relationship between design academics and professionals may lead to increased sharing of ideas and grounding of the design profession.

Chang (2009) explains that challenges to accessing the BoP are a result of unfamiliarity with the local market by western designers. Further, simply transferring existing technologies to the BoP takes away ownership from locals, who the product is being introduced to. Thus, not empowered to maintain and keep the system working; and end up being dependent on the expertise from the developed world for systems functionality. As a result costs of maintaining the system become unsustainable.

Simanis and Hart (2006, p43) points out that “it is now well accepted that sustainable poverty alleviation must recognize the poor as central agents in the process.” Further, Southoff (2004) suggests that designers must move towards adopting a multifaceted confrontation; engaging historical as well as contemporary aspects in designing and clarify its contributions to contexts of culture and use. Therefore, allowing the poor at the BoP to be agents of change help in the product development process; instead of only involving the corporations that are also to some degree detached with the poor.

Introduced by Rocchi (2006, p7), “System Thinking,” acknowledges the lack of infrastructure and the business climate at its infancy at the BoP. Thus it strives to make products sustainable within local communities, through education of the pre-product planning (supply chains, market requirements) and post-product planning (sales and distribution) in addition to “Product Thinking.” Furthermore, Rocchi argues that developing this system is a complex undertaking, therefore requiring services of local entrepreneurs. Product thinking is focussed on product development with little or no regard for the context in which the product exists (i.e. socio-economic factors, production methods).

### **2.6.2.1 Approach Models for the developing world**

These are guides towards NPD for the BoP by companies/ organisations in the developed world.

## Capability Approach

Oosterlaken (2009, p91), introduces a “Capability Approach” towards designing for society, and particularly the world’s poor. Central to this approach are human capabilities; the effective opportunities that people have to live the lives that they have reason to value. Furthermore, Oosterlaken (2009, p91) argues that the focus should be on human capabilities, “what people are effectively able to do and be” or the freedom that people have “to enjoy valuable beings and doings”.

Oosterlaken (2009, p100) states, “another feature of the capability approach is that it attaches great importance to agency, free choice, and value judgements.” Capability Approach should be, “comprehensive, but flexible and able to capture complex linkages between poverty, intervention, participation, and empowerment.”

## A model for design processes for the Base of the Pyramid

“Needs of human beings are the central driving force uniting technology and businesses, resulting in products and services,” Kandachar (2009, p23). The model’s objectives are to create sustainable, products, services and systems (see Figure 12). The success of the model is based on the successful integration of the following aspects (in green);

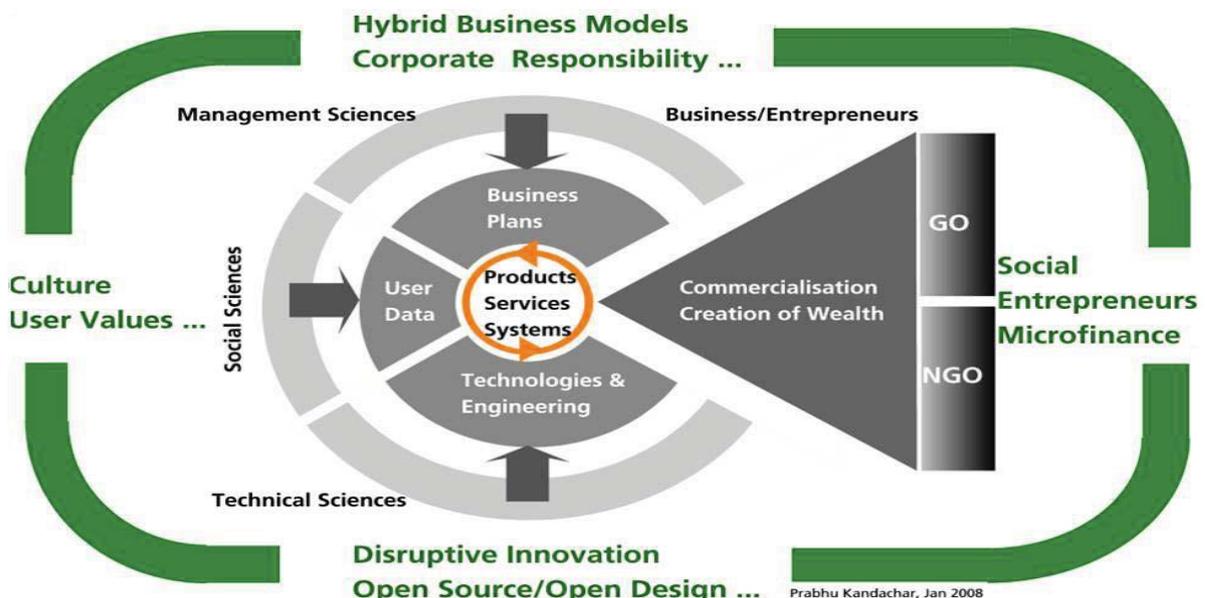


Figure 12: A model for design processes for the base of the pyramid. Source: Kandachar (2009, p23).

a) Social, Entrepreneurs, Microfinance

This aspect is based on Government Organisations (GO) and Non-Governmental Organisations (NGO) ability to create conducive conditions for NPD, commercialization, creation of wealth etc.

b) Disruptive innovation, Open Source/open design

Free sharing of ideas (technology and engineering) between the innovators and the base of the pyramid. Further, products are manufactured using local materials and labour; this helps with the product's sustainability and also empowers local communities.

c) Culture, User values

It involves involving the final user, at the base of the pyramid in product design decision making.

d) Hybrid Business Models, Corporate responsibility

Recognises the deficiency in business management skills at the base of the pyramid and ensures successful running of the entities involved in the production of products, services and systems.

### **2.6.3 UCD at the BoP**

The BoP has to provide input in the NPD process; the product has to provide income and generate wealth for poor producers. Further, Simanis and Hart (2006) argue that the success in creating products for the BoP can be attributed to the use of appropriate technologies and marketing strategies based on the needs of the rural poor. Furthermore, Findlater (2009, p52) suggests that to realise the full benefits to local empowerment, the project has to be done commercially without the dependence on the government and the NGO's for sales. The success of the following products designed for the BoP can be attributed to a more UCD approach to NPD.

#### **2.6.3.1 Street Vending bike for the disabled**

A product has to be capable of making a living. The tricycle for the disabled in Ghana initially failed as it was solely designed for mobility. Product re-designs

involved consulting with stakeholders (users and manufacturers) on the ground that led to more appropriate user needs (see Figure 13).



**Figure 13: Street vending bike for the disabled. Source: De Jong [online] (2009).**

The new bike's success can be attributed to empowering the disabled to make a living by becoming street vendors, Oosterlaken (2009). Thus the initial assumed primary need (mobility) has now become secondary.

### **2.6.3.2 Lifestraw (water purifier)**

During the re-design of the water purifier, Bottema conducted observational and brainstorming sessions on site (Ghana); the sessions helped the design researcher draw some cues from the user experience and well as some tacit information (through observational study).



**Figure 14: Lifestraw in-use. Source: Lifestraw [online] (2009).**

The study revealed that the product was hard to use especially for younger children who are much more affected by waterborne infections (see Figure 14). Therefore, revealing the need for a personal water purifier for children, Bottema (2009). Greater involvement of the user might have had better revelations, e.g. introducing the user to the design process, and continually working with them in NPD. Also, involving the user into the design process would have availed deeper information to the designer thus leading to a more appropriate product.

## **2.7 Updated Aim and Objectives**

The aim of the study was to find ways to improve product appropriateness and reduce product development costs in Botswana's design industry through the use of UCD. The term UCD is alien to the majority of the industry; however UCD practices were applied mostly at the beginning and at the end of the PDP. DP in the can be improved through documentation of the PDP by individual companies; the documentation is expected to allow review and improvement of DP.

Objectives are important as they outline the necessary steps towards achieving the study aim. In order to achieve the objectives questions that will work as stepping stones towards attaining the objectives had to be proposed. Some of the proposed questions worked towards attaining more than one objective. For this particular study the objectives and associated questions are listed in Table 5.

The objectives for this study had evolved as a result of the literature review, i.e. the researcher realised it was important to understand the level of design awareness (DA) and design practice (DP) was essential to UCD investigation. DA and DP were seen as a foundation for which UCD is built, (see Table 5).

Table 5: Post literature review objectives and questions.

Objectives	Questions
<b>Determine the level of design awareness in Botswana’s companies.</b>	<ul style="list-style-type: none"> <li>• What is design, designer and designing?</li> <li>• What are advantages and added value of design?</li> <li>• How do you measure the design effectiveness?</li> </ul>
<b>Ascertain current understanding of UCD iGlobally and in Botswana.</b>	<ul style="list-style-type: none"> <li>• What is UCD?</li> <li>• What are the implications of incorporating user input onto creativity or innovation in NPD teams?</li> <li>• How is UCD success measured?</li> </ul>
<b>Explore the training needs of companies in Botswana in relation to UCD.</b>	<ul style="list-style-type: none"> <li>• When and how can the user effectively share ideas with the design team and how these ideas are incorporated into design decision-making?</li> <li>• Is UCD part of the training given to companies or employees?</li> <li>• Are there links with training institutions?</li> </ul>
<b>Explore the teaching of UCD in industrial design training institutions in Botswana.</b>	<ul style="list-style-type: none"> <li>• At what study level is UCD introduced to Industrial Design students?</li> <li>• To what extent is the training influenced by industry need?</li> </ul>

2.7.1 Research Question

***How is UCD practiced and how might design practice (DP) and design awareness (DA) be improved in Botswana’s industry; and what is the most appropriate way of encouraging this?***

2.8 Chapter Summary

For the developed world, traditional role of design has mainly focussed on the design of products and viewed as a service within an organisation or contracted consultancy rather than a strategic business resource, Veryzer and Borja de Mozota (2005) and Balke-Schaub et al. (2010). However, for the BoP design and production still has to address poor infrastructure and the lack of access to

finance, Baker and Hall (2011). Also, the lack of design policies at the BoP can be seen as contributing to minimal design awareness.

It has been observed that academic design research has not been able to find its way into industry. The lack of cooperation between academia and profession has also been blamed by some for the profession's slow growth, Southoff (2004). Since the application of research findings to the real world occurs in industry, this is where design research (documentation of the NPD process) must also take place. Thus, design education has to be responding to an industry need. In contrast, Vienne (2003) suggests that students must develop personal content and subject matter, executed independently of client assignments. However, given the resources needed to get a product to the market; funding for developing student's personal content and subject matter may be problematic especially at the BoP.

In an attempt to reduce product development costs multi-national organisations have resorted to mass-customisation, thus able to offer one product to multiple cultures. However, Baker and Hall (2011) argue that if the project embedded too much culture it makes it more difficult for the product to fit in a different culture. Therefore, the need to focus on the balance between culture and global centric product development is crucially important. Organisations producing products at the BoP have to avoid being dependent on any particular person, group (government, NGO) for their existence or continuation. Moreover, Leong (2003) argues that cultural knowledge can provide an alternative to western design and lead to innovation in design practice in BoP companies.

UCD has been observed [Veryzer and Borja de Mozota (2005)] to promote information integration by providing a crucial fixed point toward which the efforts of the NPD team can focus. However, Papanek (1984) argues that, designers avoid excessive user participation because the needs of a human being are usually more difficult and less profitable to satisfy. In addition Rocchi (2006) considers understanding of the context of application and knowledge on user-belief systems as the two milestones of design innovation. Therefore companies are always attempting to find the balance between UCD and NPD costs.

Literature review has revealed the lack of design and UCD related publications on Botswana; thus the need for the researcher to collect data on the missing

information. The solution was to conduct a pilot study (interviews) related to the study objectives. See chapter 4: Scoping Study: semi-structured interviews for the details.

CHAPTER THREE

**RESEARCH**

**METHODOLOGY**

## **3 Research Methodology**

### **3.1 Introduction**

This chapter focusses on methods that were used to explore this study. It also strived to show the researcher's stance/ approach to data collection and analysis. Furthermore, this chapter also proposes a methodology to provide guidance to how data collection would be conducted and analysed. The methodology was expected to evolve as the study continues until the last data has been collected. Changes in the methodology were influenced by time and financial constraints.

Hart (1998, p28) defines methodology as "a system of methods and rules to facilitate the collection and analysis of data." Etymology English Dictionary (2011) defines methodology as, "an organised, documented set of procedures and guidelines for one or more phases." Therefore a methodology is made up of methods used in gathering and analysing data. Cohen and Manion (1989) point out; the aim of methodology is to help give a broader view of a study approach rather than the results of the study.

The researcher intended to use a mixed method approach where interpretivism research approach is used to gather data. Interpretivism approach supports the view that the perception of the world is subjective to an individual, which aligns well with the subjectivity of the design field. The author plans to investigate the problem by using interviews, a survey and case studies to find the solution space for the study aim; "Creating a, Generic Cost Effective UCD Methodology to be applied in Botswana's industry." The methods will be applied in a linear manner with each method utilising information gathered from the previous one.

#### **3.1.1 Types of questions**

There are two types of questions that can be asked when soliciting information from study participants; open and closed-ended questions. Skulmoski et al. (2007) recommend initial questions to be broad (open-ended) aiming to get a broad range of responses. Moreover, Hsu and Sandford (2007) argue that open-ended questions can lead to biased results. Respondents are free to answer questions however they see it fit and this helps in identifying all possibilities to the problem at

hand and useful in early stages. However, as the study progresses questions need to be influenced by previous studies, therefore more closed and specific.

The use of closed-ended questions involves the researcher providing boundaries to the solution space and it may lead to a narrow range of responses. This could be in the form of giving the respondent a set of answers to choose from or rating the solutions given. Furthermore, McCambell and Stewart (1992) as quoted in Hsu and Sandford (2007) describe closed-ended as necessary for saving time needed to collate and edit first round responses.

### **3.1.2 Inductive and Deductive approaches**

An inductive approach involves “the search for pattern from observation and the development of explanations,” Bernard & Wayne (2010, p266). Monsen et al. (2009) view inductive research as a data driven approach, where information needed is derived from the data collected. It is highly contextual and often leads to un-anticipated findings. Further, Regener (2003, p77), views the inductive approach as involving “externally orientated and explorative activities involving trial and error, informal contacts and noticing, experiments and heuristics.” Qualitative data is based on measuring human behaviour and is represented by pictures, words, or images (Singh 2007). Limitations of an inductive approach include being labour intensive and expensive and the findings are not generalizable (Murphy, 2001).

Regener (2003) explains that a deductive approach involves planning, formal reports and intelligence and routines. Svensson (2009) views the deductive approach as research efforts emanating from a specific problem. Robson (2011, p524) describes a deductive approach as “moving from a general theory to the testing of specific hypothesis derived from the theory.” Measures the degree to which certain attitudes or behaviours are manifest in a study population (Franscara, 1997).

### **3.1.3 Mixed Methods**

Mixed methods “rests on the ontology that recognizes that phenomena are complex to the extent that single methods approaches might result in partial, selective and incomplete understanding, and on an epistemology that requires pragmatic combinations of methods in order to fully embrace and comprehend the

phenomenon and to do justice to its several facets,” Cohen et al. (2011, p116). Further, Creswell and Clark (2011), define mixed method design as those that include at least one qualitative method and one quantitative method, where neither method is linked to any particular inquiry paradigm. A mixed method is considered practical as the researcher is able to use a number of methods to obtain data during their enquiry. This also helps address inherent weaknesses and provide a more balanced view especially when explaining new areas with little previous work (data to build from).

## **3.2 Research Strategies**

### **3.2.1 Case studies**

Stake (2000, p436) views that case studies “are both a process of enquiry about the case and the product of that enquiry.” Cohen (2011) defines a case study as the study of an instance in action and provides an example of real people in real situations. Further, the objective of the case study method is to highlight the multiple factors that account for decision-making, Kothari (2004). However, Gray (2004) describes case studies as time consuming, producing large volumes of data and harder to generalise. However, they are good for illustrating phenomena and adding context; usually historical, not time dependent and relies on recorded data.

Stake (2000, p435) asserts “as a form of research, case study is defined by interest in individual cases [what is to be studied?], not by the methods of enquiry used.” The best method for collecting data is subjective to each individual case, researcher skill, time, funding etc. Case studies are usually used in situations where phenomenon is subjective and highly dependent on the context in which it occurs. They can also make use of both qualitative and quantitative data collection methods.

### **3.2.2 Grounded theory**

Grounded theory originates in the health sciences (nursing), and it aims to generate or discover a theory, Dey (2008). Bell (2010, p16) defines grounded theory as “an iterative process –cyclical process- in which theoretical insights emerge or are discovered in the data. Insights are tested to see how they can make sense of some other parts of the data and then tested against the data.”

Robson (2011) describes grounded theory as a version of thematic coding process where codes arise from interacting with the data. Furthermore, the codes are based on the researcher's interpretation of the meanings or patterns in the text. The researcher follows insights and probes further through the use of methods to discover more about the problem being investigated. Corbin and Strauss (1990, p4) believe the notion of "good science" in qualitative research has to be retained but has to be modified to accommodate realities of social phenomena.

Grounded theory can be utilised from both interpretivistic and positivistic points of view. Thomas (2009) argues that interpretivism as believing that the world in which we are interested as social scientists is not perceived the same; that is, perception of the world is subjective to each individual. Similarly, Cohen et al. (2011) describes interpretivism as, a subjectivist, interactionist, and socially constructed ontology and on an epistemology that recognized multiple realities, behaviours and the importance of understanding a situation through the eyes of the participants. Interpretivism is closely associated with qualitative research method. Skulmoski et al. (2007, p9) argues that "qualitative research is interpretivist in the sense that the researcher is interested on how the social world is interpreted, understood and experienced." Qualitative research questions allow respondents to give responses that are subjective to an individual, supporting the view that the world is not perceived the same.

Cohen et al. (2011, p116) defines positivism as, "an objectivist ontology and a scientific, empirical, hypothesis testing epistemology." Similarly, Thomas (2009) describes positivism as believing that knowledge about the social world can be obtained objectively: that is, things of the social and psychological world can be observed, measured and studied scientifically. Positivism is closely associated with quantitative research method. Quantitative research questions allow the respondent to test the hypothesis and give specific measurement numeric answer for a response.

"In grounded theory, the analysis begins as soon as the first bit of data is collected," Corbin and Strauss (1990, p6). When using grounded theory the researcher has to accept that the data gathered is an incomplete but working account of social reality, Price (2001). The researcher started the study with little

or no information on the problem and results from previous methods are used to focus further data collection. The iterative (cyclical) process allows the researcher to learn more about the problem. Seale (1999, p102), sees the appeal of the grounded theory approach based on the “capacity to defend the claims of qualitative data to rigour, as well as giving it a distinctive new identity to contrast with the quantitative orthodoxy of the day.” Thus the researcher had to pay more attention to how research methods are applied to collect and analyse the data.

In order to carry out a grounded theory study, Corbin and Strauss (1990, p6-11) suggests the following procedures;

- Data Collection and Analysis are interrelated processes.
- Concepts are the basic units of analysis.
- Categories must be developed and related.
- Sampling in grounded theory proceeds on theoretical grounds.
- Analysts make use of constant comparisons.
- Patterns and variations must be accounted for.
- Process must be built into the theory.
- Writing theoretical memos is an integral part of doing grounded theory.
- Hypothesis about relationships among categories should be developed and verified as much as possible during the research process.
- A grounded theorist needs not to work alone.
- Broader structural conditions must be analysed.

### **3.2.3 Research methods**

#### **3.2.3.1 Interviews**

Robson (2011) describes an interview as a research method that involves the researcher asking questions and hopefully receiving answers from the interviewees. An interview is modelled around a conversation, thus involves questioning or discussing issues with people. Franscara (1997) observes three types of interviews, ethnographic, depth and the long interview. Kvale and Brinkmann (2009, p3) describe types of interviews as including, “journalistic interviews, legal interrogations, academic oral examinations, philosophical dialogues, religious confessions, therapeutic sessions and qualitative research.”

For this study the researcher will use the qualitative research interviews for data collection. See Table 6 for more interview method review and other methods.

Qualitative research interviews can be conducted in several formats, and for this particular study the researcher had to use a semi-structured interview format for the following reasons. Given the subjectivity of the design profession, a semi-structured interview method is recommended, Stanton and Young (1997). In addition, Blaxter et al. (2001), describe a semi-structured interview as involving two people or more than one subject and/ or more than one interviewer. Furthermore, Kvale and Brinkmann (2009, p3) describe a semi-structured interview as “an interview with a purpose of obtaining descriptions of the life world of the interviewee in order to interpret the meaning of the described phenomena.” As in Moultrie et al. (2006) semi-structured interviews were used to inform the content and the structure of the audit; including errors of omission, commission and organisation of the information. Interviews will be used to gather rich and detailed data on the current state of UCD incorporation in NPD. To improve accuracy, accessibility and quality of the interview Lofthouse and Lilley (2006, p2) suggest that the “researcher should write their notes up as soon as possible after the event.”

Murphy (2001), the interviews will allow interviewees to give own definitions of their experience and practices. They further highlighted areas that the researcher had overlooked, fulfilling a useful “hypothesis generating” function. Semi-structured interviews ensured all required details collected from all instances but enables exploration. The researcher considered five aspects of analysing a semi-structured interview data as suggested by Bernard & Wayne (2010, p67) when selecting techniques for data analysis;

1. What kind of data you have?
2. How much skill is required?
3. How much labour is required?
4. The number and types of themes to be generated.
5. Whether you are going to test the reliability and validity of the themes you provide.

### **3.2.3.2 Survey - questionnaire**

Cohen (2011, p256), describes “surveys as gathering data at a particular point in time with the intent of describing the nature of existing conditions, or identifying standards against which existing conditions can be compared, or determining relationships that exist between specific events.” Furthermore, surveys vary in levels of complexity; there are those for frequency counts and those that present rational analysis. Gray (2004), states they are used where large amounts of data have to be collected often from, diverse and widely distributed population. Robson (2011) describe three approaches to survey data collection, self-completion, face-to-face interview and telephone interview.

Also, Robson (2011) observes that a descriptive survey is concerned with providing description of phenomena and valuable in fields with little previous research. Therefore, a descriptive survey will be carried out in this study as data will be described on variables of interest, Cohen (2011). The sampling strategy is driven by the representativeness of sample, access to sample and the need to generalise the findings to industrial designers involved in product customisation Cohen (2011). Additionally the researcher plans to target more than the minimum sample size required for the study, thus compensating for potential fluctuating response rate.

Cohen (2011) and Robson (2011) view some of the challenges in surveys as emanating from; “poor sampling, poor question and wording, incorrect or biased responses (they want to be seen in good light), and low response or non-response.” However, Robson (2011) describes some of the advantages of conducting a survey as including; good for studying attitudes, values, beliefs and motives, questionnaire can be standardised for easier analysis, efficient, allows anonymity and can be generalised. In addition to sampling, question wording and answer coding are important to getting the most out of a survey study.

### **3.2.3.3 Checklists**

This is a set of questions or guides used to compare designs or evaluate the proposed product. Hundal (2002) describes a checklist method as providing a methodological instrument in assisting the decision making in the design process. Compared to interviews, they are designed to reduce pressure on the person

being interviewed, thus allowing them to focus on the problem at hand. Further, it identifies procedures to be taken by a designer in NPD and helps formulate a strategy creation for benefit of the company and the user. The problem is making the checklist comprehensive and correct.

Table 6: Comparison of methods (adapted from Okoli and Pawloski (2004))

Evaluation criteria	Survey	Task Analysis	Focus groups	Interviews
<b>Summary of procedure</b>	Can be either qualitative and quantitative data or both. Fill out survey and return it.	This qualitative method, the person being observed can be aware or unaware they are being observed. The researcher takes down the notes.	They bring together a selection of participants to contribute in a two way debate on a particular set of issues.	It is a method for collecting qualitative data. An interview is modelled around a conversation, thus involves questioning or discussing issues with (1 or more) person(s).
<b>Representativeness of sample</b>	use of sampling techniques. I.e. random.	The findings are subjective to the situation under investigation.	Targeted selection of participants. Sample size too small to be representative.	Targeted selection of participants. Sample size usually too small to be representative.
<b>Sample size</b>	analysis to determine an appropriate size.	Sample size is usually small and task specific. 3 – 5 analyses are sufficient.	Between 5 and 12 people.	One or more.
<b>Individual Vs. group response</b>	Average of individual responses.	Subjective to whether the researcher interacts with the observed.	Group response and ability for participants to influence each other	Averages of individual interviews.
<b>Reliability and response revision</b>	This is assured by pretesting and by retesting to assure test-retest reliability.	Researcher skill and subjective to the level of interacting between the observer and the person being observed.	Limited number of questions (max 10). Needs to be carefully managed to get reliable results.	This is assured by pretesting and conducting.
<b>Construct validity</b>	Careful survey design and pretesting.	Subjective to the researcher's skill and interpretation of the observations.	Needs to be carefully planned. The researcher needs assistants and facilitation skills to carry out the study effectively.	Careful survey design, pretesting and the use of appropriate interview techniques.
<b>Anonymity</b>	Respondents are also often anonymous to the researcher.	The person being observed can be anonymous to the researcher. Depends on objectives of the study.	The participants are aware of each other.	Respondents anonymous to each other, but never anonymous to the researcher.
<b>Non-response issues</b>	Needs contingency for non-response.	Low non response.	Low non response.	N/A. possible when setting-up an appointment.
<b>Participant dropout</b>	High participant drop-out. Depends on the approach	Low participant drop-out.	Low participant drop-out.	Not an issue. Unless there is a need for follow-up.
<b>Richness of data</b>	Depends on the form and depth of questions. Also depends on the ability to follow-up on respondents.	If the person being observed is not aware of the observer; the data collected is more naturalistic. If aware of the observer then clarification can be sought, thus rich data.	The data is rich and complex. Participants get to feed off each other	Richer data because of multiple interactions and their response revision. Participants tend to be open to follow-up questions.
<b>Example(s) in literature</b>	Cohen (2011), Gray (2004)	Kirwan and Ainsworth (2005), Chandrasekaran (1990)	Cohen, et al. (2011), Robson (2011), Franscara (1997), Lofthouse and Lilley (2006).	Robson (2011), Stanton and Young (1997), Blaxter et al. (2001), Murphy (2001)

### **3.3 The research approach for the Study**

It was evident that the most appropriate way to better understand the PDP in this context was to follow a qualitative approach to data collection. Grounded theory was also an ideal way to probe further and understanding the nature of the problem. Thus, the studies will be grounded in the data collected and then used to frame the problem. The researcher also believes that every participant has a unique view of the world and is equally important.

Survey questionnaire, interviews, and case studies were the methods selected to collect and analyse data needed in order to explore the research area. The chosen methods were expected to show a picture of reality, useful for thinking clearly about the problem and for trying out alternative solutions, Rosenhead (2001, p154).

Some of the reasons for choosing these methods include;

- Survey Questionnaire: Allowed the researcher to reach more participants within a short time. The questions were standardised for uniformity and easier data analysis. It is valuable in fields with little previous research.
- Interviews: It will allow the researcher to discover areas that were overlooked, from the survey and also to build a better rapport with participating companies for the next study.
- Retrospective Case studies: Provides an example of how the project was actually conducted. Used where the phenomenon is highly subjective and reliant on the context. Although may be harder to generalise. Retrospective case studies were conducted last in the study to compare how the project was conducted to responses from previous studies. Furthermore, the ISO 13407 was adapted to a preliminary tool for evaluating and improving the use of UCD practices in individual companies.

#### **3.3.1 Product Development Process**

Figure 15 is a product development process (PDP), derived from The Basic Design Cycle by Roozenburg. This PDP will be used to provide a common process for all participants in order to enable data comparison between participating companies.

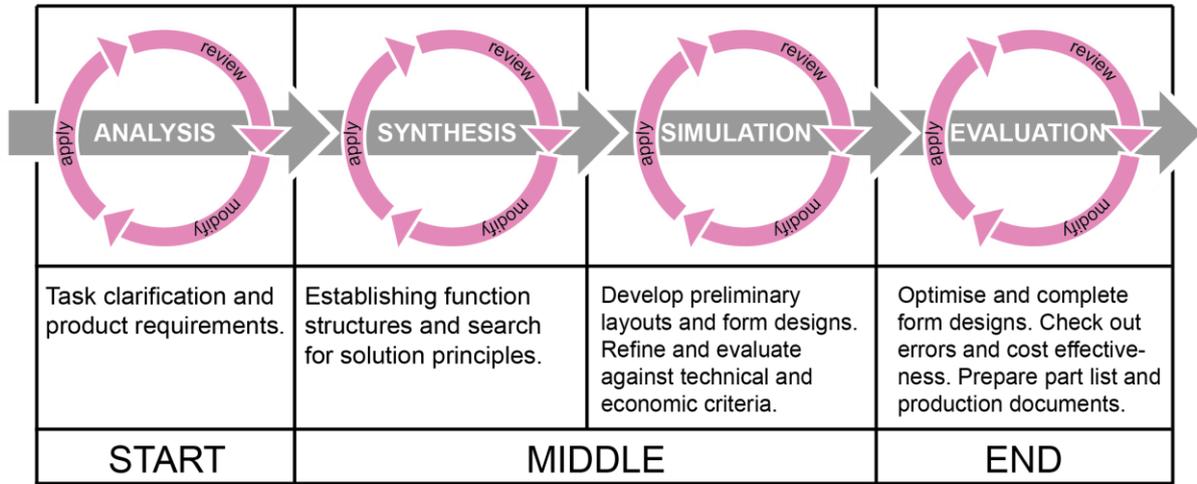


Figure 15: Simplified PDP, derived from The Basic Design Cycle.

### 3.3.2 Transcription

The vast majority of the participants were conversant in English 18/20 thus there was no need for translating. The remaining two required the researcher to frequently translate some of the words to Setswana language for better understanding. However, there was no need for an interpreter as the researcher is proficient in both English and Setswana. The majority of the time, the researcher realised the participant was not proficient in English whilst conducting the interview. The act of transcribing recorded data is part of the data analysis process, and all transcripts from this study were done by the researcher. Further, Bernard & Wayne (2010, p56-58) describes things to look for when you are analysing transcriptions;

- *Repetitions*: The more the same concept occurs in text, the more likely it's a theme.
- *Indigenous typologies or categories*: unfamiliar local words and for familiar words that are used in unfamiliar ways.
- *Similarities and differences*: As quoted (Glaser & A. Strauss (1967, p101–116)) labelled the “constant comparison method”, involves searching for similarities and differences by making systematic comparisons across units of data.
- *Metaphors & analogies*: analysis then becomes the search for metaphors in rhetoric and deducing the schemas or broad, underlying themes that might produce those metaphors (D’Andrade 1995; C. Strauss & Quinn 1997).

### 3.3.3 Data analysis techniques

Kvale and Brinkman (2009, p205), describe the analysis as involving five steps; 1. Read the data to get the sense of the whole. 2. Then, the natural “meaning units” of the text as expressed by the participants are determined by the researcher. 3. Themes that dominate a natural meaning unit is stated by the researcher as possible, thematising the statements from the subject’s viewpoint as understood by the researcher. 4. Interrogating the meaning units in terms of the specific purpose of the study.

Ryan and Bernard (2003, p85), describe analysing text as involving the following tasks: “(1) discovering themes and subthemes, (2) winnowing themes to a manageable few, (3) building hierarchies of themes or codebooks, and (4) linking themes into theoretical models.” Further, Ryan and Bernard (2003) describe themes or categories, as classifications of more discrete concepts and concepts or subtheme are described as clusters of similar statements from different participants. Tassoul and Buijs (2007, p17), describe clustering as “part of the converging stage, expanding knowledge, making connections between ideas, connecting ideas with problem statement, functionalities, consequences, values, etc. Making sense of what at first may seem like random collection of terms and suggestions.” When clustering (p25);

- Use bottom up process: emergence
- Postpone rationalizations and verbalizations
- Group on the basis of feeling and intuition
- Use metaphoric names.

Further, Tassoul and Buijs (2007, p23) describe categorising as “about fitting ideas onto set categories, whereas clustering is to be seen as a bottom-up process by which clusters or categories are to be generated.”

### 3.3.3.1 Definitions of coding

Table 7: Coding definition taxonomy.

Author	Definition
Weston et al (2001)	Views a coding system as a critical analysis tool leading to an evolution in data understanding. Furthermore, it is a way for storing the process followed for the data analysis for easier repetition of the study and verification purposes.
Singh (2007)	Coding is defined as the process of conceptualizing research data and classifying them into meaningful and relevant categories for the purpose of data analysis and interpretation
Strauss (1987, p27)	Describes coding as the “discovering and naming of categories”.
Kvale & Brinkman (2009), and Ryan & Bernard (2003),	Describe coding as involving attaching keywords to a text segment in order to permit later identification of a statement concerned with identifying a wide range of themes as possible and then be concerned with themes that are considered important for further studies.
Seale (1999, p154),	is “an attempt to fix meaning, constructing a particular vision of the world that excludes other possible viewpoints.”

Table 7, shows multiple definitions to the term “coding” given by different authors, it also sheds light onto how coding as a process is done.

### 3.3.3.2 Types of Coding

Coding can be performed in different ways and at different times of the qualitative data analysis. Below are some of the types of coding described in more detail;

**Open coding:** Strauss & Cobin (1990, p64), describe open coding as “the process of breaking down, examining, comparing, conceptualising and categorising data.” Further, Ryan and Bernard (2003, p88) refers to as “act of finding themes [as] what grounded theorists call open coding and what classic content analysts call qualitative analysis (Berelson 1952) or latent coding (Shapiro and Markoff 1997).” Strauss (1987), describes every interpretation as tentative at this point of the data analysis. It forces the researcher to fracture, break data apart analytically and leads to the inevitable payoff of grounded conceptualisation. Guides to open coding; p30-32;

- What study are these data pertinent to? (research question)
- What category does this incident indicate? What part of the emerging theory?

- What is actually happening in the data? Problems faced by participants.
- Analyse the data minutely. Important for extensive theory coverage. Overview approach.
- Frequently interrupt the coding to write a theoretical memo. This moves the analyst further from the data into the more analytic realm
- Analyst must not assume the analytic relevance of any traditional variable (age, sex, social class, and place) until it emerges as relevant.

**Thematic coding:** Robson (2011, p465), describes thematic coding in the following manner;

- All parts of the data are coded and labelled.
- Codes with the same level are grouped together as a theme.
- Codes and themes occurring in the data can be determined inductively from reviewing the data and/ or from relevance to your research questions.
- Themes serve as a basis for further data analysis and interpretation.
- Makes substantial use of summaries of the themes, supplemented by matrices, network maps, flow charts and diagrams.
- Can be used on a purely descriptive or exploratory basis, or within a variety of theoretical frameworks.

**Axial coding:** Strauss (1987, p32), views axial coding as involving “intense analysis done around one category at a time” [conditions, consequences and so forth]. Helps obtain knowledge about relationships within and between categories.

**Selective coding:** Strauss (1987) views selective coding as coding systematically and concertedly for the core category. Done when all other subordinate categories and subcategories become systematically linked with the core. It is more self-consciously systematic than open coding.

**Sociologically Constructed codes and in vivo codes:** Strauss (1987), Sociologically constructed codes are derived directly from the terms used by actors in that field. Also, they depend on the researcher’s scholarly and field knowledge. While in vivo codes are behaviours and processes. How the basic problem is resolved of processed.

### 3.3.3.3 Cutting and Sorting

Ryan and Bernard (2003, p94) describes cutting and sorting as involving “identifying quotes or expressions that seem somehow important and then arranging the quotes/expressions into piles of things that go together.” The coding is performed for each question; responses compared to the question and then clustered into groups concepts. This is an iterative process striving to have the least number of concepts possible. Further, Ryan and Bernard (2003), present a selection amongst theme identification techniques (see Table 8). For this study the researcher uses the following techniques for keyword and theme identification;

**Table 8: Theme identification techniques.**

<b>Easy</b>	<b>Difficult</b>
Repetitions	Indigenous Typologies
Similarities and Differences	Word Lists & Key Words in Context
Cutting and sorting	Word Co-Occurrence

Since this study is driven by the grounded theory, coding for this data analysis will be data driven as opposed to concept driven. Furthermore, coding for these interviews follows Weston et al. (2001) approach since it aims to build a rich understanding of the nature of each participant’s responses and allows us to aggregate the data to search for patterns. After themes have been discovered, similar themes are clustered and their relationships are written down (similarities and differences).

#### **Word Lists and Key-word-in-context**

The researcher identified all the unique words in a text and counts the number of times each occurs as suggested by Bernard & Wayne (2010). Additionally, the researcher looked for the use of industry specific terms. Thus for this study the use of more industry specific terms may be interpreted as more design awareness and vice versa. After the cutting and sorting process, data was better organised therefore the researcher in better position to identify words and the number of times each word occurs.

## Word Co-occurrence

Bernard & Wayne (2010) describes the approach as coming from linguistic and semantic network analysts. It is based on the premise that words commonly occur with other words to form a particular idea. This process was not used to analyse the text since the study is only interested in the explanation of what, how, when of the design processes; not linguistics and semantics.

Ideally the coding process has to be repeated until there is few additions and changes,” Weston et al. (2001, p391). The coding is supposed to allow evaluation of each participant against the objectives of the study and further allow the researcher to see patterns across multiple interviews. Furthermore, Weston et al. describes continuing “to confer until eventually few new or revised codes surfaced.” Also, Ryan and Bernard (2003, p89) observes that “The more the same concept occurs in the text, the more likely it's a theme.”

As with all qualitative studies the subjectivity of the responses makes it harder to consider scientific rigor. However, but the objectivity of the researcher in the study will be critical to allowing the responses to arise from the data.

### 3.4 How this research was actually conducted?

Final study methodology, Figure 16 is the result of the adjustments made to the methodology due to constraints on the study. The use of ISO 13407 was a natural replacement as it provided some degree of international expert agreement on best global practices.

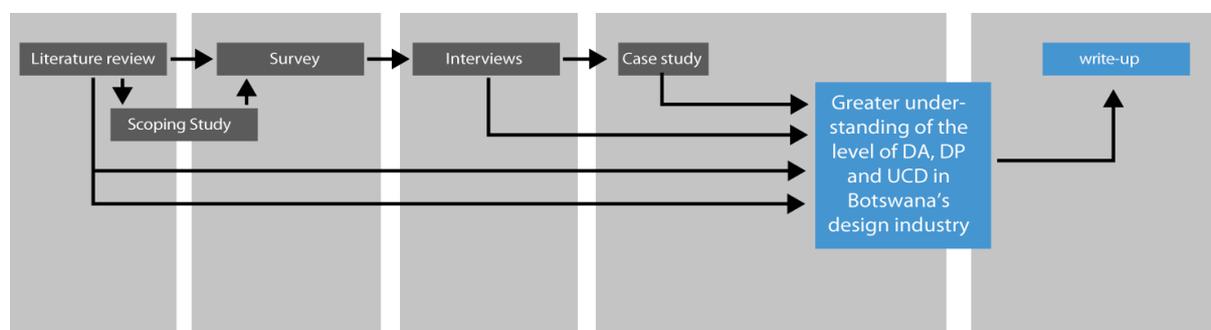


Figure 16: Final study methodology.

The researcher decided to have only one case study for data collection. Also, this was important as the interventions for each case may not be possible from just this

study, i.e. design policy, employment of designers, and change in design training. Therefore, the study will conclude by suggesting potential solutions to the case studies.

### **3.4.1 Study Design**

The research perspective is in the interpretivist tradition as it subjective to the interpretation. Skulmoski et al. (2007, p9) argues that “qualitative research is interpretivist in the sense that the researcher is interested in how the social world is interpreted, understood and experienced.” The approach follows the grounded theory in the sense that it is based on the findings of the survey study carried out earlier with the objective being to influence change in practice. Furthermore, the study has to be more inductive since the researcher knows much less about the problem, thus it is important to be objective and let the observation be the guide. Whitehead and McNiff (2006) describe practitioners investigating their own practice and explain what they are doing and why they are doing it.

### **3.4.2 Sampling**

#### **3.4.2.1 Company identification/ selection**

The criteria for selecting companies for each data collection method always builds on the one used for a previous method. As part of framing the study, cognitive aspect of design was of interest, thus the researcher’s interest in companies involved in the cognitive side of design. The funnel nature of the process allowed the study to move from being abstract to being more specific or focussed; see Figure 17 for the company selection criteria. In addition to learning more about the problem, the funnel also helped narrow/ select companies for the final case studies.

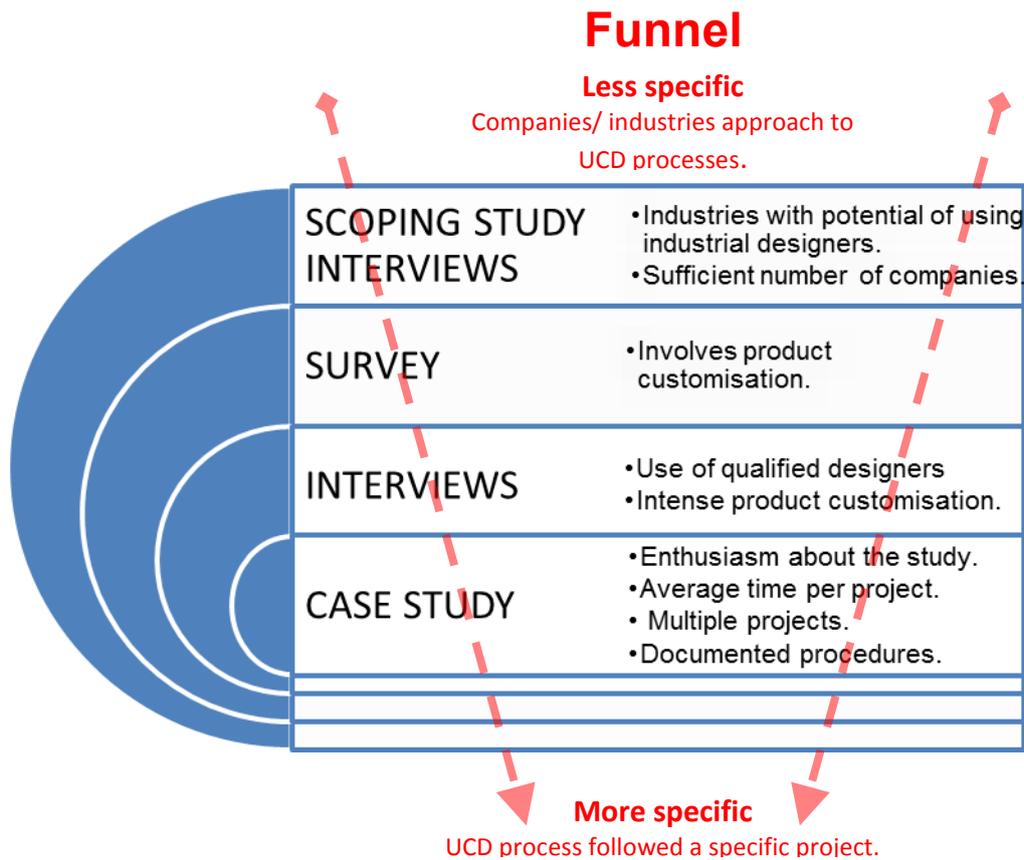


Figure 17: Company selection criteria.

The approach continued to follow grounded theory, as the nature of the data being sought was heavily dependent on the findings from the previous studies. Therefore, a study had to be fully analysed in order to move-on to the next data collection. At the same time, the study also followed a deductive research approach where the researcher sought to find the meaning from all data collected. It was anticipated that data from this study would verify some of the data collected from previous studies and enable an investigation of what is actually done by the companies during a project.

Cohen (2011), points out that researcher always collect information from a smaller sample of the population in such a way that the information collected is representative of the total population under study. However, not all studies have a burden to be generalizable to total population. Moreover, Murphy (2001, p52) thought strengthening claims of generalizability may mean “combining the intensive study of one or more cases with a more targeted examination of a larger number of cases, to discover whether the observations made in earlier case(s) hold elsewhere.”

For this particular study industry data is not fully known as the only data base available was not reliable. Therefore, finding balance between having a large sample, time availability and the cost to conduct a study is essential.

The funnel technique was used for the sampling process, starting with the survey study which had 47 participants. See Figure 18 for the sampling criteria used for the data collections conducted in this study. ‘Pink’ coloured participants were part of the GA industry, while the ‘Blue’ coloured participants represented the FI industry in the interview and case studies. The number of participants in the survey study represented the maximum number (47) of participants in this research. Sampling for the interviews was done on the survey participants for a total of 19 participants; further sampling for the case studies were based on the interview study participants for a total of four participants.

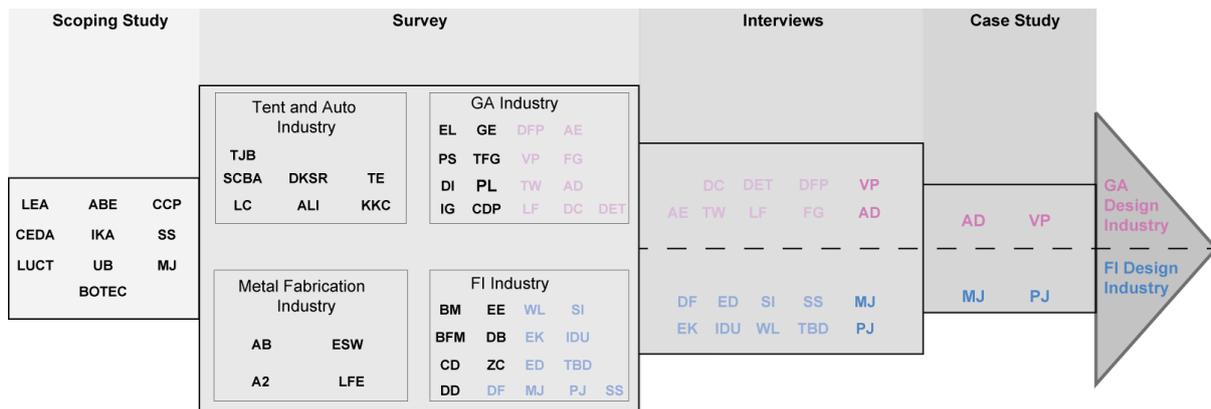


Figure 18: Sampling funnel representing companies that participated in this study.

The sampling for the different data collection methods are further explained;

### Scoping Study Sampling

The targeted companies/ organisations were discovered through government agencies website Botswana Export Development and Investment Authority (BEDIA) industry and company web listings. In addition to industry sectors, BEDIA data provided company listings within each industry including company contact details; website, email and telephone number. Table 9, shows a list of industries and companies compiled from the BEDIA database.

**Table 9: Number of manufacturers in the shortlisted industries. Manufacturers Directory [BEDIA] (2007).**

Industries	Number of Manufactures	Survey Selected Manufacturers
<b>Furniture Manufacturing</b>	37 manufactures	36 manufactures
<b>Building Construction</b>	86 manufactures	11 manufactures
<b>Arts and handicraft</b>	4 manufactures	4 manufactures
<b>Apparels and Textile</b>	59 manufactures	3 manufactures
<b>Motor Vehicle Accessories</b>	6 manufactures	3 manufactures
<b>Leather</b>	5 manufactures	0 manufactures
<b>Food Stuff &amp; Beverages</b>	64 manufactures	0 manufactures
<b>Pharmaceutical products</b>	6 manufactures	0 manufactures
<b>Paper and stationary</b>	7 manufactures	0 manufactures
<b>Other</b>	3 manufactures	0 manufactures

Industries in red represent shortlisted industries satisfying some of the company selection criteria. Furthermore, despite “Apparels and Textile” having 59 manufacturers it wasn't selected because it did not align the boundaries of the study. The criteria for industry selection for the interviews were;

- a potential use/ need for industrial design.
- secondly the number of manufacturers within a particular industry had to be sufficient to conduct a study.

A total of eight (8) organisations/ companies and two universities (2) participated in this study (see Table 10).

**Table 10: Scoping study participating companies.**

Proposed Areas	Product	Company Name
Government and industry organizations	Product research	Botswana Technology Centre (BOTEC)
	Venture capital, business advice and Incubation	Local Enterprise Authority (LEA)
		Citizen Entrepreneurial Development Agency (CEDA)
Industrial design education	Training (Universities)	Limkokwing University of Creative Technology (LUCT)
		University of Botswana (UB)
Private Sector	Furniture Design	IKA
		ABE
		MJ
	Interior Design	SS
	Ceiling and Partition	CCP

### Survey Study Sampling

Because of the lack of reliable data base, the researcher relied on the snow-ball technique to identify participating companies. Table 9 is the database used to initiate the snowball technique; starting with companies that had up-to-date information on the database and then using word-of-mouth to discover more participants. The sampling strategy was influenced by the researchers scoping study experience with data collection in Botswana. Given the low number of potential participants, 40 companies were thought to be sufficient for the survey. To identify appropriate companies the following criteria was utilised, the company;

- Had to be making user commissioned products, as there is a higher potential of user involvement in the product development process.
- Had to have potential need for designers for their product development.
- The number of manufacturers in an industry was important to attaining a sufficient sample size.

Furniture manufacturing (including interior design), Apparels & textiles, Arts & handicraft, and Building & construction were the selected industries for the study. Upon arrival in Botswana, the Arts & Crafts industry was discovered to be informal and the listed “manufactures” from the database were only re-selling and were not involved in the manufacturing. However, the researcher discovered the Graphic

Design industry which was not listed in industry databases, but had a substantial number of companies. Therefore, Arts & Crafts industry was replaced by Graphic Design.

Table 11, are the study participants from the Tent and Auto manufacturing industry; while Table 12 represents study participants from the Metal fabrication industries. These two industries were then left out of the next study.

**Table 11: Tent and Auto companies that participated in the survey study.**

<b>Company</b>	<b>Employee Number</b>	<b>Years in Business</b>	<b>Location</b>
SCBA	1-10	3-5	Gaborone
LC	31 and above	Over 10	Lobatse
ALI	31 and above	Over 10	Maun
DKSR	1-10	3-5	Maun
TE	1-10	0-2	Maun
KKC	21-30	Over 10	Maun
TJB	1-10	Over 10	Francistown

**Table 12: Metal Fabrication companies that participated in the survey study.**

<b>Company</b>	<b>Employee Number</b>	<b>Years in Business</b>	<b>Location</b>
ESW	11-20	3-5	Gaborone
AB	11-20	Over 10	Gaborone
A2	21-30	6-10	Gaborone
LFE	31 and above	6-10	Gaborone

Table 13 represents a list of companies from the Graphic / Advertising (GA) industry that participated in this study; while Table 14 represents a list of participating companies from the Furniture / Interior (FI) industry. The highlighted companies are those that were carried over to the next data collection (interviews).

CHAPTER THREE: RESEARCH METHODOLOGY

**Table 13: GA companies that participated in the survey study.**

Company	Employee Number	Years in Business	Location
VP	1-10	6-10	Gaborone
GE	1-10	0-2	Gaborone
IG	21-30	Over 10	Gaborone
TFG	1-10	Over 10	Gaborone
AD	1-10	0-2	Gaborone
FG	11-20	Over 10	Gaborone
CDP	31 and above	Over 10	Gaborone
PL	11-20	Over 10	Selebi Phikwe
LF	11-20	6-10	Gaborone
PDS	1-10	3-5	Francistown
DFP	1-10	0-2	Francistown
EL	1-10	6-10	Francistown
DC	1-10	Over 10	Selebi Phikwe
AE	1-10	3-5	Francistown
PS	1-10	6-10	Selibi Phikwe
DET	1-10	0-2	Gaborone
TW	11-20	6-10	Gaborone
DI	1-10	6-10	Gaborone

**Table 14: FI companies that participated in the survey study.**

Company	Employee Number	Years in Business	Location
BM	31 and above	6-10	Gaborone
ED	1-10	0-2	Gaborone
SI	1-10	3-5	Gaborone
EE	1-10	6-10	Gaborone
EK	11-20	6-10	Gaborone
BFM	11-20	Over 10	Gaborone
ZC	1-10	Over 10	Gaborone
MJ	31 and above	Over 10	Gaborone
TK	21-30	Over 10	Gaborone
DB	11-20	Over 10	Gaborone
CD	31 and above	Over 10	Gaborone
DD	31 and above	Over 10	Gaborone
WL	1-10	3-5	Francistown
IDU	1-10	Over 10	Selebi Phikwe
PJ	1-10	6-10	Francistown
TBD	1-10	0-2	Francistown
DF	11-20	Over 10	Selibe Phikwe
SS	1-10	6-10	Gaborone

The total number of companies participating in the survey study was 47, seven more than the initial target of 40; (Tent and Auto) = 7, Metal fabrication = 4, GA = 18, and FI = 18.

### **Interview Study Sampling**

The two selected participating industries (FI and GA) were chosen because of a greater number of participants in each industry. Target participants for the interview study were the survey study participants. Further the selection criteria included:

- There had to be sufficient number of companies within an industry for the results to be generalisable.
- The company had to be making customised products (products to be made commissioned by the customer/user).
- The company had to have designers as part of their staff or potential to hire designers for their product development.
- There was also an attempt to select typical companies and to have geographical diversity.

Since the researcher already had participant contacts from the survey study; the shortlisted potential participants were contacted through a phone call since an e-mail is highly unreliable in Botswana's context. Furthermore, the majority of companies did not have websites which could have been used to better select the most suitable participant. The intent was to interview a minimum of 20 companies, 10 from the GA industry and the other 10 from the FI industry. Table 15 is a list of GA companies that participated in the interview and Table 16 showing participating companies from the FI industry. The highlighted companies in these tables were selected for the next data collection (case studies).

**Table 15: GA companies that participated in the interview study.**

Company	Employees Number	Years in Business	Location
VP	1-10	6-10	Gaborone
AD	1-10	0-2	Gaborone
FG	11-20	Over 10	Gaborone
LF	11-20	6-10	Gaborone
DFP	1-10	0-2	Francistown
DC	1-10	Over 10	Selebi Phikwe
AE	1-10	3-5	Francistown
DET	1-10	0-2	Gaborone
TW	11-20	6-10	Gaborone

**Table 16: FI companies that participated in the interview study.**

Company	Employees Number	Years in Business	Location
ED	1-10	0-2	Gaborone
SI	1-10	3-5	Gaborone
EK	11-20	6-10	Gaborone
MJ	31 and above	Over 10	Gaborone
TK	21-30	Over 10	Gaborone
WL	1-10	3-5	Francistown
IDU	1-10	Over 10	Selebi Phikwe
PJ	1-10	6-10	Francistown
TBD	1-10	0-2	Francistown
DF	11-20	Over 10	Selibe Phikwe
SS	1-10	6-10	Gaborone

### 3.4.2.2 Retrospective Case Study Sampling

Target respondents were companies that participated in the previous semi-structured interview study. As the previous study, the research continued to focus on GA design and FI design; with an objective of selecting a total of four companies from both industries.

Interest in the study: was important as it allowed easier back and forth communication between the researcher in the UK and the participants in Botswana. Average number of trained designers within companies was also important to case study sampling process as it allows deeper or more obscure UCD issues to be discussed.

The funnelling of the companies continued into these case studies, where the target sample was selected from companies that participated in the previous study. The aim was to target six participants with a minimum of four participants required for the study. Therefore, the criteria used to select two participating companies from each industry were;

- The level of sophistication of the PDP.
- Presence of UCD practices and/or making of custom products.
- Number of designers in a company.
- More than two products being developed at the same time.
- Interest in the study.
- Average time spent on each project.

The researcher also wanted to select average company's representative of companies that participated in this study and Botswana's industry. However, the use of averages for sampling purposes was not possible in selecting the minimum four numbers of companies required for this study. Therefore, for the GA industry the researcher focussed on selecting a *Graphic design focussed company* and an *Advertising design focussed company*. While the selection from the FI industry was based of the *Furniture design focussed company* and the *Interior design focussed company*. Interest in the study was also important to sampling as it reflected the level of co-operation expected from each participant. Since these are case studies, the sample does not represent the whole industry but rather the specific projects studies and provided a window into how these companies actually conduct the PDP. However, when case study findings are analysed with other data collected, the results are expected to be applicable to Botswana's industry. Table 17 and Table 18, show information that was used in selecting the final four companies from the GA and FI design industries. The highlighted rows represent the selected participant companies.

Table 17: Graphic and Advertising design selection criteria.

Company	Graphic or Advertising	No of employee(s) with design degree	Years in Business	PDP complexity	Interest in study	Notes	Go/ No go?
VP	G	2	6-10	✓✓✓	✓✓✓✓	A good chance to find a project for this study. The products are custom made and the customer is involved in the PDP. Company managed by a trained designer and support staff to implement. The PDP exists but not organized nor written down.	YES
FG	G	2	6-10	✓✓	✓✓	Above Average. They may be the leading graphic design company in the country. There are enough customization projects to choose from for this study. Use of latest technologies, laser cutter, new materials and does work for some South African based companies.	NO
LF	A	3	6-10	✓✓	✓✓✓	Enough projects to choose from, also products are custom made by multi-disciplinary NPD team. Clients include multinational corporations, coca cola, Barclays, DTC Botswana etc.	YES
TW	A	4	6-10	✓✓✓✓	✓✓✓✓	Above average. Multidisciplinary teams including designers and interns. Does work with multinational corporations (Barclays, SADC, and giz). PDP is well organized.	NO
AD	A	2	0-2	✓✓	✓✓✓✓	The company is run by designers and the also have design interns. Products are custom made and there are enough projects to choose from.	YES
PDS	G	2	3-5	✓	✓✓	Design mostly limited to business cards, flyers; customers are involved in PDP. The only designer is still studying. Rudimentary design process.	NO
AE	G	1	3-5	✓	✓✓	Limited design work and jobs are few and far between. The company changed their core business to embroidery, digitizing existing logos and then embroidering them on fabric. The company is still under incubation with LEA (Local Enterprise Authority) where business decisions and premises are provided by this government funded organization.	NO
PS	G	0	6-10	✓	✓✓✓	Limited design work (digitise what the user already have). Majority of work revolves around business cards, letterheads, invitation cards, funeral programs etc. Designer learned on the job. There are enough jobs to choose from. Rudimentary design process.	NO
DC	F	2	Over 10	✓	✓✓✓	Limited design work. Commissioned work was far between, with the majority of the work being re-upholstery and logo embroidery.	NO

Table 18: Furniture and Interior design selection criteria.

Company	Furniture or Interior	No of employee(s) with design degree	Years in Business	PDP complexity	Interest in study	Notes	Go/No go?
ED	I	1	0-2	✓✓	✓✓✓✓	Works on one project at a time therefore less design work. Struggling and at risk of closing down.	NO
SI	I	1	3-5	✓✓	✓✓✓✓	Sufficient number of projects to sample from. But had no time to participate in the study.	YES
EK	I	1	6-10	✓✓	✓✓	This is a multinational company where majority of design decision making is done in South Africa, thus above average. Majority of Botswana work is in installations.	NO
MJ	F&I	2	Over 10	✓✓	✓✓✓✓	Ample projects to pick from for the study. Also offered both furniture and interior design. High interest in this study.	YES
TK	I	2	Over 10	✓	✓✓✓✓	Limited design work. The product is modular and standard; the product design was done years ago at the moment they just arrange the modules.	NO
IDU	I	0	Over 10	✓	✓✓✓	Limited design work. Overwhelming majority of work is re-upholstery.	NO
PJ	F&I	1	6-10	✓	✓✓✓	A good number of projects to pick from. Self-taught but willing to learn. Specialises in furniture design but also does some interior design.	YES
TBD	F	0	0-2	✓	✓	Less interest in the study. The manager was not too easy to get hold of. There is no sign of design process, even product measurements were hardly written down. The company is still under incubation with LEA (Local Enterprise Authority) where business decisions and premises are provided by this government funded organization.	No
DF	F	1	Over 10	✓✓	✓✓✓✓	Most of the work done is batch production and custom products are negligible. Most of the orders came from govt., council, retailers etc.	No
SS	I	5	6-10	✓✓✓✓	✓✓✓✓	Enough projects to select from and they are all commissioned. Most of the work is done with the biggest companies in the country. Design process is followed and most of the staff is design trained. They have advocate for greener solutions and alternative materials for a competitive edge.	No
WL	F	1	3-5	✓✓	✓✓	Limited design work. Design work was few and far between. The company spent most of its time replicating existing designs. They involve design interns to come-up with new products. The company is still under incubation with LEA (Local Enterprise Authority) where business decisions and premises are provided by this government funded organization.	No

### 3.4.2.3 Map of distances between places

Figure 19 shows the study was carried out on the most population dense eastern part of the country; see Figure 2 for comparison with Botswana population density. The map shows distances between data collection locations, data collection methods and a brief description of the participating industries in each location. The dot size represents the relative size of a data collection location.

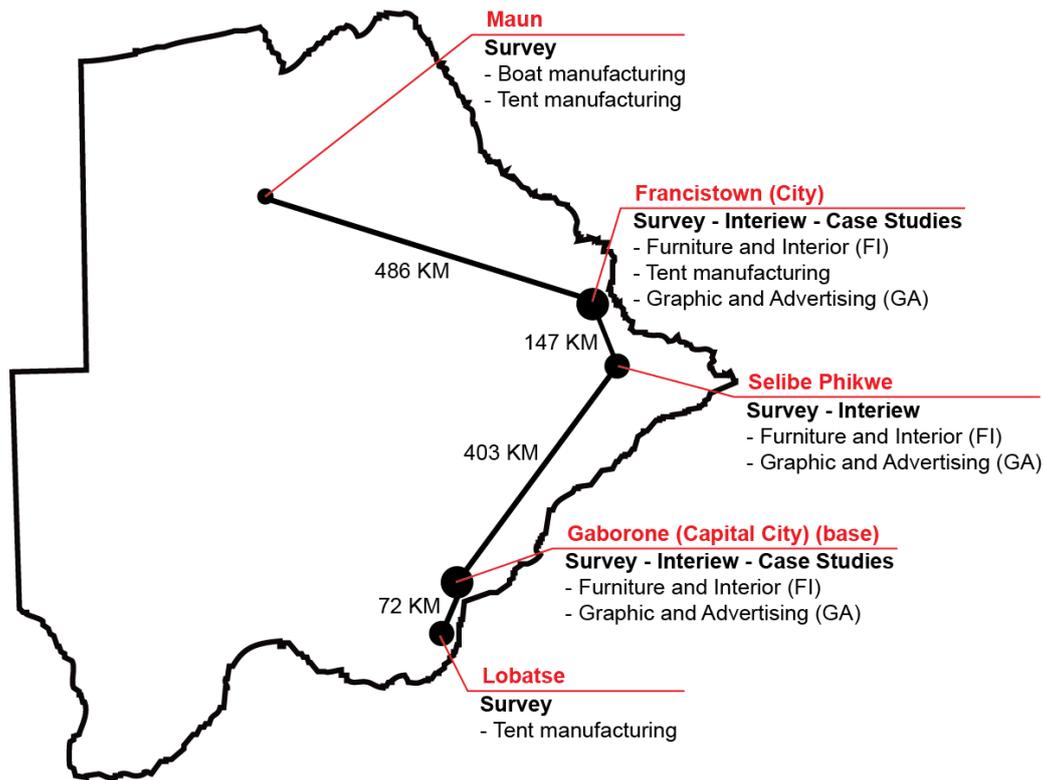


Figure 19: Data Collection Geographic Scope.

### 3.4.3 Data collection procedures

#### 3.4.3.1 Scoping Study Procedure

The level of design awareness in Botswana's companies was investigated through the use of the design ladder and design management staircase proposed by Bakker and Goossens (2008). Additionally, the researcher to explore the training needs of companies and design education programs in relation to UCD activities, questions were derived and/or guided by the literature review.

Over 20 companies were contacted for this study, the intent was to have as many as possible within a span of two weeks. Company websites were explored to gain better

understanding of the individual companies and locate persons of interest. Telephone calls were subsequently made to the identified companies and requests were made to speak to whoever was in charge of PDP. Since the industry data was not reliable, with outdated contacts, out of business (closed) and others now producing different products; the snowball technique was used to discover more potential companies to participate in the study.

Upon identifying appropriate individual(s) an appointment was requested for an interview one week later. During the call the interviewer insisted on physically delivering the participant information sheet and the cover letter prior to the interview date. This was a way to allow the interviewee to incubate on the information that will be solicited from them during the interview.

Interviews were conducted at the interviewee's workplace. This was based on the assumption that the interviewee would be relaxed and comfortable when they are in a familiar environment. Arrival at the interview place was at least 10 minutes prior to the scheduled time, providing enough time to review interview material and prepare. Comprehensive understanding the questionnaire meant avoiding questions that have already been answered.

Length of interviews ranged between 30–50 minutes, excluding the informal conversation at the end of the interview session. Debriefing immediately followed the interview, interviewees were reassured of information confidentiality, and they were offered the results of the study and were told the interview was very helpful to the study. However, the informal conversation at the end of the interview often revealed valuable information; this additional information was incorporated into the interview notes prior to leaving the location. Price (2001) describes participants after interviews as being surprised at how much the interview has covered and being concerned to how their contribution was perceived by the interviewer.

### 3.4.3.2 Survey Procedure

This survey study gave the researcher an opportunity to quickly gather/ collect data from a large sample. The direction of the study was influenced by data from the literature review and the scoping study experience. This study was applied across short listed industries (see Table 9), to acquire a better understanding of design, UCD and narrow-down the selection of industries/ companies for the next study. This section shows the process of preparing, conducting and analysing the survey results. Figure 20 provided a guideline for preparing and conducting a survey. The method was adapted from Czaja & Blair (1996); Stages of a Survey.

The survey questionnaire was hand delivered as a hard copy, to the appropriate companies and then collected after the respondent has completed the survey. The participant was given a consent form to fill-out and a brief explanation of what the study concerned. The Product Development Process (PDP) was briefly explained to the participants upon delivery of the survey materials and if needed upon collection of the survey materials the researcher took time to clarify misunderstood questions.

Upon hand delivering the questionnaire, the participant was asked about their competitors, therefore discovering more companies to approach. This was repeated until the time allocated for the study elapsed. The goal was to have as many respondents as possible above the minimum number of 40. There were instances where the researcher had to translate and be the one filling-out the questionnaire. When the answered questionnaire was collected the participant was debriefed and asked about their possible participation in future studies. The final number of participants in this study was 47.

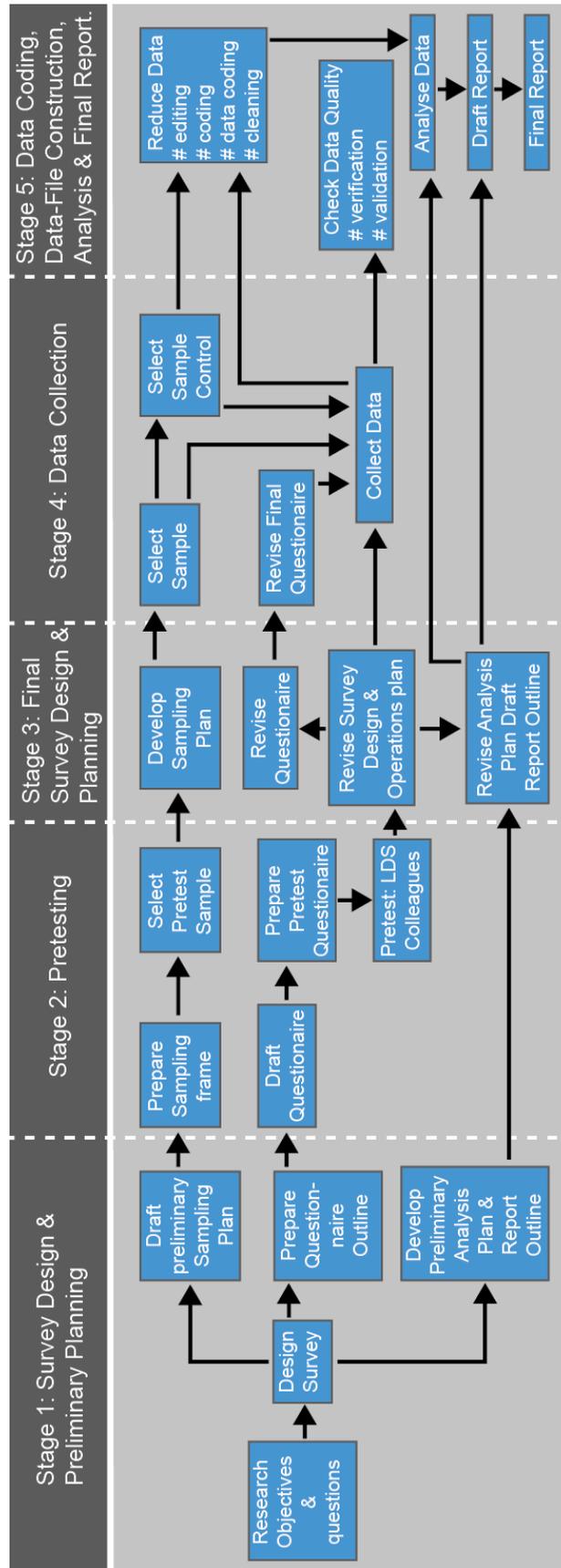


Figure 20: The stages of a survey. Adapted from, Czaja and Blair (1996).

### 3.4.3.3 Interview Procedure

The semi-structured interview consisted of a mixture of open-ended questions and closed questions derived from the survey and the literature review. Having an element of structure for the interviews ensured some consistency across all interviews at the same time ensuring a boundary on the response space. Kvale and Brinkman (2009) describe a semi structured interview as containing elements of both structured and unstructured interviews, thus able to explore ideas with participants but also get fixed responses for some criteria.

Participants were contacted through a telephone call, and during the call if a participant was willing to participate, the date and time were scheduled. The consent form was signed, agreeing to take part in the study. A questionnaire was provided for each interview and notes were jotted on the questionnaire in addition to the use of a voice recorder. The researcher paid attention to questions that were answered ahead and avoided having to repeat the question. Upon completion, participants were thanked for their participation and the researcher proceeded to discussing how the information will be used. Also, participants were invited to participate in the next study.

Before starting the interview the participant was reminded of the purpose of the study and permission requested to record the audio of the interview. Prior to starting an interview the researcher had to ask for permission to record the interview. The researcher was conscious to listen more than they spoke, at the same time had to show some enthusiasm about the study. The questions were asked in a clear was the laddered questionnaire assisted the transition to the next question.

Questions were only asked in the manner they were written on the questionnaire; both the main question and the follow-up were asked. This decision was made after the review of the first five interviews. Whenever there was need to elaborate more on the question, the researcher made an effort to avoid leading participants to responding in a particular way.

The data collected was divided into two groups, Furniture and Interior (FI) design and Graphic and Advertising (GA) design. The responses were first analysed to see if they are answering the question asked prior to being sorted into any group. Responses to each question will be clustered into these two groups and compared to

each other. For this study, cutting and sorting began from printouts of the excel spread sheets. Each answer is given a code to allow referencing back to context and blind sorting of the data.

#### **3.4.3.4 Retrospective Case Studies Procedure**

The case studies involved retrospective case studies (project documentation inspection) followed by a semi-structured interview to follow-up on undocumented activities. Retrospective case studies were performed on the documentation associated with a recently completed project; and then followed by a semi-structured interview aimed at filling in any UCD practices that were not documented. The case studies attempted to link the UCD practices to different stages of the PDP and the level of PDP documentation.

The companies' documentation review was initially used to answer the questionnaire as comprehensively as possible to obtain unbiased information; and the remaining unanswered questions were answered through a semi-structured interview with the project leader. Thereafter, participants were asked whether they performed UCD practices not found in the documentation review. Furthermore, the questionnaire was formatted to accommodate these two methods of data collection.

Appointments were made with the selected companies and they were informed about what the study entailed. Another purpose for the introduction was to allow participants to prepare the required materials and prepare for what the study may require them to recall. Additionally, they were also informed of the intent to have the interview's audio recorded. A reminder call was made 24 hours before meeting the participant(s) to make sure everything was in place. Upon arrival at the company the researcher followed the following process;

*Documentation review:* Was performed to make a connection between what participants had mentioned in prior studies (survey and semi-structured interviews) and what is actually being practised. However, since the researcher was looking at a recently completed project, three out of four projects were already delivered; therefore there were no pictures of the product to take. At the end of the documentation review the researcher set an appointment for the follow-up semi-structured interview, if it could not be done immediately.

*Semi-structured Interview:* The researcher anticipated a lot of data related to the PDP would be missing or not documented. Therefore, two to three days were spent reviewing product documentation and producing a list of questions for the semi-structured interview which would fill the gaps and answer questions arising from the documentation review. These semi-structured interviews were conducted with one of the project leaders directly involved with the particular project under investigation.

The Basic Design Cycle was re-introduced to the respondent prior to starting the questionnaire. All participants were already familiar with the Basic Design Cycle from previous studies and for simplicity in this study it referred to as Product Development Process (PDP).

#### **3.4.4 Ethics**

Ethical clearance was obtained from the Loughborough University Ethical Advisory Committee to allow data collection (see 12.1 Ethics Clearance Documentation). The Participant information sheet was given and explained to participants prior to the data collection day. At the beginning of each data collection the researcher asked for permission to record and this was followed by the signing of the informed consent forms. During the data collection and analysis data was stored securely; additionally participant names were replaced by codes in order to protect participant confidentiality in the thesis. Finally, the participant was debriefed; reminded of the confidentiality and told the next stages of this study.

### **3.5 Chapter Summary**

This PhD study followed a qualitative approach since the data being sought involves detailed descriptions and evaluation of processes. The data was based on understanding the interaction between the design team and user. Additionally the study will follow an inductive approach as information needed is derived from the data collected/ driven. Furthermore, the inductive approach fits well onto grounded theory procedures.

Methodology for this study followed grounded theory procedures for data collection, analysis and application of the findings. Grounded theory meant the data collection process was linear; data has to be fully analysed in order to move to the next study. This was because the results of the previous study inform the next questionnaire. Grounded theory will be utilised from an interpretivistic points of view which

describes the world that we are living in as subjective to each individual; same way PDP is subjective to each project. Data collected through grounded theory is subjective to the researcher's interpretation.

Construct validity, was an important aspect of doing this study, in addition to the iterative process where the researcher learns more about the problem through solving it. Data collected was validated through comparison of the data from the data collection methods used in this study. Did a participant provide the same information for the survey, interviews and case studies? For companies' confidentiality and anonymity the researcher decided focus groups were not going to be part of this study; unless it was done within a company.

CHAPTER FOUR  
**CONTEXTUAL REVIEW**

## **4 Contextual Review: Botswana**

### **4.1 Culture**

Botswana is made of many different tribes and cultures, i.e. Bamangwato, Bakwena, Bangwaketse and others. “Our multi – ethnic value systems, traditions and beliefs as reflected through the various languages, performing and visual arts as well as other forms of cultural expression constitute the strands of a broader national culture and need to be well researched in order to be known, appreciated and respected,” Botswana culture guide (2008), as expressed in the National Policy on Culture. However, the similarities between the different tribes far outweigh the differences; therefore these tribes first consider themselves Batswana (Motswana singular) and this notion binds all different cultures existing in Botswana. Also, despite the tribes having their own languages, Batswana still share the Setswana language that is made-up of a mixture of these languages. Further, English is one of the official languages and the majority of Batswana are conversant in English.

Botswana National Policy on culture has been developed to promote the following goals: National Policy on Culture (2001, p10)

- Re-awake appreciation and respect of culture to re-enforce a sense of national unity and pride.
- To stimulate and foster creativity in all spheres of national life and allow Batswana to continue to improve the quality of their own life whilst making their contribution towards the vast store of human civilization.
- Strengthen the sense of identity, thus guiding Batswana to assimilating innovation within the context of their own culture.

#### **4.1.1 Geert Hofstede’s Cultural Dimensions**

In order to create products for Botswana’s local market and the SADC regional market, it is important to understand the local cultural context and how it relates to the regional cultural context. In this situation Geert Hofstede’s Cultural Dimensions, were used to gain more understanding of the local (Botswana) and regional cultural dynamics; what to anticipate from local and regional users, see Table 19. This

information is especially important for foreign companies looking to do business in these new cultures; they are able to compare the new culture to their own and structure a plan for the new market.

Since Hofstede's study did not include Botswana and the only regional (SADC) countries included in this study are South Africa, Zambia and Tanzania. The data from these countries will be used to shed light into how values in the workplace are influenced by culture in Botswana and this part of the world. Hofstede's study on cultural dimensions utilised five cultural values namely;

**Table 19: Geert Hofstede's Cultural Dimensions, Geert Hofstede [online] (2011).**

<b>Cultural Dimension</b>	<b>Explanation</b>
Power Distance Index (PDI):	Is defined as the extent to which the less powerful members of organisations and institutions (includes family) accept and expect that power is distributed unequally.
Individualism (IDV):	In individualist societies ties between individuals are loose; everyone is expected to look after him/ herself and his/ her immediate family. On the other hand, cultures that are less individualistic individuals have strong ties to with other individuals, more social and value extended families.
Masculinity (MAS):	Explains the distribution of roles between genders. In 'masculine' cultures people are expected to be assertive and competitive; while 'feministic' cultures they are expected to have modest and caring values. Women in 'feministic' countries have the same caring values as men and in 'masculine' countries they are somewhat assertive and competitive, but not as much as men.
Uncertainty Avoidance Index (UAI):	The extent to which a culture programs its members to feel either comfortable or uncomfortable in unstructured situations. Uncertainty avoiding cultures minimize such situations by strict laws and rules; people are also emotional and motivated by inner nervous energy. While uncertainty accepting cultures are more tolerant of different opinions, try to have as few rules as possible and are expected to show emotions.
Long-Term Orientation (LTO):	Values associated with LTO are thrift and perseverance; while the values associated with short-term orientation is respect for tradition, fulfilling social obligation, and protecting one's 'face'.

Comparison of the SADC members represented in the study, Sources: Hofstede (2011). LTO data for South Africa was not available (Table 20) on the database.

**Table 20: Botswana's neighbours cultural dimensions.**

	<b>PDI</b>	<b>IDV</b>	<b>MAS</b>	<b>UAI</b>	<b>LTO</b>
South Africa	49	65	63	49	
Zambia	64	27	41	52	25
Tanzania	64	27	41	52	25
<b>SADC average</b>	<b>59</b>	<b>40</b>	<b>48</b>	<b>51</b>	<b>25</b>

### **Geert Hofstede's Cultural Dimensions: Assumptions on Botswana**

These assumptions on Botswana are based on average ratings of the listed SADC member states; South Africa, Zambia and Tanzania, see Table 20;

- *PDI*: Botswana can be expected to have a moderate PDI (59) since the maximum index on the scale is 120. Comparison to other African countries on the study, South Africa had the lowest power distance.
- *IDV*: With a score of (40) Botswana can be considered less individualistic than South Africa. Therefore more socialistic and as valuing family more than South Africans, but less than the Zambians and the Tanzanians.
- *MAS*: Botswana can be expected to be having modest and caring values than South Africa but less than Zambia and Tanzania with a score of (48). However, Botswana can also be viewed as less assertive and competitive compared to South Africa but more assertive and competitive that Zambia and Tanzania.
- *UAI*: The uncertainty avoidance index shows the represented countries having a similar value. Therefore, Botswana like the region accepts new ideas and show average emotions compared to the world's average.
- *LTO*: Botswana's LTO like the regions can be expected to be below the world's average. Therefore people are expected to have respect for tradition, likely to fulfil a social obligation and more likely to care how their behaviour reflects on their greater family.

## 4.2 Economy

### 4.2.1 Employment by Sector

Figure 21 shows Botswana's employment per sector. It is evident that the major employer is the private sector (49.7%), closely followed by (local and central) government (46%) and lastly parastatal sector's (4.3%).

*Parastatal*: is defined as an organisation or industry, (especially in some African countries) having some political authority and serving the state indirectly, Oxford English Dictionaries [online], 2011.

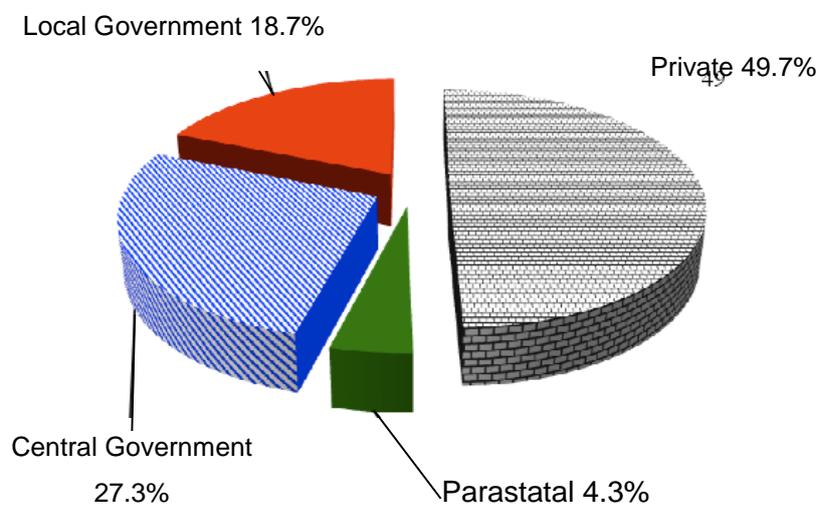


Figure 21: Employment by sector (Botswana). Source: Labour Statistics (2010)

### 4.2.2 Gross Domestic Product (GDP)

Kroon (2007, p79), defines GDP as the “market value of all final goods and services produced within a country in a given period of time.” Botswana's annual GDP growth has slowed in recent years, and achievements have fallen short of National Development Plan (NDP) projections. Botswana has always spent more of GDP on education, e.g. 8.9% of 2009 GDP was spent on education, 8<sup>th</sup> in the world, Botswana Excellence Strategy (2008).

The estimated Gross Domestic Product (GDP) at current prices for the first quarter of 2011 was £1813.04 million representing a decrease of 2.2% over the revised level of

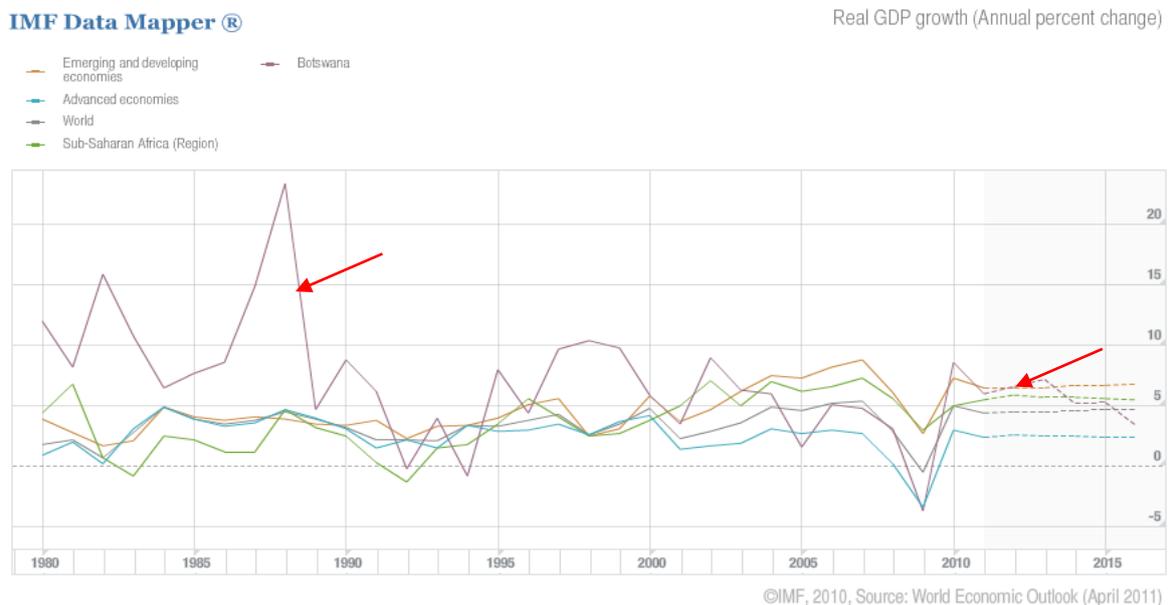
£1809.01 million registered in the fourth quarter of 2010 (see Table 21). However, GDP increased by 6.4% for the year ending March 2011. GDP [Botswana], (2011).

**Table 21: Employment by sector (Botswana). Source: Labour Statistics (2010).**

	% change March 2011 over December 2010	% change March 2011 over March 2010
Total final consumption	2.6	16.8
Gross fixed capital formation	5.8	22.8
Gross Domestic Product	-2.2	6.4

### 4.2.3 Real GDP growth (Annual percentage change)

The graph in Figure 22 shows Botswana's GDP growth (annual % change) is projected to grow above the regions average over the next three years (till 2014). Sub-Saharan Africa is expected to grow better than the world's average but below the emerging and developing economies average, IMF Data Mapper (2010).



**Figure 22: Botswana's GDP compared to the region, emerging and developing economies, advanced economies and the World. Source: IMF Data Mapper (2010).**

This shows a potential for increasing the standard of living in the sub-Saharan region, therefore increase in the region's purchasing power (market for different products). The increase in the sub-Saharan's standard of living represents a new market for multinational companies, including those in Botswana.

#### 4.2.4 GDP purchasing-power-parity (PPP)

GDP-PPP is the value of goods and services produced in a given year divided by the average population for the same year. It is used to show the standards of living. Evidently Botswana is above the SADC regional average coming second to Seychelles; however the small population does not provide a sufficient market for locally produced goods, see Figure 23. Hence local producers have to look externally (regionally) for a greater market. The regional disparity in the standards of living makes the market difficult to target with a single product, thus the need for different versions of a product or service (mass-customization) in order to satisfy the regional market.

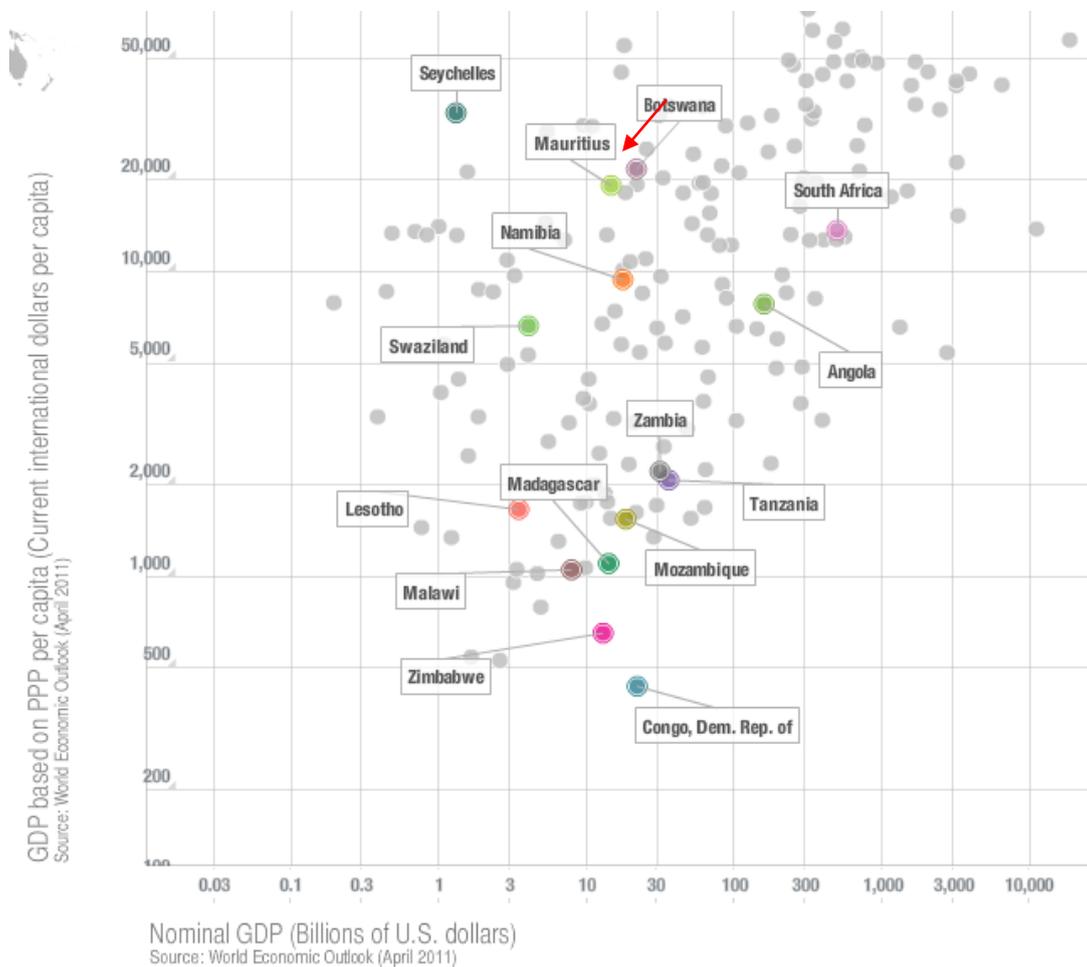


Figure 23: GDP (PPP) SADC region comparison. Source: IMF Data Mapper (2010).

### **4.3 Botswana Strategic Aims**

Botswana's strategic aims are based on economic diversification and sustainable growth. Diversification is aimed at reducing the dependency on diamonds and mining in general for economic growth; after all diamonds are a non-renewable resource therefore will be depleted in the future. Thus the need to add value to diamonds and have more sectors contributing towards sustained economic growth. To stimulate this growth the government aims to create an enabling environment for business and entrepreneurial development.

Business and Economic and Advisory Council (BEAC) have been tasked with identifying projects for diversifying the economy and coming-up with strategies to maintain sustainable growth. The following steps are followed to achieve the strategic aims; i. Identifying constraints hindering economic diversification, ii. Formulate a Strategy and an Action Plan; and iii. Identify key projects for taking Botswana forward.

#### **I. Identifying constraints hindering economic diversification, Botswana Excellence Strategy (2008, p7-8).**

- Much of the country's growth is government generated with most businesses depending on the government to purchase their products; and not driven by the business sector and private investment. The establishment of the Local Enterprise Agency (LEA) is aimed at creating more opportunities for private sector growth and wealth creation.
- "Unemployment remains relatively high in general terms, particularly in non-urban areas".
- Inward looking culture that only sees the local market and avoiding international competition.
- "Mind-set change, including an emphasis within citizen empowerment policies on capacity building, and taking decisive actions to achieve economic openness is essential".
- Policies aimed at addressing unemployment and poverty has bred the entitlement culture, rather than self-reliance and wealth creation.

**II. Formulate a Strategy and an Action Plan, Botswana Excellence Strategy (2008, p9-32).**

The strategy identifies a number of related actions and instruments to achieve economic diversification and sustainable growth, namely; Creating an Enabling Framework; Mind-set Change, Openness and Empowerment; Policy and Institutional Matters; Instruments in Support of Diversification; and Projects to Drive Diversification.

*Creating an Enabling Framework*

- Ensuring continued political stability, internal security, shaping a strong educational system to reflect changing needs arising from diversification, supported by continued sound economic monetary and fiscal management. Botswana has managed to achieve these areas, as evidenced by stable governance, 8.9 % of GDP (2009) invested in Education (8th in the world) and being recognised as the least corrupt country in Africa.
- Making it clear that the government will lead the economic diversification including acting as a lead investor where justified. Botswana Development Corporation (BDC) and Citizen Entrepreneurial Development Agency CEDA act as government's investment agencies.

*Mind-set Change, Openness and Empowerment*

- Government recognizes that for the strategy to be successful the globalization process has to be embraced by all; and it is necessary for the public and other stakeholders to be educated on what to expect and how to embrace this change.
- Laying foundation for capacity building and an economy capable of generating high value added activities and high quality employment. This can be achieved through the processing of the country's raw materials into secondary products to be sold regionally and internationally.
  - Provision of incentives for procurement from small and medium enterprises and to also promote partnerships between local and Foreign Direct Investors (FDI).
  - Government shift from primarily protecting local interests to being a facilitator, efficient administrator and regulator.
  - Reward mechanism for companies creating new employment.

- The need to restructure the education aimed at supporting a dynamic private sector; thus re-looking at admission criteria and graduate profile of universities and vocational training.

Policy and Institutional Matters

Although Botswana has relatively high credit rating compared with the region, a lot of room is available for improvement. Therefore, ensuring continued stability of the financial sector through the effective handling of the interplay between inflation, money market and bond interest rate, and the exchange rate. Furthermore, the concept of “Free Trade Zones” aimed at high technology and high value-added services is being explored.

Instruments in Support of Diversification

This begins with the co-ordination and the management mechanisms for different stakeholders, both public and private sector. Thus, the establishment of the Government Implementation Coordination Office for the public sector and Botswana Investment Fund (BIF), which is part of the Botswana Development Corporation (BDC), mandated to invest in the private sector on behalf of the Botswana government.

**III. Identify key projects for taking Botswana forward, Botswana Excellence Strategy (2008, p22- 32)**

Projects were selected in relation to existing economic activities, better utilization of existing areas of strength, resources and capabilities. The most important criteria being human resource, utilizing the local skills developed over time.

Establishing the Botswana Innovation Hub (BIH)

The hub is being developed to the high technology sector and will be located in a proposed free trade zone. Its aim is to provide room and incentives to the IT, communication, biotechnology companies including (start-ups) local and foreign businesses. The feasibility study has been concluded; the government intends to provide a suitable infrastructure and moreover support the incubation facility for start-up companies.

### Agriculture

Commercializing, and restructuring the livestock sector. Support for Agro-industry projects through infrastructure provision, removing regulatory obstacles, and the appropriate incentives.

### Establishing a Transport Hub

Botswana's positioning at the centre of Southern Africa has the potential to be an ancillary regional transport and logistics hub for the region. Thus, becoming easier and cheaper for local businesses to distribute their products throughout the region.

### Diamond Beneficiation and Related Processing Activities

Free trade zone privileges will be extended to all diamond polishing and other diamond related operations. Therefore, adding value to a local raw material that is currently being exported in its raw form.

### Building Mining Diversification around Botswana's Coal and Gas Energy Base

Coal and gas use for more energy production and establishment of other industries has full government backing, while allowing private sector involvement where feasible. Developing these resources will help drive energy prices down (good for overhead costs) and also contribute towards the country's exports. Additionally, mining industry has substantial local skill-set and manpower within the country.

Substantial effort has been given to align Botswana's strategic aims with other policies, programmes and strategies, i.e. Vision 2016 and the National Development Plan. For the strategy to succeed companies are encouraged to look outward regionally and internationally given the small domestic market. Finally, it is crucial to have measures and indicators in place for performance tracking and measurement, i.e. sector contribution to GDP, level of domestic investment and FDI.

## **4.4 Botswana's Design Policy**

Design policies are a sign of a country's understanding and appreciation of design's potential to positively impact the economy and the quality of life. Design policies advocate for design to be at the forefront of government's strategies in innovation, manufacturing and enterprise. (Sources: Design Policy [UK] and National Design Policy [India] (2007)).

However, Botswana has yet to develop a design policy. The closest initiatives to a design policy are Botswana Technology Centre (BOTEC) and Rural Industries

Innovation Centre (RIIC). These organisations undertake research, technology development and dissemination in line with Botswana’s vision and the National Development Plans. However, these organisations have no impact on the design related private sector and educational institutions.

**4.4.1 Botswana Technology Centre (BOTEK) Source: BOTEK (2008).**

BOTEK supports the national development goals by aligning research, science and technology products and services with the Vision 2016 ideals and the National Development Plans. It operates under the Ministry of Infrastructure, Science and Technology. Some of the activities include; Research programs, Service projects and Technology transfer activities, see Table 22.

**Table 22: BOTEK areas of interest.**

<b>Activities</b>	<b>Projects</b>
<b>Research programs</b>	Energy Built environment ICT and Electronics
<b>Service projects</b>	Kgalagadi sand building block Sustainable housing Kitsong centres
<b>Technology transfer activities</b>	National technology business incubator Solar thermal testing facility Discovery center Solar water heating curriculum

**4.4.2 Rural Industries Innovation Centre (RIIC) Source: RIIC (2010).**

RIIC is the national appropriate technology development and dissemination centre for Botswana. It undertakes new and renewable energy activities with projects in solar cooking and pumping, biogas, energy management, solar space heating and solar cold room. Additionally, RIIC implements an agricultural technology development programme which has resulted in the development and dissemination of various technologies as follows: Sorghum thresher, Maize sheller, Chaff cutters, Fodder processor, Planters, Mini Silo, Grain grinder, Hammermill, Double Barrel

Dehuller, Animal Feed Mixers (two and three augers), Small stock dipping tank, Bush Pump, Sorghum milling plant, Animal feed mixing plant.

The centre has a full-fledged design and drafting office responsible for the production of all technical drawings and designs of products. It also undertakes prototype development and testing to ensure that the resulting prototypes conform to the designs and provide a suitable solution to the problem for which the technology is being developed.

#### **4.4.3 Business Finance, Incubation and Management Services**

CEDA and LEA are government organisations with extensive knowledge and up-to-date local industry information with a mandate of diversifying the economy. Naturally they know the importance and have resources to do thorough market research and pass on the information to the companies they are assisting.

**Citizen Entrepreneurial Development Agency (CEDA)** Source: CEDA (2012).

CEDA was established by the Government of the Republic of Botswana to provide financial and technical support for business development with a view to the promotion of viable and sustainable citizen owned business enterprises.

The Agency is established to address the need for coherent and holistic support for the development of small, medium and large scale enterprises through the soft window and package offered through the subsidiaries. CEDA offers funding for capital expenditure, stock or working capital in new and existing business ventures. It also offers training and mentoring for new and seasoned entrepreneurs and business advisory services to entrepreneurs in various skills as identified through the needs assessment that is conducted during project monitoring.

BOTEC and RIIC have merged to form Botswana Institute of Technology Research and Innovation (BITRI). The aim of this merger is to be a research institution in the area of science and technology relevant to the local culture. Again, it fails to have design as the focus of their activities.

**Local Enterprise Authority (LEA)** Source: LEA (2012).

LEA is a coordinated and focused one-stop shop Authority that provides development and support services to the local industry needs of Small, Medium and Micro Enterprise (SMMEs), encompassing training, mentoring, business plan finalisation, market access facilitation, and facilitation of technology adaptation and adoption.

The Authority's key sectors are manufacturing, tourism, agriculture, and any services that support the three business sectors. In particular, LEA targets women, youth, and the unemployed. Part of the strategy is to encourage businesses to use locally available natural resources and raw materials, within the identified sectors above. Also the authority strives to build competencies in quality and efficiency, and to encourage import substitution and export oriented products and services.

LEA does not provide finance to entrepreneurs, however the authority facilitates access to finance as well as provide support services to SMMEs, before and after funding. Efforts continue to be made by the Authority to engage various stakeholders in the Financial Services industry, including commercial banks, to work together in the development and support of the SMME sector in the country.

#### **4.5 Design Education**

Given the lack of design and UCD related publications on Botswana and the need to obtain information related to the study objectives, there was a need to conduct a scoping study (semi-structured interviews) in Botswana, see chapter 4: Scoping Study.

#### **4.6 Chapter Conclusion**

With a population of just over 2 million Botswana has to nurture trade relations with the neighbouring countries especially South Africa which has the largest population in the region and shares a lot of culture with Botswana. The government accounts for about half of employment, and this is one of the reasons for the need for economic diversification. Another reason for diversifying employment is that the diamond industry and mining in general contribute the vast majority of the GDP; and it this situation is not sustainable in the long run.

CHAPTER FIVE

**SCOPING STUDY:  
SEMI-STRUCTURED  
INTERVIEWS**

## **5 Scoping Study: Semi-structured interviews**

Semi-structured interviews were selected for this scoping study as they are flexible, adaptive and provide rich data in a short time. Furthermore, they provided an overview of the information that was not available on Botswana through literature review and accustomed the researcher to data collection in Botswana. Therefore, interviews were structured, to fill the gaps on Botswana data identified during the literature review. Moreover, Kuhlmann et al. (2013, p7), describes a scoping study as providing "qualitative and explorative dimensions, such as personal experience and the consultation of experts and stake- holders to improve context-sensitivity [in the preparation for data collection]." Also, given the subjectivity of the design profession, a semi-structured interview was recommended by Stanton and Young (1997) as more suited to investigating the motives and processes followed during NPD. Face to face interaction during the interviews also helped in creating relationships needed for possible collaboration in future studies.

### **5.1 Aim of the study**

The aim of these semi-structured interviews was to sample across industry to gain more knowledge about the understanding of design in Botswana. The secondary objective included were for the researcher to experience collecting data in Botswana; forge links with companies for possible participation to future studies; and give direction future studies.

#### **5.1.1 Objectives**

- Explore attitudes/ awareness in the use of design in Botswana.
- Explore the training needs of companies in Botswana in relation to UCD.
- Explore the teaching of UCD in design education programs.

### **5.2 Questionnaire**

Interviews were recorded in the form of notes. Given the time constraints on this study, this was an effective recording method as it eliminated the need for transcribing. In addition, the questions solicited information about interviewee's actions and knowledge; thus there was less need for long answers. Table 23, shows questions associated with the outlined study objectives. Almost all questions are

open-ended and the researcher expected diverse responses from the participants. See Appendix 12.2: Scoping study interview framework, for the actual questionnaire including the follow-up questions.

After all questions were listed they were further arranged starting with the least invasive and proceeding to deeper matters if the subject signal their readiness; explained as a laddering technique by Price (2001).

**Table 23: Scoping study objectives and the associated questions.**

Objectives	Questions
<b>Explore attitudes/ awareness in the use of design. (The design Ladder)</b>	What is design?
	What are advantages and added value of design?
	To what extent are companies using the right people for design work?
	At which stage of product development is design used?
	How professionally does the company organise the design process?
<b>Explore the training needs of companies in Botswana in relation to UCD.</b>	How do you measure the design effectiveness?
	Is UCD part of the training given to employees?
	How is UCD success measured?
	How are user needs obtained?
	Are there links with training institutions?
<b>Explore the teaching of UCD in design courses.</b>	When in the product development process is the user involved?
	How many students graduate every year?
	What are the levels of training? (Degree type)
	How is UCD incorporated into student projects?
	At what study level is UCD introduced to students?
	How is UCD measured in student work?
	To what extent is the training influenced by industry need?

### 5.3 Analysis

After the interviews the answers to each question were written onto Post-it Notes, grouped and stuck on to the wall. The answers to each question were further clustered in terms of similarity; this served to reduce clusters for a better overview of the answers to the questions, see Figure 24. Appendix 12.2.1: Scoping study interview framework, lists all questions used for data collection. Table 23, further

shows questions and the associated objective; however, some questions addressed more than one objective.



Figure 24: Clustering of responses.

## 5.4 Study results

Data analysis took longer than anticipated. Some of the responses to questions covered more than one objective; therefore the researcher had to be vigilant in connecting points arising from the data.

In order to proceed to satisfying the study objectives it was important to first find out Botswana's definition of the term design.

### 5.4.1 Investigating Botswana's understanding of the word design.

To find out the understanding of design, the questionnaire utilised the following questions; what is design? (See Table 24) and what are the advantages and added value of design? See Table 25. Answers to Table 24 (What is design?) show design being viewed as a final product and also as a process to solving a problem. Answers in Table 25 (What are the advantages and added value of design?) point towards design being a process or guide to product development. Responses in each table were distilled to a statement representative to all responses.

Table 24: Responses to "What is design?"

Organisation or company	Product design research	Venture capital, business advice and Incubation		Interior Design	Furniture Design			Ceiling and Partition	Training (Universities)	
	BOTEC	CEDA	LEA	SS	IKA	ABE	MJ	CCP	LUCT	UB
<b>What is design?</b>	Scientific product to <u>improve</u> people's lives.	Planned way for developing new and <u>innovative</u> products.	Conceptualization influenced by a <u>need</u> or gap in <u>innovation</u> .	Creation of spaces with attention to <u>user friendliness</u> and <u>ergonomics</u> .	Ideation aimed at making <u>usable</u> products.	Breakdown of customer's <u>imagination</u> onto a piece of paper.	System or product that <u>helps people</u> overcome obstacles and makes life easier.	Concept or an <u>idea</u> of an endpoint [solution].	It's all about coming up with <u>solutions</u> to problems that we come across in our daily lives.	Creating <u>innovatively</u>
<b>Summary</b>	<i>Satisfying a user need by providing an innovative product that improves people's lives</i>									

Table 25: Responses to "What are the advantages and added value of design?"

Organisation or company	Product design research	Venture capital, business advice and Incubation		Interior Design	Furniture Design			Ceiling and Partition	Training (Universities)	
	BOTEC	CEDA	LEA	SS	IKA	ABE	MJ	CCP	LUCT	UB
<b>What are advantages and added value of design?</b>	Makes the life of the <u>user easier</u> . Less complexity, Durability and <u>ergonomics</u> . Systematic way of doing things.	Makes the product more appropriate <u>for the user</u> .	Process & product improvement. <u>Usability</u> , authenticity, and close a gap (need satisfaction)	Design is important. Spaces allocated serve the purpose. Brings together, interior designer, material finishes and aesthetics.	Determines the right <u>users</u> . Enhances better <u>ergonomics</u> and safer products.	Makes it easier for both the <u>customer</u> and designer to have common understanding of what being done. Makes it easier to make a product.	Helps identify a problem and a solution with in a specific field. Helps being organised.	Rat race... concerned with improving the old stuff. Encourages throwaway society – disposability and lack of durability.	Solutions and efficiency that meets the current times.	Gives base to rational decision making & structuring work. Gives details that are important in <u>user interaction</u> , <u>usability</u> and durability.
<b>Summary</b>	<i>Meeting clients' expectations through product and/ or process improvement</i>									

Responses given in Table 24 and Table 25 were expected to shed light to understanding of the word design by Botswana’s design industry. As a result it can be deduced from the tables that, “Design is satisfying a user need by providing an innovative product that improves people’s lives. Furthermore, participating companies see design used to meet client’s expectations through product and/ or process improvement.” Given the context of this study it was positive to see ‘users’ mentioned so frequently as important to design.

#### 5.4.2 Level of design awareness in Botswana’s companies.

In order to determine the level of design awareness in Botswana’s companies, the design ladder and design management staircase were utilised to prepare part of the questionnaire and evaluate the data.

##### 5.4.2.1 The Design Ladder

Design ladder is used to evaluate the extent/ intensity to which design or designers are utilized within a company. Bakker and Goossens (2008 p120), describes the scale as comprises of four steps, 1. Non-design. 2. Design as styling, 3. Design as a process, and 4. Design as a continuous process, see Table 26. This order and the arrow in the diagram represent the increase in the integration of design to the daily running of a company and vice versa. The design ladder will be used to compare the intensity to which companies are aware of and utilize design.

Table 26: The design ladder.

	Increase in the level of design integration
<ul style="list-style-type: none"> <li>• <b>Non-design:</b> design plays a negligible role.</li> </ul>	
<ul style="list-style-type: none"> <li>• <b>Design as styling:</b> the use of design is limited to the form or styling of a product.</li> </ul>	
<ul style="list-style-type: none"> <li>• <b>Design as a process:</b> design is used to effectively launch products and services on the market.</li> </ul>	
<ul style="list-style-type: none"> <li>• <b>Design as a continuous (innovative) process:</b> design drives all business activities.</li> </ul>	

#### **5.4.2.2 Design Management Staircase**

Derived from the design ladder, the design management staircase aims to investigate the following five aspects (awareness, people, timing, process and expertise) of the product development process. Each aspect is evaluated against the design ladder, Bakker and Goossens (2008). Table 27 show the Design management staircase in relation to the Design ladder. Furthermore it shows and explains the five aspects of the design management staircase, awareness, people, timing, process and expertise.

**Table 27: Design management staircase.**

	<b>Awareness</b>	<b>People</b>	<b>Timing</b>	<b>Process</b>	<b>Expertise</b>
<b>1. Non-design</b>	To what extent are the companies aware of the advantages and added value of design?	To what extent are companies using the right people?	At which stage of product development is design used?	How professionally does the company organize the design process?	How good/effective is the company managing the process?
	Barely aware of the advantages of design and hardly busy with design at all.	Less involvement of the upper management in the product development process.	Design process not planned. Inconsistent use of the design process.	Ad hoc. Activities, product development processes are hardly organized.	No expertise in the area of design management. Has some of the expertise in design management.
<b>2. Styling</b>	They are aware of design but the upper management is not fully sold on the idea.	Greater involvement of senior management and outsourcing for the appropriate knowhow.	Design is used as early as possible in the product development process.	Some process being followed.	Has expertise that is not fully explored.
<b>3. Process</b>	Design is considered indispensable and everyone is convinced of its effectiveness.				
<b>4. Strategy</b>					

### Design management staircase applied the interviewed companies.

Table 28 represents an overview the design management staircase derived from all interviewed companies. The numbers in each box show the number of company responses per aspect of the design management staircase. The design management staircase analyses of all of the individual companies are merged into one table. The ranking is also dependent on a comparison between the participating companies. Table 28 clearly shows participating companies understanding of design as limited to styling/ form of a product and to effectively launch products on the market.

Table 28: Design management staircase company summary.

	awareness	people	timing	process	expertise
1. non-design	2			1	
2. styling	3	7	1	5	5
3. process	4	1	8	2	4
4. strategy		1		1	

Design is still yet to be fully integrated at a strategy level and every day running in the participating companies; where design drives all business activities. NPD teams in these companies are aware of the advantages of design but the upper management was yet to understand this reality. The upper management has less involvement in the product development process (PDP) and design is used as early as possible in the PDP. The PDP is hardly organised with little to no process being followed. The companies have some of the expertise in design management but not fully explored.

#### 5.4.3 Explore training needs of companies in Botswana in relation to UCD.

UCD's incorporation in NPD begins with a thorough market research aimed at understanding the user and his/ her context. Participating companies' incorporation of the user in the design process is similar to Sato's views, where he describes users being considered only for data collection instead of problem solvers, Sato (2009). The interviews revealed that the user is mainly involved at the beginning of the product development process and randomly afterwards. The interviews revealed that two thirds (2/3) of the participating companies did little or no market research;

instead, they relied on word of mouth for marketing and publicity. With most companies claiming good quality products as a competitive advantage, competition can be described as at 'quality level'. As the number of companies producing better quality products increases, companies can be expected to do more market research in order to stay ahead of the competition through finding ways of differentiating themselves/ and their products from competitors. The remaining one third of participating companies (government initiatives); CEDA, BOTEK and LEA recognized the importance of doing market research. In addition, CEDA has market research as one of the requirements for a successful business plan.

The understanding of UCD by the companies involved in the study is based on common sense and the notion of "the customer is always right"; therefore the need to understand what they want. Moreover, two thirds (2/3) of the interviewees indicated that the management encouraged interaction with the user/ client. All companies involved in the study stated the importance of involving the user at the beginning of the design process with the first contact with the user usually being customer initiative or a project brief. Additionally, two of the companies (MJ and SS) further asserted that they never give a quotation prior to meeting the client face to face and discussing the potential solution to the problem brought fourth. Methods used to collect data included questionnaires, interviews, baseline survey and site visits. The data collected included ergonomic, finish (colour, material etc.), functionality and usability. All interviewed companies periodically consult with the user for input and continual validation of what the design team is doing. However, this process was typically not structured nor documented.

Two thirds (2/3) of the companies responding to this question measured the effectiveness of UCD at the end of the product development process; with the key words being "site visits" and "field tests". Other means of measuring UCD success included, repeat jobs and more contracts. Additionally, two thirds (2/3) of the companies reported not having any ties with training or institutions; apart from offering students internships. Even when they get the interns the main objective remains getting the job done without interest in the educational aspect of the internship program. However, only SS and LEA had links going beyond just internships. SS provides critiques for final year projects at LUCT, and also gave advice on the graduate profile they aspire to have (i.e. advise on which software is

currently used by the industry). LEA utilised UB students and lecturers to help incubating companies, live projects for students and lecturers participating in seminars.

Government is the most important stakeholder for the companies involved in the study. About half (4/9) of the companies (CEDA, BOTEC, LEA and ABE) directly depended on government spending for their work. 2/9 of the companies depended indirectly on the government for their jobs; they get their work from contractors that heavily rely on government contracts. Therefore, two thirds (2/3) of the interviewed companies have the Botswana government as a major stakeholder and this is typical of Botswana's companies reliance on government tenders. Similarly, Botswana's strategy for economic diversification and sustainable growth raises the same point, "Much of the country's growth is government generated with most businesses depending on the government to purchase their products; and not driven by the business sector and private investment," BotsExc (2008, p7). This is a disturbing trend as the literature review has shown that companies or organisations that depend on the government for majority of their earnings rarely become successful due to fewer incentives to compete and be innovative. Findlater (2009) points out that to realize full benefits of local empowerment and success projects have to be done commercially without government dependence. The lack of a conducive business environment is seen as a hindrance to private sector growth, thus the dependency on the government, Rocchi (2006).

The remaining third (1/3) of the companies (MJ, SS and AKA) had the private sector as their major stakeholder; although part of the revenue still comes from government contracts. One of the companies (MJ) has identified the opportunity brought by the increase in the number of Chinese building contractors, that they now have a Chinese sales team targeting this growing market.

#### **5.4.4 Explore the inclusion of UCD in Industrial Design educational programs.**

The interviews conducted targeted the two Universities (University of Botswana (UB) and Limkokwing University of Creative Technology (LUCT) that have Industrial Design degree programs in Botswana. Each university graduates approximately 10 industrial design students each year.

UCD is incorporated in student projects by encouraging students to involve users and understand their context prior to, and during, the PDP. Moreover, students are encouraged to solve real life problems with problem owners and to consult with them as this is what students will face after graduating from the university. However, the user or problem-owner is mainly involved at the beginning and at the end of the product development process.

It is observed that the design schools introduce UCD into student projects late in the Industrial Design education. UB introduces UCD in the 3rd year of a four-year program while LUCT introduce it in the final year of a three-year program. Thus, students graduating with two years and one-year of UCD experience respectively. Both design schools measure UCD in student work through a comparison of the final solution to the user needs and the context analysed at the beginning of the project. However, this was not sufficient as they failed to follow the UCD process in the product development process.

Both industrial design programs claim their programs are influenced by local industry need, but also admit the relationship could be improved. The Industrial Design program coordinator at UB asserts that about 30 – 40% of student training to be influenced by industry need. Given the need for products to be built around the user, UCD has to be incorporated earlier in the Industrial Design training program.

## **5.5 Chapter Discussion**

Botswana's understanding of the term 'Design' according to this study is not far off from the global definition; thus "satisfying a user need by providing an innovative product that improves people's lives." The understanding of the term 'Design' deduced from the literature review is "A satisfying and planning activity towards a desirable product or outcome aimed for industrial production." Design awareness in Botswana averages from design being limited to product styling to being used to launch product and services on the market. SS was the only company that showed signs of using design as a continual innovative process, driving most business activities. It has a product design manager that is a trained designer, and strived for continual improvement of their design processes as well as the products.

For the interviewed Botswana companies, UCD as an approach to new product development is not fully understood. However, the basic business principle that the

customer is always right might have unknowingly moved them closer towards a UCD approach. Despite not being familiar with the term UCD, almost all companies involve the user at the beginning and at the end of the project, to collect user needs and testing the final product. The interviewed companies show user involvement in the PDP is neither organized nor structured; and the user is randomly involved.

The industrial design training programs offered in Botswana are familiar with UCD and its benefits to NPD. However, UCD is introduced late in the industrial design programs. Thus, students graduate with minimal understanding of the application and importance of UCD approaches to new product development. Even though both universities claim to have strong industry links, they admit more needs to be done to learn from industry and introduce UCD activities earlier in their industrial design programs.

Two thirds of the interviewed companies saw themselves as market leaders regionally. MJ was looking to grow the brand image, SS were seeking to continually transform methodologies and IKA more looking into using latest technologies (for example CNC manufacture). While the other company (ABE) saw itself relying less on government tenders and targeting the private market more. Evidently these companies are already looking in the right direction and their aspirations could be assisted by a better understanding of the user and UCD.

## **5.6 Chapter Conclusion**

Not all targeted entities participated in this study, a total of nine companies participated in the study and two universities (UB and LUCT) that offer industrial design degree participated. At the moment the study is only applicable to the companies/ organisations that participated. This study also allowed the researcher to better understand industries in Botswana and paves way to a more context appropriate study design for subsequent data collections.

The time available for the study was limited and as a result there were days when more than two interviews were conducted. In contrast to one interview per day, recommended by (Price, 2001). Both questions and follow-up questions were asked to all participants, thus allowing everyone to have the same information. The unreliability of the industry data and Botswana's small manufacturing sector, led to the use of a snowball technique to discover more potential participants. Entities with

valid contact details were contacted upon arrival in Botswana. Moving around visiting each company also added to data collection expenses. However, the process of contacting and conducting these semi-structured interviews provided a valuable experience informing the development of future studies in Botswana.

Having conducted the scoping study, it was important to find out “what evidence of levels of sophistication does the customer/user involvement ever go beyond traditional functional consideration onto interaction experience?”

### **5.6.1 What was learnt from this study**

Most of the questions from the scoping study were repeated in this study as the nature of a scoping study was to define the scope of the project. The researcher also wanted some of the questions to be responded to, by a larger sample size.

Moreover, the nature of a follow-up question was evaluated as to whether it can be best answered the subsequent Survey or Interview study. Table 29 show themes derived from the scoping study findings; furthermore, it also shows questions derived for the next studies and the data collection methods to be used per question.

**Table 29: Themes from the scoping study.**

<b>Themes from the scoping study?</b>	<b>Derived questions for the next study</b>
Understanding of the term “Design” was similar to the global definition.	What is your definition of design, designer and designing? <b>[Interviews]</b>
Advantages and added value of design were, meeting clients’ expectations through product and/ or process improvement.	What is the importance of design in a PDP? <b>[Survey]</b>
Companies have few qualified design personnel and not led by personnel with a design background.	Does your company employ qualified designers for design related work? <b>[Survey]</b>
The user is mainly involved at the beginning of the PDP and then randomly afterwards.	How important is design at the following stages of the PDP? <b>[Survey]</b>
The use of design processes for most of these companies is project specific and do not use any company approved process as a base for approaching different projects.	Does your company document the PDP? <b>[Survey]</b>
Design effectiveness is measured through, more contracts, repeat orders, user appreciation, field testing and feedback from non-design staff within the company.	How do you measure the design effectiveness?
The majority of companies (2/3) did little or no market research; instead, they relied on word of mouth for marketing and publicity.	Does your company undertake market research? <b>[Survey]</b>
Two thirds of the interviewed companies have Botswana government as a major stakeholder.	How important is incorporating the user into the PDP? <b>[Survey]</b>
The majority (two thirds) of companies measured the effectiveness of UCD at the end of the PDP (site visits and field tests). Other means of measuring UCD success included, repeat jobs and more contracts.	At which stage of the product development process do you measure product usability? <b>[Interviews]</b>
Methods used to collect user needs included questionnaires, interviews, baseline survey and site visits. The data collected included ergonomic, finish (colour, material etc.), functionality and usability.	How does your PDT know what the user wants in a product? How does your PDT know what the customer wants in a product? How do you know what product to develop? <b>[Survey]</b>
The user is mainly involved at the beginning of the product development process and randomly afterwards.	Rate the importance of involving the user at different stages of the PDP? Do you get your customers involved in the product development process? <b>[Survey]</b>
The majority of participants indicated that the management encouraged interaction with the client. Besides offering students internships, participants reported not having ties with training or institutions; apart from.	Does your company have links with training and/ or educational institutions? <b>[Survey]</b>
Unavailability of data on Botswana’s design industry.	The researcher allocated more time to identifying relevant participating companies. <b>[Survey]</b>
The term UCD was alien to most of the participants.	Instead of using the term UCD, the researcher described UCD as “user involvement in PDP”
Interviewed companies saw themselves as market leaders regionally, grow brand image, and transform methodologies, use of latest technologies and less reliance on government.	Where do you see your company (future plans) in 5 years? <b>[Survey]</b>

CHAPTER SIX  
**SURVEY**

## **6 Survey**

The survey intended to include as many design industries as possible and have the largest sample of this study. Data gathered from the survey was expected to give a broad view of the issues facing Botswana's design industry; design awareness and user-involvement in NPD.

An internet based survey was not used due to the low number of companies with access to the internet in Botswana. Over half of the companies identified using the government databases ended up being dead ends. Upon arrival in Botswana attempts to get an updated list of companies were not fruitful as what was on the data base turned out to be the latest information.

### **6.1 Aim of the Study**

The aim of the survey was to gain a better understanding of the nature of the relationship between the NPD team and the user during the PDP. Also, the study provided the data needed to select industries to participate in the next study and build a relationship with the participating companies.

#### **6.1.1 Objectives**

- Determine the level of design awareness in Botswana's companies.
- Ascertain current understanding of UCD in Botswana.
- Explore the training needs of companies in Botswana in relation to UCD.
- Subsequent studies selection criteria.

### **6.2 Design of the questionnaire**

The design of the questionnaire was guided by the literature review data and the scoping study experience. Aims and objectives were also important to making sure this study, remained focussed on the information needed.

Themes for the questionnaire were also derived from the study objectives. Given the subjectivity of the design field and the subject matter, the questionnaire had to be qualitative; thus able to accommodate diverse viewpoints. However, the researcher had to format the questions in a way that there were boundaries to the solution space. The boundaries are meant to reduce the complexity and the clutter

associated with analysing qualitative data. The questionnaire was a mixture of open-ended and closed questions; with the majority of the open-ended questions following-up on the closed questions. The final survey questionnaire can be found in Appendix 12.3.

### 6.3 Analysis & Results

A total of 47 out of 80 contacted companies participated in the study. The analysis of the data began with the first received answered questionnaire. Figure 25 shows the cutting and sorting of the transcripts; where data was clustered and relationships between the clusters identified.

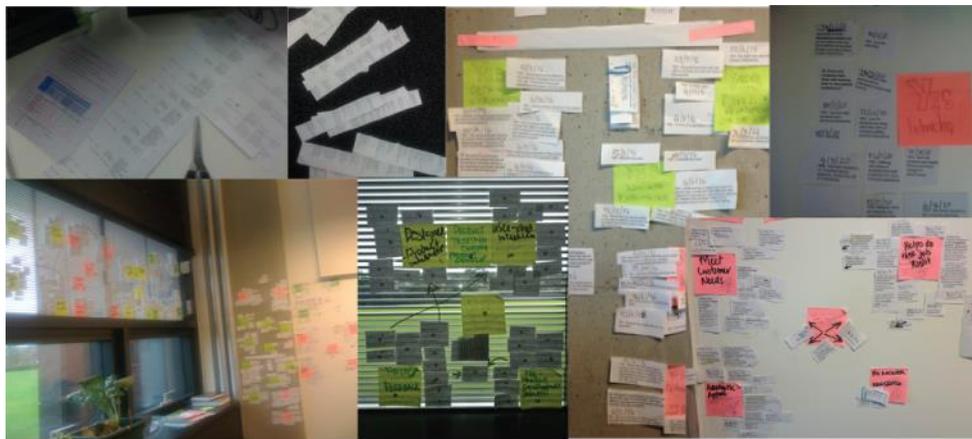


Figure 25: Cutting and sorting process.

The questions were analysed within the four study objectives;

#### 6.3.1 Objective 1: Determine the level of design awareness in Botswana's companies.

87% of the participants in this study thought design was important to the PDP and their responses were further clustered into two groups; *meeting customer needs* (26/41) and *help do the jobs right* (15/41).

- **Meet customer needs:** The majority of the respondents reported and believed design helps the PDP meet customer needs. Design helps in translating user needs into a product and creates a relationship between a user and the product. In order to satisfy customer needs the NPD team had to work with the customer to cover product's functionality, usability, affordability and the aesthetics to achieve the right product for the right user. Some of

quotes include; *“It helps to develop ideas into reality right from the initial stages,” FI/9/12. “Ensures that you come up with an efficient product that meet the expectation of the market/client and that it’s cost effective,” MF/1/12. “To make it more attractive just from the point of looking before getting more details from there sales team,” G/7/12. “Design takes ideas and present them in a visually appealing way,” FI/2/12.*

- Helps do the job right:** The rest of the respondents to this question credited design as helping them do the job right by organising the PDP. Design offers an ability to visualise and make solid future decisions much earlier in the PDP; thus lower product costs and time to market. *“Gives the feel and view of how the actual product will look like. Saves cost as paper illustration and models may cut down the costs of production,” G/1/12. “To provide an assessment vehicle that helps an organisation achieve its goals,” FI/3/12.*

The majority of the participants agree that all stakeholders (investors, suppliers, employees and the user) are equally important to PDP, see Figure 26. However the results failed to show a clear hierarchy (the most important to the least important stakeholder) which the researcher was aiming for. Thus, the follow-up study will have to specifically ask the respondents to rank the different stakeholders starting with the most important.

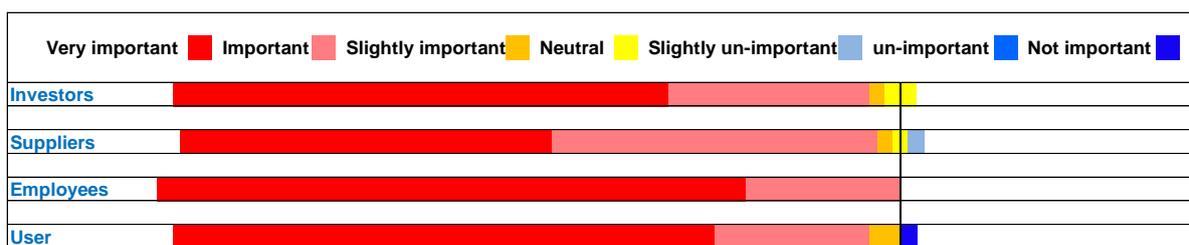
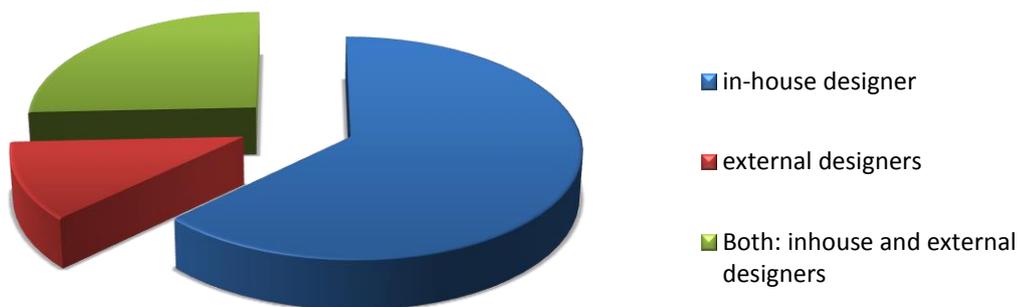


Figure 26: Comparison of stakeholder importance.

To investigate participating companies’ awareness of the need to have a qualified designer doing design related work. The results show the majority of the respondents (73%) reported employing services of qualified designers for their design related work, while the remaining respondents reported not employing the services of a designer.

- **Companies employing qualified designers:** 73% or 35 companies that employed the services of a designer were given three choices to identify the type of designer employed; In-house, external and (both in-house & external designers). The results show majority (63%) of the designers were in-house, 11% external designers and the rest of the companies utilised both in-house and external designers, see Figure 27. Definition of these designer employment scenarios are listed below;
  - **In-house designers:** those employed by your company.
  - **External designers:** contract designer(s) brought in for specific jobs.
  - **Both:** in-house and external designers.



**Figure 27: Types of qualified designers employed.**

However, the researcher had expected a much smaller number of companies to be employing the services of a qualified designer given the relative infancy of design as a profession in Botswana. Also, some of the companies may have referred to in-house trained designers as qualified designers. The phrase “qualified designer” could have been better defined to clearly understand the credentials of the employed designers.

- **Companies NOT employing qualified designers:** 27% or 13 companies reported not having qualified designers doing design related work. 12 of these 13 companies gave reasons to why they had no qualified designers doing

design related work. The reasons given were further clustered into two groups namely; *their trades covered the needed design work* and *cannot afford a designer*.

- Their trades covered the needed design work:** The majority of the companies that did not employ trained designers regarded the different trades they possess (i.e. carpenter, artist and framer) as sufficient for all the designing they need. The assumption, that these trades are sufficient to do all the designing needed can be interpreted as a lack of understanding of the design profession, thus the need for design awareness. “Framers got an idea to design,” G/4/3; “One of the directors is a talented artist” FI/13/3. Most of these companies referred to training their employees in-house as a way to reduce costs compared to hiring a qualified designer. However due to low wages, after they are trained they often leave for better pay elsewhere.
- Cannot afford a designer:** Many of the companies were small, start-up companies that expressed interest in employing a qualified designer but cannot afford to hire one. A better relationship with training institutions may help provide student designers to work part time at some of these companies.

In an attempt to find out the importance of design at the different stages of the PDP all 47 participants in this study responded to this question. The findings show the vast majority of participants viewed design as important to all stages of the product development processes, see Figure 28. However the results do not present a clear distinction between the different stages; thus the researcher could not determine the stage which design is most essential. The researcher expected the synthesis stage to be rated the most important, since this is where the actual shaping of the product commences, but this is not clear from the data.

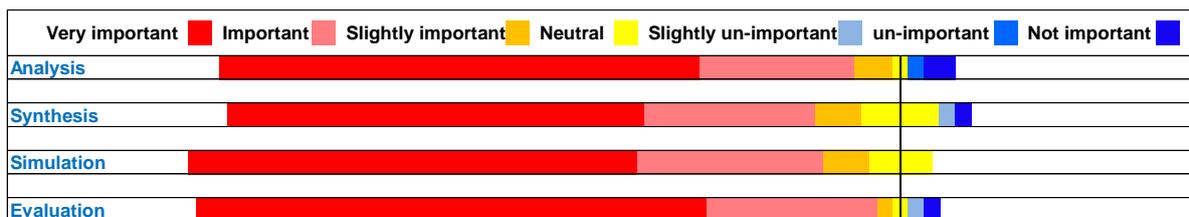


Figure 28: Importance of design at different stages of the product development process.

In order to find the level of PDP organisation in participating companies. All 47 participants responded to this question. 60% of the participants reported documenting the PDP, 35% reported not documenting the PDP and the remaining 5% were not sure whether their companies documented the PDP, see Figure 29. The researcher expected the companies to be doing much less documentation of the PDP, given Botswana’s small and young design industry. When some of the participants were asked to explain or show their documentation, the majority showed or described product specifications/ dimensions and not the “process” of product development. Which indicates either a lack of process or a lack of a documented process?

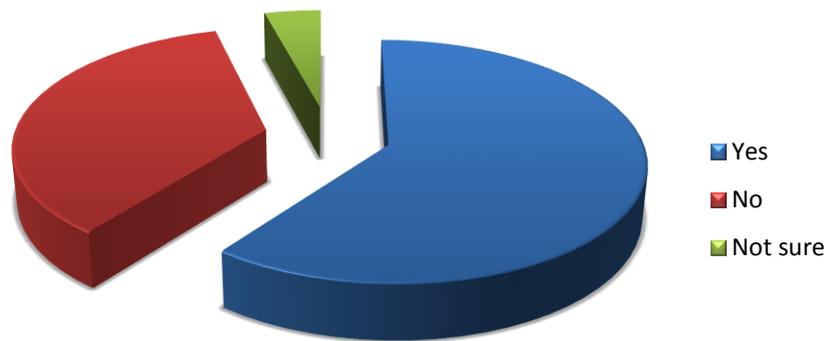


Figure 29: Company documentation of the PDP.

To find out the different ways participating companies measure a product’s success, 45 out of 47 participants responded to this question. Responses were clustered into three groups; *happy client/customer* (16/45), *product reviews* (18/45) and *sales/profit* (22/45). Response distribution between the three groups was relatively similar.

- **Happy Client/customer:** Companies in this group report having a happy client/customer and word of mouth advertising as a measure of product’s success. *“Customer bringing other customers for the quality of our work, not how cheap they are,” G/15/06. “If a customer is happy with a product and refers other people to us,” TA/7/06.*
- **Product reviews:** Companies in this group viewed product reviews as their way of measuring product’s success. Thus, positive reviews are

expected to encourage more people to purchase a product. These product reviews are collected through the use of suggestion box, product evaluation and benchmarking after sale. *“Routine inspection and comparison with competitors,” TA/4/06. “Reviews and customer/user feedback e.g. suggestion boxes placed at customer’s premises for end-users to point out different opinions,” G/5/06.*

- **Sales/profit:** Companies in this group used product sales/profits as a measure of product’s success. As expected, the majority of the companies reported sales/profits as their measure of product’s success. This is a reality for every business, sales/profit are a necessity for any business in order to continue to exist. *“Sales over long periods. Profitability of the product is important,” FI/11/06.* To get this sales/profit a company needs a happy client who will in turn give positive reviews of the product that will influence more people to purchase a product.

Happy client >>>> Product Reviews >>>> Sales/profit.

The study also looked into product usability issues and attempted to understand how participating companies measure the ease of product use during and after PDP. A total of 35 responses were recorded for this question, and were then clustered into three groups, *pre-product development (9/35), during-product development (17/35) and post-product development (9/35).*

- **Pre-product development:** Companies in this group conducted most of the usability testing prior to the product planning stage. Planning involves detailed research about the user and setting the quality standards for the product to be developed. Furthermore, the product was expected to be in line with the industry standards; table and chair dimensions, readability of the graphics etc. Discussions with relevant stakeholders were essential for comprehensive product planning.

- **During-product development:** As expected, a clear majority of the respondents for this question reported usability testing of the product during the product development stage. The usability testing is done at two different levels; *Designer-product interaction* and *User-product interaction*.
  - **Designer-product interaction:** A small number of companies that responded to this question reported testing product usability at different stages of the development process. The testing involves evaluation of mock-ups and prototypes, prior to developing the final prototype.
  - **User-product interaction:** for most companies participating in this study, this is where the user is re-engaged in the PDP since the product briefing meetings when the project started. A potential user is brought-in to try a final prototype, the main objectives being to test product usability and evaluate the best ways to educate the user on how the product is used. A small number of respondents mentioned the use of focus groups to measure the ease of product use and participants chosen at random.
  
- **Post-product development**

After sale follow-up is essential as it provides critical feedback and raises issues overlooked by the product development team. Information collected at this stage of a product lifecycle is critical as it verifies if the product works in the intended context. The required information is obtained through interviewing the user and/or observing user-product interaction. The company is able to build a relationship with the user to gather the critical data necessary for continual product improvement.

To investigate how participating companies plan to improve the design of their products; responses to the questionnaire were clustered in to four groups namely; *research (14/47)*, *technology (17/47)*, *acquiring qualified designers (16/47)* and

*product development process (8/47)*. The secondary aim of this question is to identify companies suitable for next phase of this study; interviews.

- **Research**

14 of the respondents reported conducting research with the focus on understanding the market, latest trends, customer/user and the latest (sustainable and eco-friendly) materials. Where the researcher was able to ask follow-up questions it was evident that the research was conducted in a casual, less organised manner. Moreover, these companies had no clear plan of incorporating the findings into PDP, thus were unlikely to reap the full benefits from the collected data.

- **Technology**

A slight majority (17/47) reported their plans to obtain better technologies in order to improve the design of their products. However, this is a common misconception that technology alone can improve product design; there has to be sound strategy and human resources to fully benefit from new technologies. The majority of the companies in this group were looking to get bigger and more up-to-date machinery and the rest were looking onto introducing digital technologies (computer and software).

- **Acquiring qualified designers**

Respondents in this group reported that they were looking into sending staff for further training and hiring qualified designers in an effort to improve the design of their products. One respondent reported, *“Expanding our business to employ experienced full time designers,” FI/2/23*.

- **Product development process**

The least number of companies mentioned improving the product development processes in order to improve the design of their products. This is the group the researcher would have expected to find most participants; it provides the reasoning for other answers to this question. Thus, other groups (research, technology and acquiring qualified designers) can only work when the right product development processes are in place. One of the respondents

looked into producing Botswana centric products through utilisation of local elements (natural or manmade) to inspire and direct the design processes. Another respondent reported “documenting the product design process and also register our noble designs with patents & copyright [agency],” G/1/23. The researcher observed the need for some companies to improve finish quality and presentation of their product.

### **6.3.2 Objective 2: Ascertain current understanding of UCD in Botswana**

The researcher explained and emphasised the importance of separating the end-user and the customer. The end-user was defined as a person using a product, while the customer was described as a person purchasing a product. Furthermore, the researcher explained to the participants that the end-user can also be the customer.

The person purchasing a product is not always the user of the product. Are there efforts to go beyond the purchaser and get in-touch with the end-user? - Attempts to find out if participants can differentiate between the user and the customer/purchaser. All participants answered this question, *56% participants answered YES* to getting in touch with the user and the remaining *44% answered NO*, to making efforts to go beyond the customer to get in-touch with the end-user. Upon giving a YES/NO answer, participants were then asked to give reasons for their answers. However not all respondents gave reasons for their answers.

- **YES, reasoning**

Out of all respondents that answered YES to this question 85% gave reasons why they found it necessary to go beyond the purchaser and get in-touch with the end user. The reasons given were further clustered into two groups, *obtaining user-needs (14/23)* and *educate the end-user (9/23)*.

- **Obtaining user-needs:** The user is important to understanding the design problem, is there a need for a product? And/or finding out what the user expects from a product etc. The majority of the participants thought getting in-touch with the end-user helped obtain user-needs and to obtain product feedback. Moreover, the end-user is able to provide reliable product feedback, giving valuable information regarding in-field product

performance, which the company would have never obtained from within. *“This way the design team will get un-biased information on the product from the user. It is the end-user who interacts more with the product and therefore precise information would be gathered,” G/9/16. To confirm customer satisfaction and if there are any queries they can be addressed,” TA/1/16.* Product feedback and user-needs are essential for continuous product improvement and development.

- **End-user education:** the second group of respondents that made an effort to get in-touch with the end-user were looking to educate and build a relationship. Since education is a two way process it can be said that the company will not just be educating the user, they will also learn from the process. Again, this relationship is the basis an on-going research and development that is essential to continual product development. *“Certain care and attention with regards to maintenance and handling needs to be relayed to the end user. Often this is overlooked and results in product failure,” G/6/16. “To protect the purchaser & build-up a business relationship,” TA/3/16.* User education is essential as it may improve product’s user experience and may lead to better product reviews and word of mouth.
  
- **NO, reasoning**

The majority of participants that reported not making effort towards getting in-touch with the end-user gave reasons for their answer. The reasons given by the respondents can be categorised into two groups, *the customer is the user (12/18)* and *customer & industry standards give sufficient information (6/18)*.

  - **Customer is the user:** The majority of the respondents did not bother to enquire more about the end-user and assumed the customer is the end-user. Therefore, is a high possibility of the purchaser not being the user. *“They are the same person,” FI/17/16. “The user and the customer are always the same person,” G/2/16.* This question was rephrased on the next study in order to find out if participants enquired feel the need to go beyond the customer to get in-touch with the end user.

- Customer & industry standards:** the remaining respondents reported that the customer and the industry standards gave sufficient information to represent the end-user. Clearly, these companies do not consider the end-user important to the PDP. These companies fail to understand the customer may not always relay true user-needs and that the industry standards target a much larger group thus cannot be used to target individual users. Correct user needs gives a company a competitive edge over the competition; it allows the product produced to be much more suited for a particular user than the next company. *“These products are made to comply with industry standards and are therefore made accordingly,” FI/10/16. “Due to costs we usually deal with the purchaser who generally would relay usability issues to us,” G/1/16.*

Although, 56% of the respondents admitted to making efforts to go beyond the purchaser/customer to get in touch with the end-user; an overwhelming majority of the participants agree that incorporating the user into the PDP is desirable and that the user can effectively share ideas within a PDP. Figure 30 clearly show the participants in this study are aware of the importance of incorporating the user into the PDP; furthermore, Figure 31 shows the participants also overwhelmingly agreeing that the user can effectively share ideas with the NPD team. It is evident that participants believe incorporating the user in a PDP is important. Also, an overwhelming majority of the participants agree that the user can effectively share ideas with the NPD team. So they can see the value although they do not share a view on how this value is achieved.

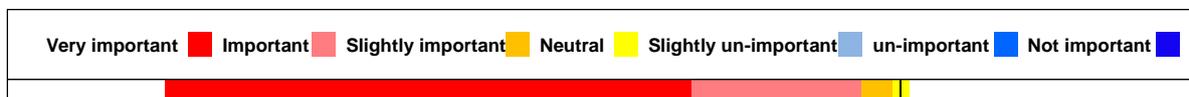


Figure 30: Incorporation of the user onto PDP.

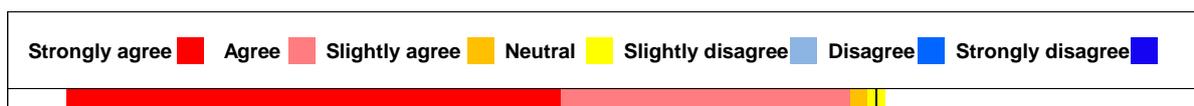


Figure 31: Users ability to effectively share ideas with the PDT.

This is a good starting point towards investigating user-centred approaches to design practice in Botswana, (objective of the PhD). The results show recognition of the user’s importance to the PDP; furthermore, the results show the importance of the user at all stages of the PDP and that the participants think the user can effectively share ideas with the NPD team. These are important building blocks to practicing UCD. However, a small number of the participants hinted at some kind of user involvement during the PDP. User involvement was unstructured, haphazard and had little benefit to the companies PDP.

A large majority of the participants believe it is important to involve the user at all stages of the PDP, see Figure 32. The companies that answered Slightly-unimportant to Not-important were in just two industries Graphic design (G) and Furniture & Interior design; however, other than that they have nothing in common. This further emphasises the presence of important basics to implementing UCD strategies in Botswana.

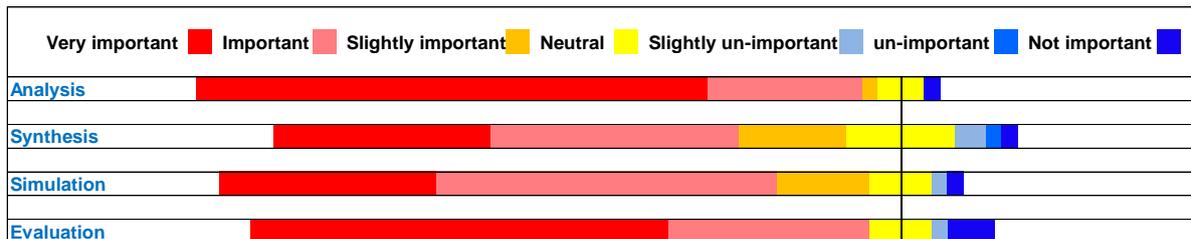


Figure 32: Importance of involving users at different stages of the PDP.

A total of 46 responses were obtained from asking, how does your NPD team know what the user wants in a product? These responses were further clustered into four groups, *Consultation with the user (15/46)*, *Consultation with the customer (7/46)*, *Consultation approach (17/46)* and *Designer knows best (7/46)*.

- **Consultation with the user:** NPD team consults with the user in an effort to understand what the user expects in a new product; the NPD team also informs the user on what is possible or not. Despite having acknowledged the importance of involving the user at all stages of the PDP in question 15, the majority of these companies only conducted this consultation at the beginning

of the PDP. Some of the comments included; *“Through intense evaluation of the end user,” FI/9/18. “Communication with the end-user,” TA/4/18.*

- **Consultation with the customer:** Consultation with the customer is conducted to get to what the end user wants. A closer look shows that these respondents were more inclined to product commission (3/7 Product commission and 4/7 Both Product commission & Batch production) thus against the researcher’s expectations of batch production. Also, as expected five of the seven companies did not go beyond the purchaser to get in touch with the end user (Question 16). *“Information is relayed to us through the buyer,” FI/10/18. “Understanding what the customer wants to sell to the user,” G/7/18.*
- **Consultation approach:** Respondents in this group mainly gave insight into how users/customers communicate their ideas with the NPD team. The product brief is the beginning of the consultation process explaining what the customer/user wants in a product; the brief consists of text, pictures, drawings and market research. This front loaded consultation leaves room for misunderstandings that may lead to product delay and cost increase. However, a small number of companies continue the consultation throughout the PDP until product delivery. *“Product brief” FI/17/18. “Customer demand patterns,” FI/11/18.*
- **Designer knows best:** This group believed there was no need to consult with the user. Companies in this group are from the two industries [Graphic and (Furniture & Interior) design] that hired the most qualified designers. Some of the statements include, *“User always want convenience and safety,” G/1/18, “User needs something new and changing,” G/4/18. “Our products usually have similar qualities which makes it to be user friendly,” FI/6/18.*

The overwhelming majority of the respondents reported involving the customer in the PDP. Despite not being familiar with the term UCD, most of the respondents followed the saying *“the customer is always right”* and were able to practice some form of UCD. Again, customers are mostly involved at the beginning and at the end of the PDP, to basically get the customer needs and for usability testing. With this approach the stakes are high if the customer is not happy with the product. The

remaining participants (10%) did not involve the customer and were expected to be focussed in batch production, however (4/5) of these companies reported being product commission focused companies.

To investigate how the NPD team knows what the customer wants in a product, a total of 47 responses were recorded for this question. The responses were further clustered into two groups, *consultation with the customer (41/47)* and *customer/market research (6/47)*.

- **Consultation with the customer:** 87% of all respondents reported that consultation with the customer was essential to understanding what the user wants in a product. Consultation involves communication between the NPD team and the customer and starts with the customer briefing the NPD team regarding the product they want made. Again, the majority of these consultations were only performed at the beginning and end of the PDP. The customer is only needed to clarify what they want at the beginning of the PDP and validate the final product. Thus, the customer is perceived to be less important in the middle stages of the PDP. However a small number (2) of respondents did involve customers throughout the design process. *“Sit and discuss (brainstorm on how the product can be),” G/10/17. “We communicate with the customer. They normally write the specification of the product,” TA/2/17. “We meet with them prior to orders and do a design of what the end product will look like and thereafter if it is quantity ordered we make one sample. When the customer is satisfied we do the rest,” FI/18/17.*
- **Customer/market research:** The remaining respondents know what the customer wants through customer/ market research. Some of the methods used to collect this data include the use of questionnaires, benchmarking with the competition, monitoring latest trends and training customers on how to use a product. However, the research seems to be done in a casual manner and the information obtained cannot be expected to be reliable.

By conducting market research it is assumed that a company will be willing to know more about the user; therefore more willing to adopt UCD approaches to PDP. The majority of the respondents reported doing some kind of market research, see Figure 33; however most of the research seemed to be ad-hoc and not organised.

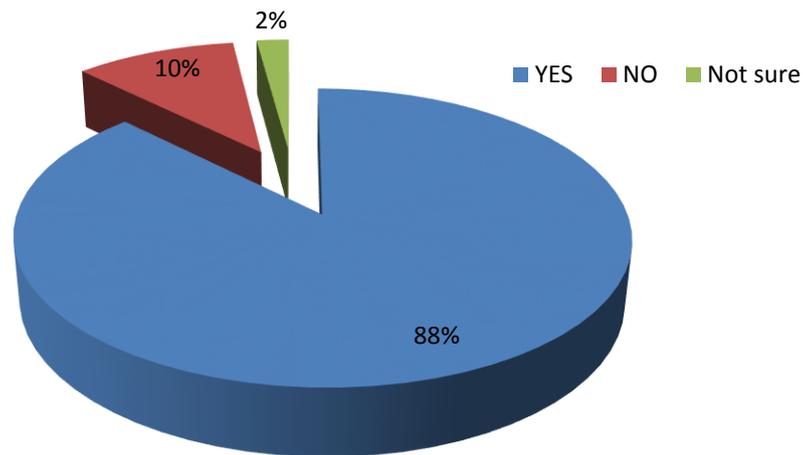


Figure 33: Companies with a history of market research.

### 6.3.3 Objective 3: Explore training needs of companies in Botswana in relation to UCD

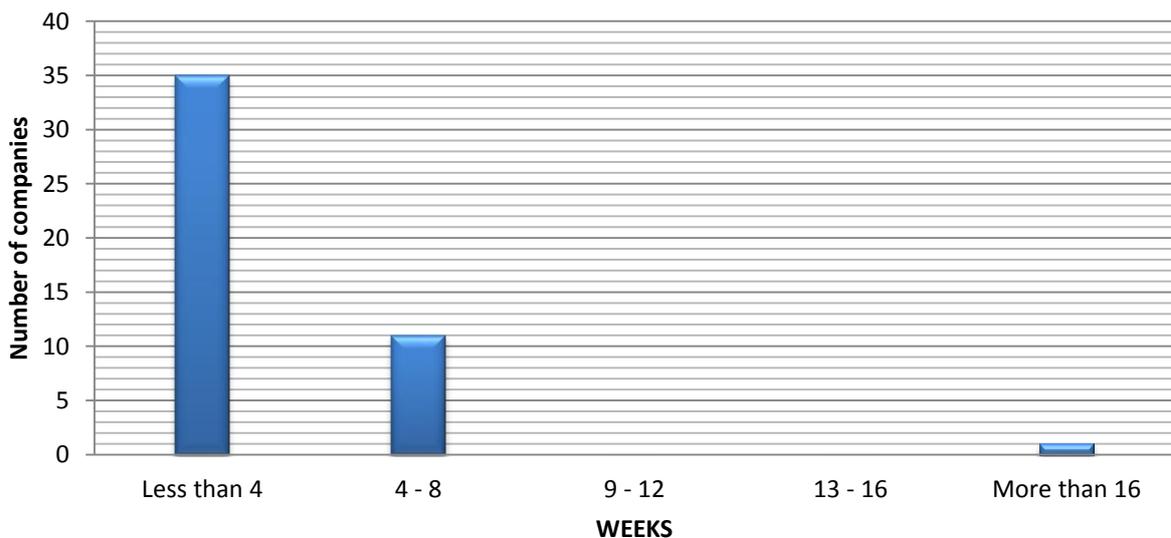
In order to identify the different ways that participating companies cooperate with educational institutions. Participants were asked to give a YES or NO answer to having links with training or educational institutions, additionally they were asked to give reason(s) for their answers. A slight majority, *52% or 25 respondents reported not having links with educational institutions, while 48% or 23 respondents reported having links with educational institutions.*

- **NO:** The majority (52%) 25 respondents to this question admitted that their companies did not have links with educational/training institutions. 22/25 participants gave reasons for not having links with training institutions, some of the reasons given include;

- 6/25 of the respondents viewed the educational institutions as not offering the needed skill for their individual companies. Thus, resorting to training staff in-house.
- Other participants indicated their small size, as meaning they are not ready to have increased commitments; while others were not aware they could have relationships with educational institutions. The rest of the participants indicated that they were thinking of developing these links.
- **YES:** Out of all those who had links with educational institutions 22/23 gave reasons for having these links. The majority of these companies reported having links through offering students internships and the reasons given included, bringing fresh ideas and providing additional staff as well as learning from each other.

**6.3.4 Objective 4: Interview and case study selection criteria**

To identify companies with a four or less week’s PDP for the next study, the respondents were asked to pick an average time spent on a typical project, see Figure 34. A vast majority of the participating companies reported their projects taking less than four weeks, followed by 4-8 weeks and lastly more than 16 weeks. There were no similarities observed within the groups recorded in this question.



**Figure 34: Average time spent on a typical project.**

20 participants reported running more than six products at a time, see Figure 35 studies as it provides choice for the researcher. However, having more than 6 projects may signal that a company may potentially have less time to participate in the subsequent case studies.

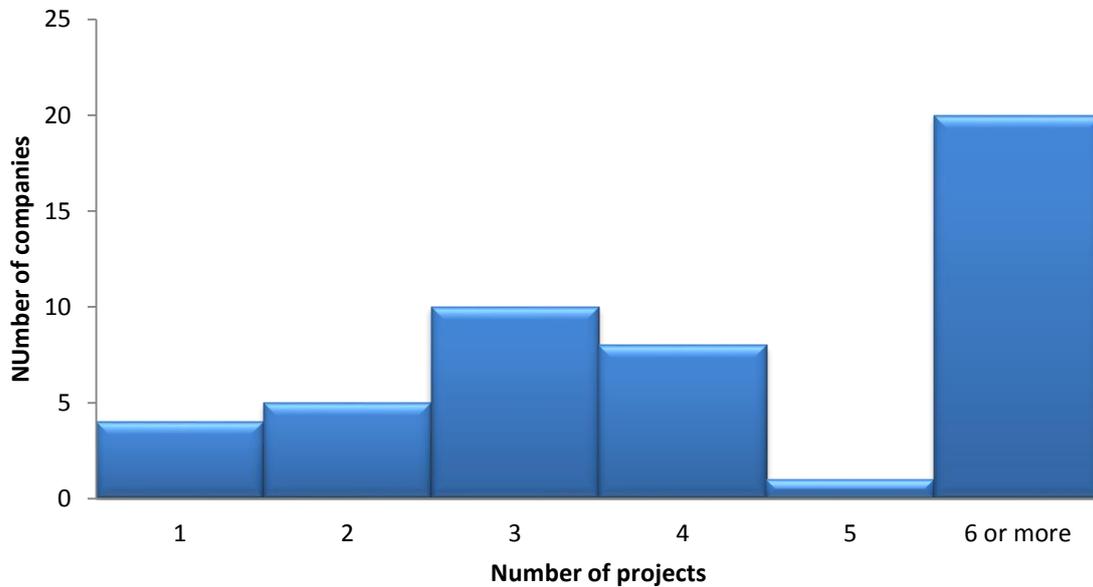


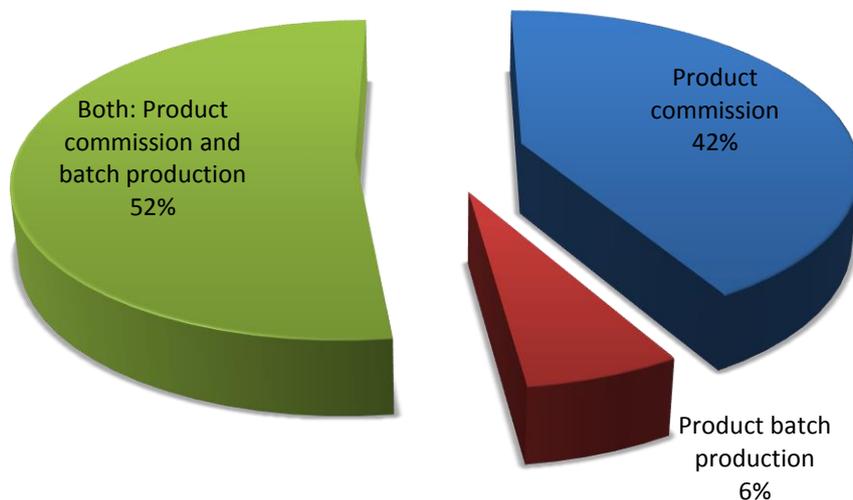
Figure 35: Number of projects being run at the same time.

Given the time constraints on this study, companies with less than a four week PDP and producing multiple products were identified as suitable for the case studies. Projects with a PDP of less than four weeks allow the researcher to observe and document PDP within an acceptable time. In order to further reduce the time needed for case studies, the inclusion of a company with multiple projects running at the same time allows the researcher to document different stages of the PDP at the same time. Thus companies most likely to be selected for the Case Studies, would have an average project time of 4 weeks or less and have more than one project running at the same time.

To identify companies involved in making customised products, participants were asked to select a method by which they know which product to develop, *product commission*, *product batch* and *both (Product commission & Batch production)*, see Figure 36. The responses to this question show a clear majority 94% (42% product commission + 52% (both: product commission & batch production)) of the companies having their products developed through product commission.

Therefore, companies that rely on product commission for product development are considered appropriate for the following phases (interviews and case studies) of this study. These companies deal with individual orders from private individuals, thus the need to make exactly what the customer/user ordered. This higher percentage of companies making to order products highlights the need for this study; a structured approach to obtaining user needs and translating them into actual products.

- **Product commission:** a client telling your company what they want.
- **Product batch production:** company deciding which products to make.
- **Both:** Product commission and batch production.



**Figure 36: Who initiates product development (company or individual clients)?**

In order to reveal companies willing or planning any changes to the PDP; a total of 47 participants responded to this question and almost all (42) responses were optimistic about the future of their companies. The responses were further clustered into two groups; *growing their businesses 25/42* and *producing a better product 17/42*.

- **Growing their businesses**

The majority of participants reported expanding and growing their businesses both nationally and internationally. *“We would have ventured into the Southern African market or Africa as a whole,” TA/1/22*. To achieve these

goals, companies looked into increasing product output and attaining capabilities to produce even bigger products. Thus, attaining bigger and more modern machinery, more employees, capabilities and financially stable. *“Get government tenders, grow and have more space. Bigger machinery for easier work,” FI/16/22.*

- **Producing a better product**

In the next five years participants expected their companies to produce better products and competing with market leaders. *“Being a company that does not only design for profits, but to change people’s interaction with a product/service use design to change the world around us to make it better place to be,” G/16/22.* To achieve these goals these companies are looking into improving product quality and PDP. A very small number of the respondents mentioned being environmentally friendly and being more design focussed rather than sales orientated. *“We advocate for re-use of recycled materials or from sources that do not harm the environment,” FI/19/22.*

## **6.4 Chapter Discussion**

The majority of participants thought design was important to PDP as it helped meet customer needs and do the job right. This was important as it shows participants understand the importance of design to a PDP. Data failed to show which stage of the PDP design was most or less important; therefore had to be probed further in the next data collection.

The difference between the terms “user” and “customer” were blurred for most participants. It was promising to find out a slight majority (56%) of the participants, wanted to go beyond the customer to get in-touch with the end user. Other participants reported the customer being the user and that the customer and industry standards provided sufficient information. Product usability and ease of product use were mostly evaluated during the middle stage of the PDP; this evaluation was done in two phases, designer-product interaction and user-product interaction. This made sense, as this is where the product takes shape and can be tested prior to finalising the product.

An overwhelming majority of participants agree to the importance of incorporating the user into PDP, furthermore they believe the user can effectively share ideas with the NPD team. These were important results as they show a good foundation for UCD policy structuring. Moreover, participants reported consultations as a way of finding out what the user wants in a product. The majority of the consultations were done at the beginning and end of the PDP. It was not surprising to find out that majority of participants reported reliance on product commission for projects, as the researcher targeted companies with a potential of making custom products.

Hand delivered questionnaire, allowed more than 2/3 of each questionnaire to be answered, and a good majority of the questionnaires delivered were returned answered. Sales/ profit seem to be the most important measure of product's success, followed equally by a happy customer and product reviews. A happy client encourages 'word of mouth' campaign and will give better product reviews leading to improved sales.

The majority of the companies claimed employing qualified designers, with a large number being in house; and this went against the researcher's expectations. The question may have failed to clearly define what was meant by a "qualified designer" thus the question had to be rephrased in the next study for clarification. Further, about half 52% of the participants reported having no links with educational institution; again the researcher expected a much higher number. As expected, offering internships was the only link between companies and the training institutions. The researcher believes just offering an internship is not sufficient and there are better ways in which the industry and educational institutions can work together for mutual benefit i.e. offering live projects to be solved by students, final year student evaluation and sharing industry experience (presentation). It was not clear whether most of the respondents thought the only relationship with an educational institution is providing internships.

The majority (60%) of the participants reported documenting the PDP. Whenever was possible upon collecting responses to questionnaires, the researcher asked if there were any hard-to-understand questions and quickly flipped through the questionnaire to check for unanswered questions. The documentation reported by

the participants was mainly on the product itself (dimensions and materials) not the process followed. Participants reported willingness to make changes to the PDP in order to grow their business and be able to produce a better product. Moreover, there is a relationship between producing a better product and growing their business; a better product can be a stepping stone towards growing a business. As expected the vast majority of participants reported their typical projects lasting less than four weeks; as Botswana does not have a sophisticated or complex manufacturing industry.

A small number of participants reported aspirations to improving the design of their products by improving the PDP. The majority reported willingness to; improve research, technology and acquiring qualified designers in order to improve the design of their products. The objective of the questions was to help in selecting participants that are willing to participate in further studies. Despite majority of the participants reporting doing some kind of market research, when some of the participants were probed further; it was clear that the market research was unstructured and not documented.

## **6.5 Chapter Conclusions**

There was no reliable industry database to quickly identify ideal companies for the study. Moreover, the online presence of Botswana's companies was inadequate and as a result the survey could not be carried out online. Thus, the researcher had to rely on the snowball technique to identify prospective study participants. Participants that were not conversant in English were helped by the researcher to go through the survey questionnaire.

Intellectual property is not respected, and most companies will not hesitate to reproduce a competitors' product. This trend was observed in the furniture industry, where a customer just brings a picture of a product and a company will try hard to make a duplicate. Moreover, all companies making Tents (canvas) produced the same designs, and did little or no experimentation with new products.

Since the study methodology follows grounded theory it was essential for the survey findings to inform the interview questionnaire. In addition to the survey findings,

original questions that were inappropriate for the survey were included onto the interview questionnaire. The aim of the interview study was to probe further and better understand the issues raised by the survey.

The furniture fitting market has a significant number of Chinese owned companies, and local competitors in this market are finding it hard to compete. An attempt to run the survey with identified Chinese owned companies were futile due to communication barriers, the command of the English language and the local language (Setswana) was poor. Some of these companies were secretive and did not want anything to do with the study.

### 6.5.1 What was learnt from this study

Table 30 shows the themes derived from the survey study findings; and, it also shows questions derived for the next studies and the data collection methods to be used per question. Themes with no follow-up question means the survey study was adequate in finding answers for the questions, therefore no need for a follow-up question in the next study.

**Table 30: Themes from the survey study.**

<b>Themes from the survey study?</b>	<b>Derived questions for the next study</b>
Design helped PDP to meet customer needs (26/41) and help do the jobs right (15/41).	What is an added value of design? <b>[Interviews]</b>
The majority agrees that all stakeholders (investors, suppliers, employees and the user) are equally important to PDP. However the results failed to show a clear hierarchy (the most important to the least important stakeholder) that the researcher was aiming for.	Rank the following stakeholders (investor, supplier, user and employees) in terms of importance to PD? <b>[Interviews]</b>
The results show the majority of participants (73%) reported employing services of a qualified designer: (63%) of the designers were in-house, 11% external designers and the rest utilised both in-house and external designers.	How many employees have been through a design school? <b>[Interviews]</b>
The findings show the vast majority of participants viewed design as important to all stages of the product development processes.	
60% of the participants reported documenting the PDP, 35% reported not documenting the PDP and the remaining 5% were not sure whether their companies documented the PDP.	How is your product development "process" documented? <b>[Interviews]</b>
Participants listed; happy client/customer (16/45), product reviews (18/45) and sales/profit (22/45). Response distribution between the three groups was relatively the same.	Which one of the following measures of product success is the most important? (product reviews, sales/ profit and a happy client) <b>[Interviews]</b>
Ease of product use is mostly measured during the PDP ( <b>designer-product</b> interaction and <b>user-</b>	

product interaction) and after PDP (after sale follow-up).	
The majority (56%) of participants reported going beyond the purchaser and getting in touch with the end user to obtaining user-needs and educate the end-user. However, participants that failed to go beyond the purchaser thought; customer is the user and that the customer and industry standards provided sufficient information.	
Participants believe the user can effectively share ideas with PDT.	How can the user/ customer best share ideas? What is the best way to incorporating user's ideas into design decision-making? <b>[Interviews]</b>
The majority of participants reported doing some kind of market research.	How is your market research conducted? <b>[Interviews]</b>
Almost all participants recognize the importance of incorporating the user in the PDP.	What do you think are the implications of incorporating user on creativity and/ or innovation of NPD teams? <b>[Interviews]</b>
A large majority thought consultation was important to knowing what the user wants and a few thought the designer knows what the user wants. A clear majority 94% of the participants having their products developed through product commission.	Do you do any of the following UCD activities (sample from ISO 13407)? <b>[Interviews]</b>
The majority of participants thought the user was important to all stages of the PDP. A large majority reported involving the user (beginning and end) while the rest thought standards and anthropometry data as sufficient.	When is it most crucial to involve the user in the PDP? Are you willing to incorporate UCD activities to PDP? <b>[Interviews]</b>
About half of participants reported not having links with educational institutions. The other half provided internship positions for the students.	Besides, offering internships what type of a relationship would your company like to have with educational institutions? <b>[Interviews]</b>
Majority of participants reported running more than six products at a time. A good majority of participants reported their projects taking less than four weeks.	Participant selection criteria for the next study.
The terms "user" and "customer" seemed blurred to most participants.	The researcher had to explain the two terms at the beginning of the next questionnaire, to get all participants on the same page. <b>[Interviews]</b>

CHAPTER SEVEN

**INTERVIEWS:  
FI AND GA INDUSTRIES**

## **7 Interviews: FI and GA industries**

This chapter describes the semi-structured interview study carried out as a follow up to the survey carried out earlier. Since this study follows grounded theory, the majority of the questions were derived from the survey results. The rest were original questions from the literature review that were deemed inappropriate for a survey study.

The semi-structured interview study was focussed onto two industries, Furniture & Interior (FI) design and Graphic & Advertising (GA) design. The results from the interviews were compared to the ISO 13407 (User-centred design cycle). Qualitative methods were used to analyse the responses and come-up with some consensus as to what are the perspectives from the two industries being investigated.

### **7.1 Aim of the Study**

The aim for this phase of the study is to record the opinions of the participants through semi-structured interviews to attain deeper knowledge and confirmation of the issues arising from the survey.

#### **7.1.1 Objectives**

- Further understand the level of design awareness in Botswana's FI and GA design industries in more detail.
- Ascertain current understanding of (UCD) in the investigated industries.
- Explore detailed UCD training needs of the investigated industries.

### **7.2 Questionnaire**

The questionnaire was carefully laddered to help make the interview more like a conversation rather than a formal activity, see Appendix 12.4.1, for the final Questionnaire.

To validate the accuracy of the information from the participants, some of the information was sought through more than one question, comparing reports of various participants and comparing reports with direct observations. No interpretation of what the user might be saying was done; the analysis was solely based on what was said. Parker (2005, p91), states that "you can only address what you see on the transcript."

The interviews lasted between 30 minutes and just over an hour, depending of the participant's availability. A majority were closer to 30 minutes.

### **7.3 Data Analysis**

Interviews provided richer data and response revision (follow-up questions); it involved questioning and discussing issues and as a result was produced. Therefore, a smaller sample than that of the survey was possible since each participant provided deeper information and needed more time per interview. The sample was intended to be representative of both design industries and the findings were expected to be generalizable to the selected industries in Botswana.

Data was collected through interviewing 20 participants from diverse companies and different geographical locations. FI design 11 participants and nine (9) participants for the GA design. The data was all collected in the eastern part of the country where the majority of the population resides, see Figure 2.

Data analysis started with listening to the audiotapes and the transcription process. The researcher took notes of the ideas and observations arising during the various phases of the data analysis. Given time and resource availability it was essential to have the audio files transcribed within a short time. Thus, the first eight transcriptions (four from each industry) were mostly verbatim except for the omission of repeated statements, examples emphasizing what has just been said, laughter, icebreakers and sighing. Eight transcriptions were enough since data was starting to repeat, and there was nothing new coming out of the data. Kvale and Brinkman (2009) advice for saving time when transcribing by fully transcribing earlier interviews and then for later interviews summarising of the themes and writing full quotes. When transcribing, the researcher observed signs of transitions in order to achieve paragraph/ sentence started. Transcription of the remaining nine interviews summarised statements from the participant's viewpoint as understood by the researcher. Full quotes were also written down in the process of listening to the interview audio. "Many people get around this by transcribing early interviews fully and then summarising the themes and writing full quotes in full from later ones," O' Reilly (2012, p154). Table 31, is an example of how the audio ended-up on an excel spreadsheet. Finally, each response on the spread sheet was cut to start identifying similarities and differences amongst the responses.

Kvale and Brinkman (2009,) describe meaning condensation as distilling the meanings expressed by the participants into shorter formulations that are easier to manage and compare statements from different participants. In this study for the second batch of transcriptions the researcher listened to the entire interview to get the sense of the whole and then reduced each question to the researcher's objective interpretation. Furthermore, the researcher notes down meaningful/important direct quotes. Seale (1999, p151), points out that "quotations from "verbatim" records are used to add authenticity to an ethnographic account."

Themes generated from a response per-question from both industries were compared. Responses per objective were compared and analysed within each industry; these were generated from responses to each question comparison. Furthermore word lists and key-word in context were also generated for each objective per industry.

Table 31: Transcription samples.

Transcription method	Sample Question	Transcribed Answer	Answer on Excel
<p><b>Mostly verbatim</b> except for the omission of repeated statements, examples emphasizing what has just been said, laughter, icebreakers and sighing.</p>	GA/AD/13	<p>Are you talking about market and communication? "yes" there is always an ongoing research going-on just to see what people need of either potential customers or customers we have on board... we don't have a criteria that we follow to do market research... we start with a telephone call, questionnaire sent to a client. Then followed by a more formal research on the client's customers i.e. survey, focus groups or any kind of research that we can come with... and then we look at our client now (internal research)... this is the only thing that we do on daily basis for our clients.</p>	<p>We start with a telephone call and a questionnaire sent to the client. Followed by "External research" a closer look at the client's customers through the use of survey and focus group. And lastly, "internal research" aimed at better understanding the client.</p>
	FI/SS/2	<p>I think is just a creative process. There is no definition... I think these days, it could be anything! It's unlike before where you had periods of designing; these days it's what you make it to be if it appeals to whoever then its design. The bottom line is it has to be something that is functional, to the client's requirements or the brief. But what form it takes, colour there are no design boundaries anymore.</p>	<p>"I think it's just a creative process. It has to be something that is functional, to the client's requirements or the brief." However the colour, form and material it takes have no boundaries anymore.</p>
<p>Reduced each question to the researcher's <b>objective interpretation</b>. Meaningful or important direct quotes are also jotted down.</p>	GA/FG/17	<p>I would like to, personally! But whether it's going to make any difference to my user I do not know? If you don't cut corners in this industry in Botswana you end-up losing out; therefore "therefore when you put something like that behind your name, that means that you don't cut corner, you can't cut corners, you are not allowed to cut corners because you are under obligation and then whether it's going to give you more business or not I debate." I use ISO quality products in my industry but unfortunately I have to also short-cut take.</p>	<p>Not aware! I would like to, personally! If you don't cut corners in this industry in Botswana you end-up losing out; therefore "therefore when you put something like that behind your name ... you can't cut corners, you are not allowed to cut corners because you are under obligation and then whether it's going to give you more business or not I debate."</p>
	FI/DF/2	<p>"Design is something that would attract each person's eye." If you are designing something for someone it has to be attractive to yourself and to the person. But what designer person wants is something different, meaning they bring a picture of something they want. Designer is the individual that does the drawings for the design. Designing, a designer will draw a design, which is his own designing (it a process).</p>	<p>"Design is something that would attract each person's eye." If you are designing something for someone it has to be attractive to yourself and to the person. But what designer person wants is something different, meaning they bring a picture of something they want. Designer is the individual that does the drawings for the design. Designing, a designer will draw a design, which is his own designing (it a process).</p>

### **7.3.1 Reliability and validity**

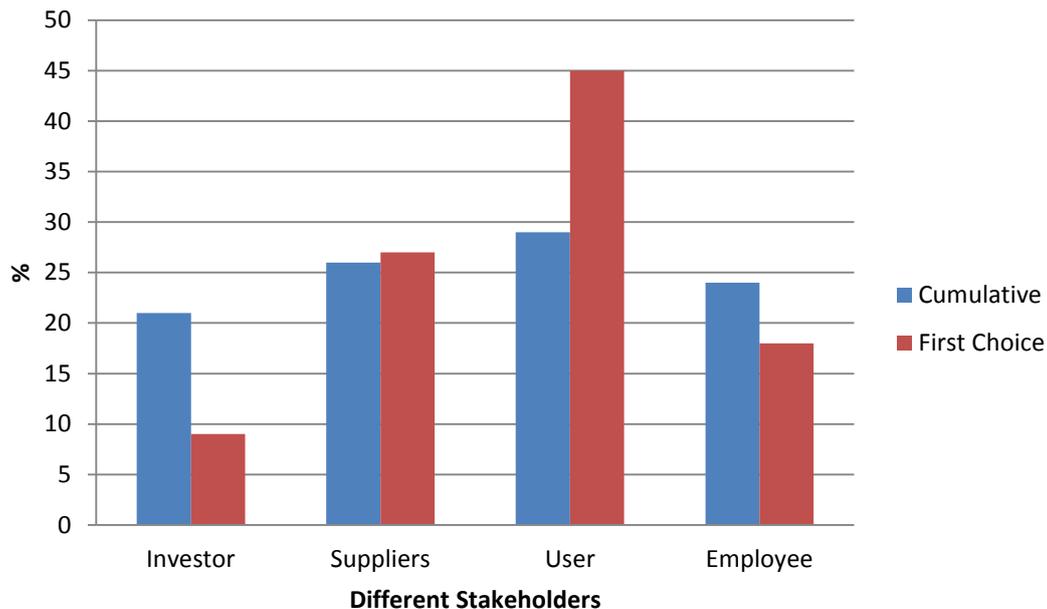
The ideas were to be incorporated onto the data after the analysis phase to avoid influencing the data analysis. The use of more than one question to obtain the same information from a participant was also important for the validity of the study. The primary and the follow-up question were asked to every participant in an effort to have consistency in the questioning. Semi-structured questions gave structure to compare different interviews at the same time providing flexibility for the participant to answer with less constraint.

Comparison between FI design and GA design industries allows possible generalizability to the entire design industry and some level of validity to the data collected. When themes from these two industries were taken to a higher abstraction level they were virtually the same.

Context of interpretation guideline “Theoretical Understanding” from Kvale and Brinkman (2009) was used to evaluate the data emerging from the interviews. Thus, the researcher followed the theoretical frame for interpreting the meaning of statements applied by the research community. Literature review information represented the design community and to evaluate the researchers work, supervisors and colleagues evaluated the interpretations.

The comparison of the FI and GA industries allows the researcher to notice some of the abnormalities in the data.





**Figure 38: Stakeholders ranked in terms of importance to PDP.**

Therefore, the user can be considered a more important stakeholder to PDP, followed by the supplier compared to the rest. Cumulatively, it can be interpreted that participants think stakeholders are relatively equally important to product development. Therefore, companies from the FI industry involved in this study can be considered slightly user focused.

To understand the participants understanding of the word design participants were asked to define the term design. The most common phrases found in participant responses to this question included ‘process’, ‘user-friendliness’ and ‘aesthetics’. Thus for this industry design can be defined as a *process* of realising a *user friendly* product that is *aesthetically* pleasing. Also a small number of participants in this industry defined design as a *final product*. Furthermore, participants described the value added by design to new product development (NPD). A small majority of the participants thought the value added was the ease at which the end-user can *understand and use* the product. Other participants thought the *design process* and *aesthetics* were also important added values of design.

In addition to finding the user the most important stakeholder, an overwhelming majority of participants thought *customer/ public reaction* was important to measuring

design effectiveness. Coming at a distant second was checking the final product against the initial *objectives*, followed by *sales, low-maintenance & green solutions* and *quality*. Further, participants were asked to rank the measures of product success (product reviews, sales/ profit and a happy client); these are measures that are derived from the survey carried out earlier. A clear majority (73%) of the participants selected a happy client as their first choice (red columns) for measuring product success, see Figure 39.



Figure 39: Measures of design effectiveness.

Cumulative ranking (blue columns) also point towards a happy client as an important measure of product success. One of the reasons given for a happy client include, *“it is all about client satisfaction, as long as the client is not happy then you have not done a good job,” FI/EK/5*. Assuming client is user, it is clear that participants from this industry perceive the user as essential to successful PDP.

The study revealed that the overwhelming majority of the participating companies in the FI industry failed to document their PDP (9/11) and a small minority of the companies (2/11) did some kind of process documentation. For companies that did not document PDP, participants pointed to documentation of the following, *product*



in terms of importance to product development. Moreover, the cumulatively ranked (blue columns) results show the order of importance remains relatively the same, despite little differences in the stakeholder ranking. The user is at 38%, employees (24%), investor (23%) and suppliers (15%). Some of the reasons given for this decision are that, the user was the most important stakeholder as they are the ones the product is being made for and are expected to purchase the product when it is all done. "Because that is the purpose and the reason why we are operating in the first instance," GA/PV/1.

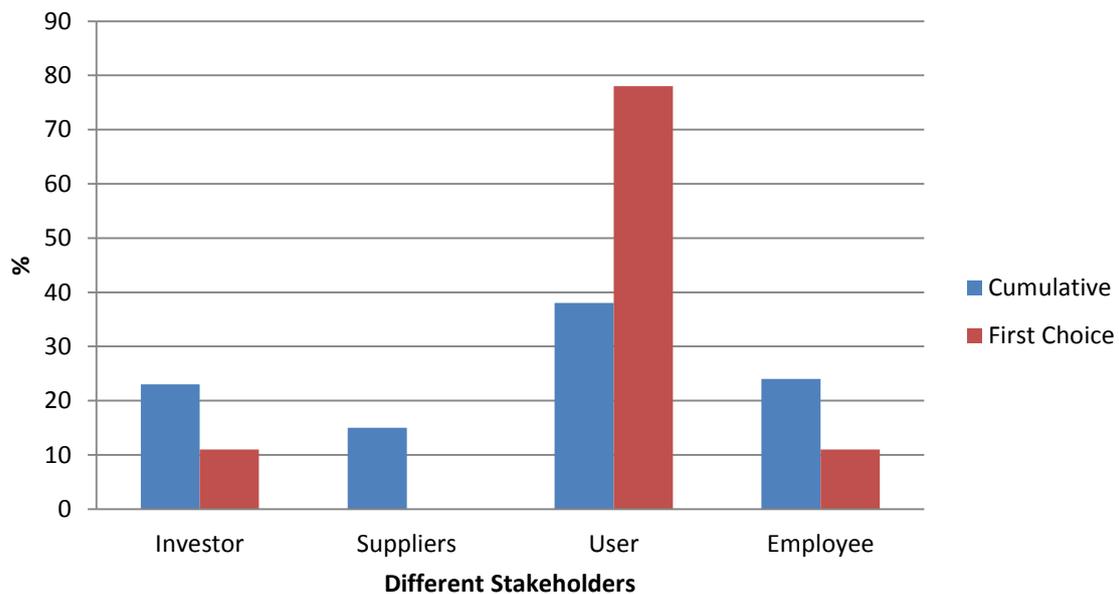


Figure 41: Stakeholders ranked in terms of importance to PDP.

It is clear the user is the most important stakeholder in PDP in this industry and suppliers are the least important. Thus it can be concluded that companies in this industry can be viewed as inclined to be user focussed.

When participants were asked to define the term design, all participants agreed that process/ planning is an integral part of the definition of the term design, other phrases used included aesthetics and useful/ functional. Thus, the definition from this industry can be; design is a *process/ planning* of making an *aesthetically* pleasing and *useful/ functional* product.

Further, a small majority of the participants thought design adds value to the PDP by guiding the design *planning/ process* and helping the designer envision the final product prior to production. Other participants thought the ability to *attract customers* and the *usability/ functionality* of the product was also important. In addition to determining the user as the most important stakeholder an overwhelming majority of the participants believed *user (customer/ public)* reaction was a reliable measure of design effectiveness. Participants also thought product *sales* were significantly less important to measuring design effectiveness. Product reviews, sales/ profit and happy client are measures of product success deduced from the survey conducted earlier. When asked to rank the measures of product success the vast majority (78%) of the participants' selected *happy client* as their first choice (red columns), 22% picked *sales/ profit* as their first choice and none of the participants (0%) *put product reviews* as their first choice, see Figure 42. Moreover, cumulative rankings shows happy client still the majority with 45% and product review at 22% & sales/ profit at 33%.



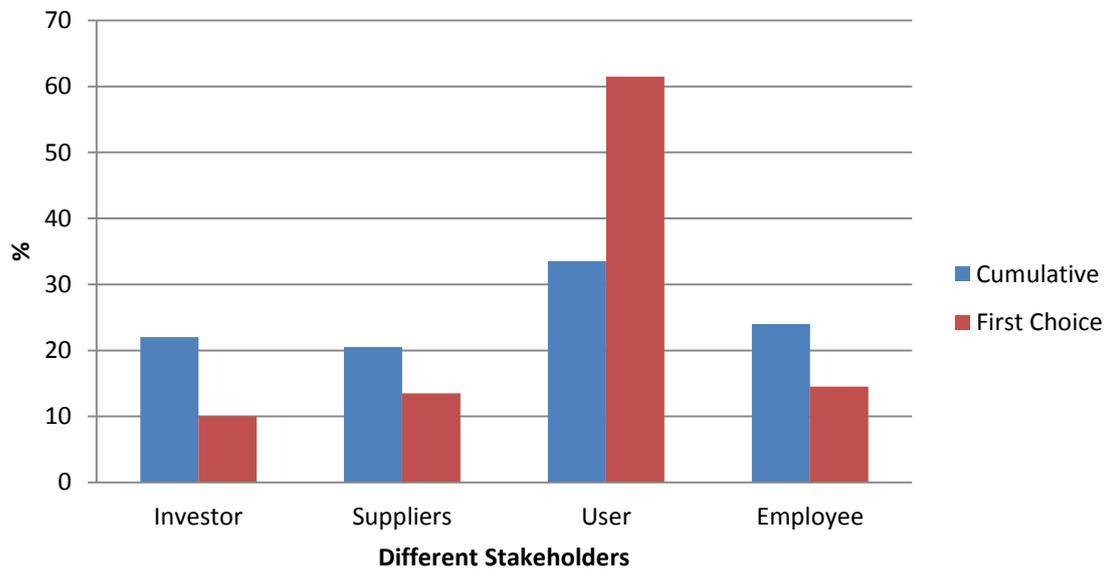
**Figure 42: Measures of design effectiveness.**

Clearly product reviews are the least important to participants from this industry. Some of the reasons given for happy client are that the client is the one bringing profit to the business. *“A happy client is the earliest evaluator of the product’s potential success, they give instant feedback to allow the necessary adjustments,” GA/LF/5. “A loyal client makes your profits go higher,” GA/AD/5.*

An overwhelming majority of the of participants in the GA industry reported not documenting the design process (7/8) and only one participant (1/8) reported some form of process documentation. However some of the companies that failed to document PDP pointed to documenting, *product development attributes* and *customer needs/ wants*. “As, a graphic designer I document the softcopies, the properties of what was used for each graphic (colour pallet),” GA/LE/6. “A questionnaire is sent to better understand the client,” GA/AD/6. The only participant that reported their company documenting their PDP described the process of using “Job bags”. At the centre of the process is the traffic department, where tasks relating to all projects are assigned and results received from different departments.

**7.4.1.3 Objective 1: FI and GA comparison**

Figure 43 clearly shows the user as the most important stakeholder in both industries; moreover, investors, employees and investors can be considered equally important to both industries. The user is significantly more important to the GA industry compared to FI industry. Suppliers are much more important to the FI than to GA.



**Figure 43: Stakeholders ranked in terms of importance to PDP.**

The definitions of design given by participants from both industries included the following phrases, process/ planning, user-friendliness and product aesthetics. The vast majority of the participants viewed design as a process and/ or an act of planning. However a higher percentage of GA industry participants as compared to

the FI industry thought process/ planning is the most integral part of the definition of design.

Both industries rated usability and process/ planning, high in the added value of design to NPD processes. For the FI industry usability was at the top followed by process /planning; while for the GA industry process/ planning was at the top followed by product aesthetics.

It is evident that both industries see the *user reaction* as the most important measure of design effectiveness. For the FI industry the second most important measure of product success was “*checking the final product against the objectives*”; while for the GA industry it was *product sales*. The researcher’s assessment of both industries shows all measures of design effectiveness leading to product *sales*. Moreover, this shows that the majority of the participants were focused on pleasing the user and expected the sales to follow naturally. In support of the user-reaction being the most important measure of design effectiveness participants from both industries FI and GA consider a happy client as most important measure of product success. Moreover, product review can be considered to be more important to FI than sales/ profit and vice versa for the GA industry.

The majority of the participants interviewed reported not documenting the PDP. However, the majority of the participants reported documenting the product its self; product attributes (dimensions, materials, tools used) and customer needs/ wants. But they failed to document the knowledge, the process behind the product being what it is. As observed from the survey the PDP lacks structure in both industries. However the little that is being done provides something to build on. Participants that reported some documentation described an abstract process being followed without the details necessary to guide someone else to replicate the process.

Figure 44 shows the accumulation of the measures of design effectiveness from both FI & GA; clearly a happy client is the most important measure of design effectiveness. Product reviews and sales/ profit can be considered equally important to determining the design effectiveness. The use of happy client in measuring design effectiveness may be viewed as having a good foundation to implement UCD activities.

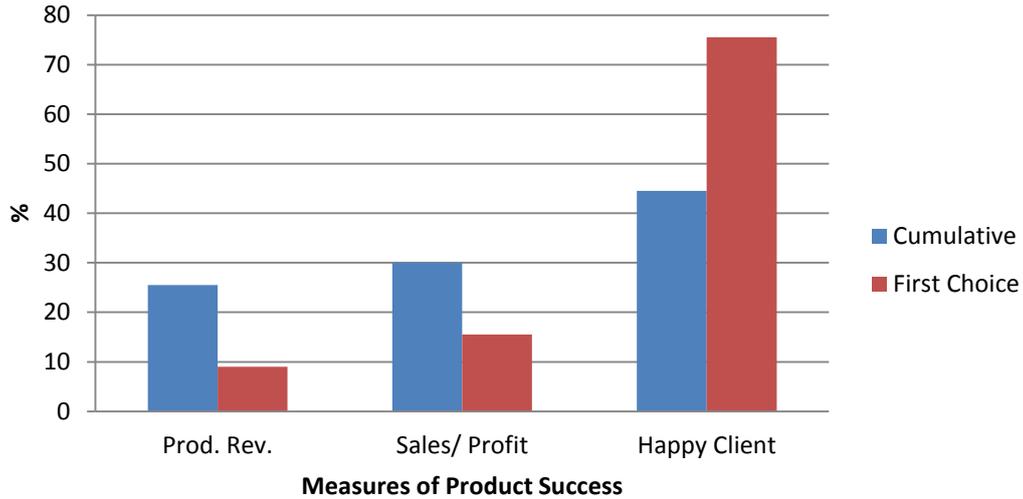


Figure 44: Measures of design effectiveness (FI and GA).

## 7.4.2 Objective 2: Ascertain current understanding of user-centred design (UCD) in Botswana.

### 7.4.2.1 Furniture and Interior (FI) Design

Figure 45 shows a word map based on the FI design industry’s responses to questions in objective two. The larger the word/ phrase the more mentioned and the more important to the objective; therefore ‘start’, ‘user’, ‘product’, ‘customer’ and ‘design’ can be considered important to this objective.



Figure 45: Furniture and Interior design objective two word map

In an effort to investigate how the product development team can best communicate with the user, participants were asked to rank ways in which the user can best share ideas. Participants were given the three modes of communication (talking, drawings/ images and written) derived from the results of the survey conducted earlier. First choice findings (red columns) show a good majority (55%) of the participants from FI industry made *talking* their first choice effective mode of sharing ideas; followed by (27%) *drawings* and 18% *written*. The cumulative rankings (blue columns) show drawings (38%), talking (36%) and written (26%) relatively the same, see Figure 46.

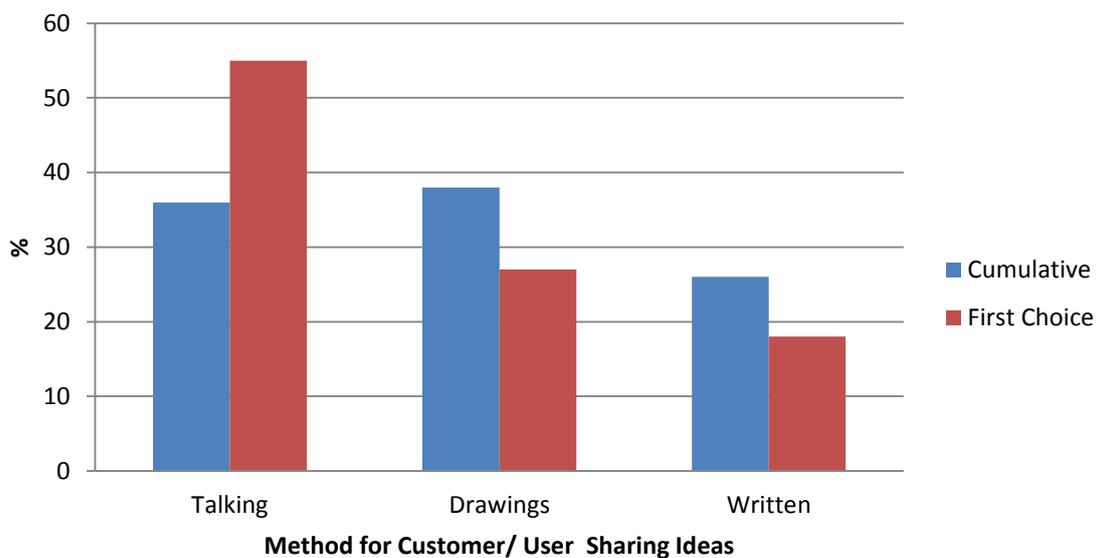


Figure 46: Product development team best communication method with the user.

The cumulative analysis show drawings and talking virtually utilised in the same manner while written is considered the least effective for sharing ideas. The findings show an inclination towards talking being the most important mode of communication.

In an effort to determine the stages of the PDP where the user is involved the most, participants were asked to choose a stage (start, middle and end) of the PDP where they perform the most usability testing. The results show that the majority of participant's first choice revealed that usability is tested more often at the *start* (6/11) of the PDP. The results also show the *middle* (3/11) and *end* (2/11) stages having

relatively the same amount of usability testing. They were further asked how usability is measured at these different stages participants and gave the following reasons;

- **Start:** *“It has to be functional on paper before it is made,” FI/MJ/9.*  
Experience, industry practices and detailed drawings help measure/ predict product usability.
- **Middle:** *“The designer tries the product before finishing it,” FI/TK/9.* The product is checked for durability and if it is well done.
- **End:** the company does the testing once the product is fully assembled and the dimensions confirmed. This is followed by the adjustments. *“By checking whether you are using the proper measurement and confirm the cuts,” FI/NK/9.*

To find out participants attitudes towards user involvement in PDP, participants were asked whether user involvement would help or hinder creativity or innovation in PDP. Responses from this industry are divided as to whether user involvement will help (7/10) or hinder (6/10) the NPD team. Participants that thought user incorporation will help creativity/ innovation of NPD teams gave the following reasons. The designer can easily obtain user needs and have the PDP monitored by the user for instant validation. *“You are able to get user needs and the user better appreciates the products usefulness,” FI/ED/10.* However, there were participants that thought user involvement will hinder the NPD team; they thought the user ends up delaying projects and inhibiting their freedom to explore. *“Some delay us when they change what they want at every meeting,” FI/SI/10.* *“Some clients would have seen something somewhere so at times they want that piece exactly as it is,” FI/EK/10.*

In addition to talking being the most preferred mode of communication, participants also thought the best way of incorporating user’s ideas into design decision making is through consultations and that includes user education. *“We look at the possibilities and come up with a compromise between what the customer wants and what is possible,” FI/LO/11.* *“Trying to incorporate their ideas accompanied by the education on possibilities,” FI/SS/11.*

Figure 47 shows an overwhelming majority (11/11) of the participant’s first choice results show that it is crucial to involve the user at the start (beginning) of the PDP. The cumulative response also shows the majority of participants think it is crucial to

involve the user at the beginning of the PDP. Moreover, participants have already indicated that most of the usability testing is also done at the start of the PDP. Reasons for involving users at the start are to help in product planning by enabling the scope of all that is necessary to build a successful product and obtaining user wants and needs. *“Input of what product requirements are before the product development stage,” FI/TK/12. “Because they will be giving us some ideas on what they want to do,” FI/SI/12.*

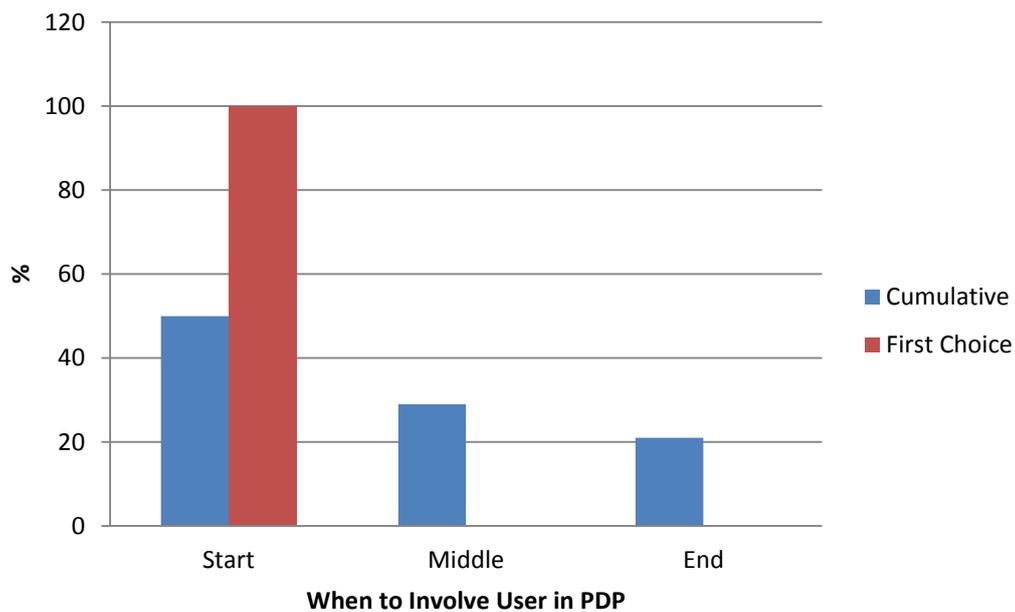


Figure 47: When to involve the user in PDP.

#### 7.4.2.2 Graphic and Advertising (GA) Design

Figure 48 shows a word map based on the GA design industry’s responses to questions in objective two. The larger the word/ phrase the more mentioned and the more important to the objective; therefore ‘user’, ‘product’, ‘client’, ‘design’ and ‘end’ can be considered important to this objective.



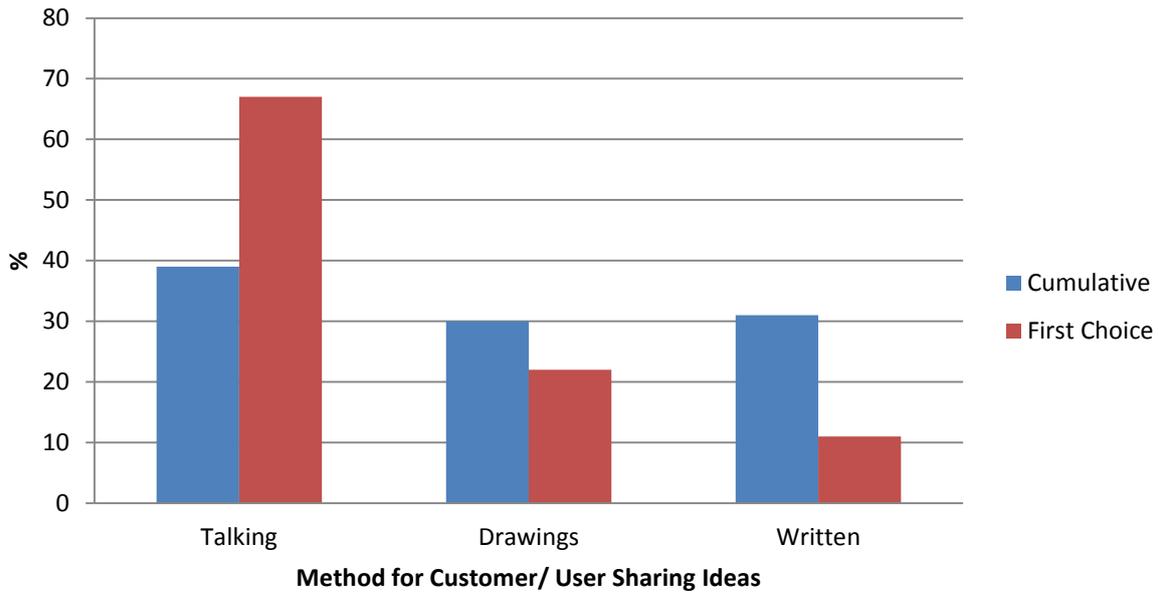


Figure 49: Product development team best communication method with the user.

From these two points of perspective on the data it is clear that talking is considered the most effective mode of communication between the user and the new product development team.

First choices given by participants from the GA industry reveal that usability is relatively measured equally across the PDP; (start (4/9), middle (2/9) and end (3/9). Therefore, there is no clear majority. Participants were further asked how they measured usability at these stages of the PDP and gave the following reasons;

- **Start:** The majority of the usability testing is done in-house by the designers themselves. However there are instances where a random person or a client is used to test a product. *“The customer has to come and tell you if they are happy”, GA/PD/9.*
- **Middle:** This is when the customer can best understand what is being proposed, thus in a better position to give the relevant feedback.
- **End:** The product is tested whether it does what it was made to. *“That’s when the product is actually done and it is better to measure usability here compared to earlier stages”, GA/LE/9.* Attention can also be paid to how people are talking about the product.

The vast majority (8/9) of the participants from GA industry thought user involvement will help the creativity/ innovation of NPD teams and the rest (2/9) thought user

involvement would hinder the process. Those that thought user involvement would help NPD teams; mainly mentioned the ability of the user to articulate their needs/wants, therefore guiding the design team to make a more desirable product. *“In all product development the end idea is for the user to be satisfied... If you do not know what people want then you cannot supply what they need,”* GA/DC/10. Participants that thought user involvement will hinder the NPD TEAM also thought the user would delay the project and inhibit team’s creativity. *“Some don’t know their boundaries and sit here for hours and hours moving things around your computer and you politely assist them,”* GA/TW/10. *“They need to give us a chance to be creative on what we are doing... I am a designer and know what I am doing,”* GA/KM/10.

The majority of participants (7/9) first choice in the GA industry believes it is crucial to involve the user at the start (beginning) of the PDP, see Figure 50. Some of the reasons given for involving the user at the beginning are that this is where product planning and context understanding is done and the team gets what the user wants. *“The brief is the most important part as it defines what the task is all about and project initiation,”* GA/TW/12. *“This is where you conceptualise what the user wants... including when they want the product delivered,”* GA/DC/12. A reason given by a participant (1/9) for involving the user in the middle of the PDP is that this is where the end-user can better visualise the end product, thus *“are in a better position to say I will move that bit change that bit,”* GA/FG/12. And lastly the last participant thought involving the user at the end of the PDP was most important as it allowed the user gets to confirm that the final product is what they originally envisioned. They have *“to come and confirm what I have done; my final work,”* GA/KM/12. The cumulative analysis also show that the user is almost mostly involved at the beginning of the PDP.

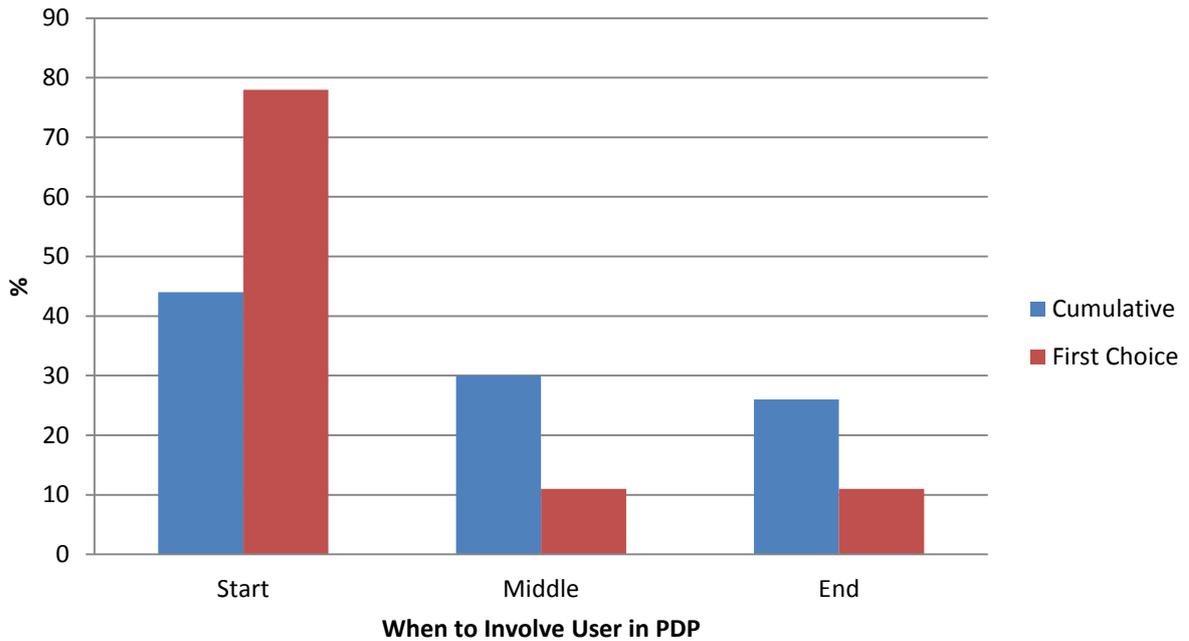
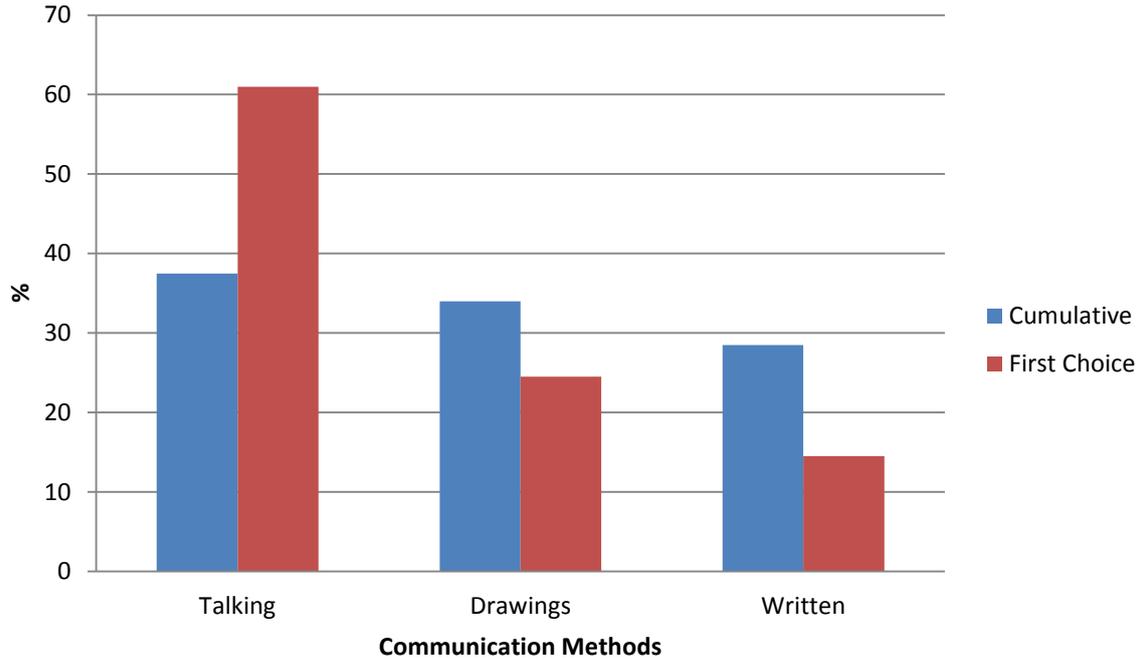


Figure 50: When to involve the user in PDP.

#### 7.4.2.3 Objective 2: FI and GA Comparison

When asked to rank three ways (talking, drawings/ images and written) in which the user/ customer can best share ideas with the NPD team. Participant responses went against the researcher's expectations of drawings being the most effective mode of communication. Figure 51 clearly shows that participants believe talking is the most effective mode of communication, thus it was the first choice by the majority, and drawings were the second choice. When we look at the results from the cumulative ranking calculations both industries show talking and drawing as equally effective and writing as the lesser effective of the two.



**Figure 51: Product development team best communication method with the user.**

It is evident that majority of the participants from both industries measure product usability at the start of the PDP. More observations show GA industry measuring product usability substantially higher than the FI industry at the end of the PDP. The findings show the vast majority of participants from the GA industry thought user involvement will help the creativity/ innovation of NPD teams; however participants from the FI industry were equally divided on whether user involvement helps or hinders creativity/ innovation in NPD teams. Thus an assumption can be made that GA industry are much more likely to involve the user in the PDP.

In both industries participants agree that consultation with the user is essential to incorporating user input onto design decision making. Additionally participants from the FI industry also thought education of the user was important to incorporating user needs into design decision making. A small number of participants from the GA industry also mentioned the discussion of user needs.

Responses from both industries show the majority of participants believe it was essential to involve the users at the beginning of the PDP, see Figure 52. The vast majority from both groups made their first choice to involve the user at the start of the

PDP; moreover all participants from the FI industry reported the criticality of involving the user at the start of the PDP. However, the cumulative view at the responses show that involving the user at the ‘start’ PDP was also important; however ‘mid ‘and ‘end’ were more or less viewed similarly by both industries.

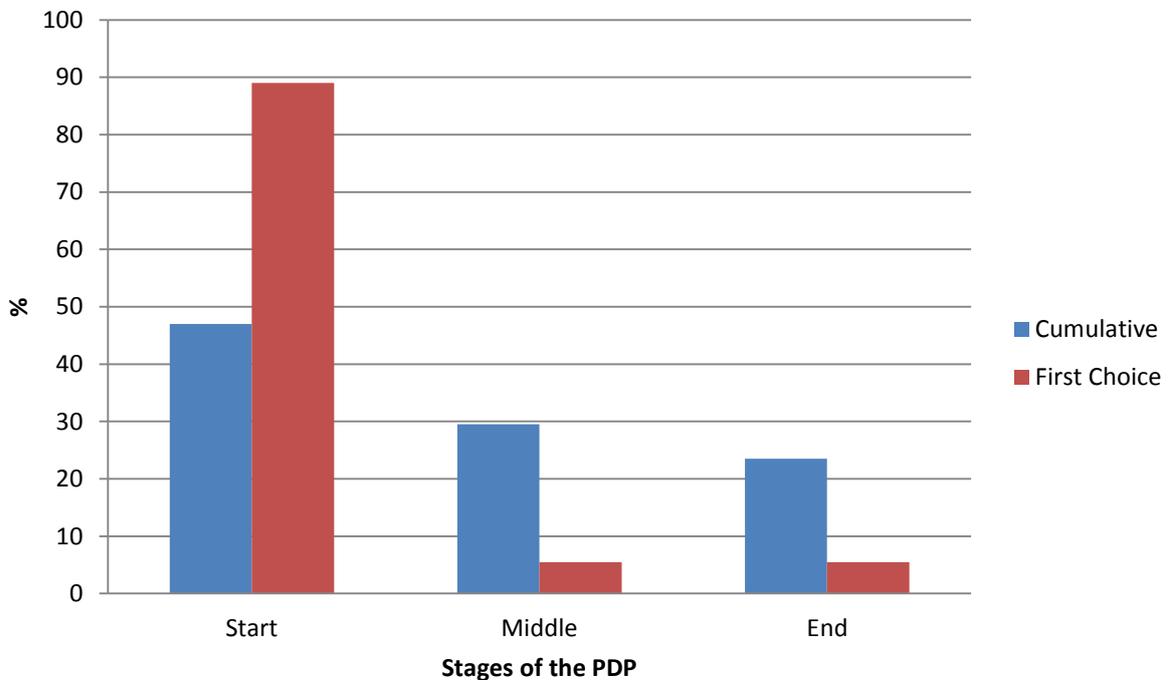


Figure 52: When to involve the user in PDP.

### 7.4.3 Objective 3: Explore the training needs of companies in Botswana in relation to UCD.

#### 7.4.3.1 Furniture and Interior (FI) Design

Figure 53 shows a word map based on the FI design industry’s responses to questions in objective three. The larger the word/ phrase the more mentioned and therefore more important to the objective. Therefore ‘company’, ‘activities’, ‘client’, ‘product’ and ‘design’ can be considered most repeated for this objective.



The vast majority (10/11) of the participants from the FI industry are willing to incorporate UCD activities to their PDP. Only one (1/11) participant reported not being willing to incorporate UCD activities onto their PDP. Participants that were willing to incorporate UCD activities because it will lead to a happy customer (3/10), facilitate PDP (4/10) and (4/10) participants failed to provide a reason. Some of the reasons given for incorporating UCD activities are; *"It can help us know we are making strong products and that the customers are happy with the product," FI/PF/16. "You have something to say you have done your research and this is where I am going," FI/EK/16. "Is to protect ourselves, the client and to draw expectations of the end product... helps bring people to a common understanding of what deliverables are," FI/SS/16.*

The participant (1/11) that was not willing to incorporate UCD activities reported their target market not needing these activities. Their aim is to produce the cheapest product possible and incorporating these activities is likely to increase the product price.

Total of 11 participants from the FI industry responded to this question, however, all but one participant (FI/DF/17) were not aware of the UCD ISO standards. Participants that were not aware of the ISO standards were further clustered into two groups those that are interested (8/10) and not interested (2/10) in UCD activities. Clearly the vast majority of the participants not aware of the standards were interested in UCD activities. Some of the comments from the interested participants include; *"They bring awareness to the customer that this company knows what it is doing... and follows international standards," FI/LO/17. "It's a great idea so long as it doesn't restrain you," FI/MJ/17.* A small number of participants that were not aware of the ISO standards and not interested reported, *"I do not think they will be of any use to this market and the industry we are in. The primary focus is the bottom line because our customers are not the users," FI/TK/17. "No I do not know them and no I wouldn't want to follow them... like I said we are not really in the core process of manufacturing but I guess if I was already there I would say definitely I will need to know them," FI/ED/17.* The only participant aware of the UCD ISO standards expressed interest in knowing more about these standards; *"I have heard of them but we do not have them... yes I will be interested in them," FI/DF/17.*



institutions on some of their projects (2/9). Some of the statements include, *“people designing the curriculum are lagging behind and they are never at pace with what the industry wants,”* GA/DC/14. Furthermore, that *“if educational institutions could come to exhibitions to learn more about advertising, printing and understand what’s new on the market,”* GA/FL/14. (4/9) participants suggested that the industry can learn from the educational institutions. Thus educational institutions should share ideas on design and that this could be done through e-learning. *“e-learning courses on their websites,”* GA/PD/14.

The vast majority (8/9) of the participants were willing to incorporate UCD activities to PDP; however one (1/9) participant was less willing to incorporate these activities. Participants that were willing to incorporate UCD activities believed that these activities will help improve business/ design practices (6/8) and product appropriateness (2/8). Some of the reasons given by participants for the willingness to include UCD activities include; *“I know the end result is that nothing becomes a secret, clear documentation of the processes of cycles and will help the company to move smoothly without a problem when someone is not there,”* GA/PV/16. *“Because to have the best product you do not have to take short cuts,”* GA/LE/16. It is *“very important that at the end of the day we come-up with a product relevant to the user and his/ her clients,”* GA/AD/16. The only participant less willing to incorporate UCD activities mentioned that staff at his company is not skilled enough to apply these activities and stick with them. Also, that they *“do not want to waste time too much in a lot of thought processes because someone might beat us at making the product,”* GA/FG/16.

Nine participants from the GA industry responded to this question, however, all but one participant (GA/TW/17) were not aware of the ISO standards. Thus responses were clustered in to two groups, those *aware* (1/9) and those *not aware* (8/9) of the ISO standards. All participants not aware of the standards reported interest in knowing more about them. Some of the reasons include; *“they make our products internationally marketable. If we are looking to expand in the future we cannot do without these, the quality is assured,”* GA/DC/17. *“When you put something like that behind your name... you can’t cut corners, you are not allowed to cut corners because you are under obligation and then whether it’s going to give you more business or not I debate,”* GA/FG/17. *“The standards will give us a competitive edge,*

over bigger companies,” GA/AD/17. The only participant aware of the ISO standard also expressed interest in knowing more about these standards. “Yes I am aware. Yes I will be interested in it because there is a lot of flyby nights out there, dodgy designs,” GA/TW/17.

### 7.4.3.3 Objective 3: FI and GA Comparison

Almost all participants reported the lack of market research departments in their companies. However, some reported doing some market research related activities which can be described as mostly less organized and hardly documented. The lack of organization in these activities might translate to the company benefitting little from these activities. The majority of participants from both industries revealed monitoring of trends and competition as the most used market research method for both industries. Targeting potential individual clients was also significantly important to GA industry than in the FI industry. Only one participant (from GA industry) reported their company having an organized marketing process.

Figure 55 shows numbers of graduate designers per company. Majority of the FI industry companies had one qualified designer, while majority of GA industry companies had two qualified designers per company.

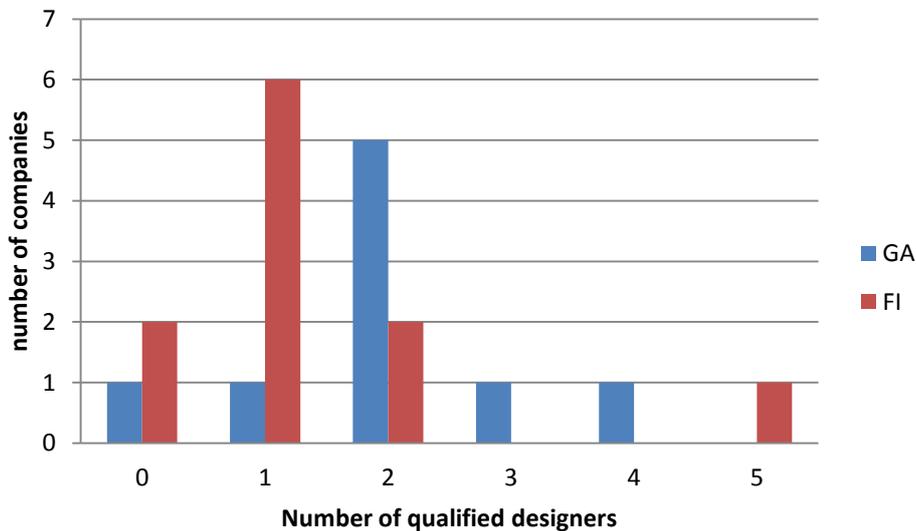


Figure 55: Number of qualified designers in the participating industries.

Since interventions resulting from this study may involve training of employees, it was important to see how these two systems can potentially interact. When participants were asked what types of relationships they would like to have with educational institutions in addition to offering internships. The suggested relationships were clustered into two groups; Learning from Universities and Learning from Industry. The majority of the participants reported educational institutions having more to learn from industry.

Results show an overwhelming majority of participants willing to incorporate UCD practices onto their PDP and strongly believe these activities are essential for structuring business/ design practices. There was one person per industry that was not willing to incorporate UCD activities to PDP.

Almost all participants from both industries were not aware of the UCD ISO standards. A large number of participants showed interest in learning more about these standards, including all participants from the FI industry. Only two participants (one from each industry) reported being aware of the ISO standards and are both interested in learning more.

Figure 56, shows UCD activities that participants were asked if they performed at their respective companies and at which stages of the PDP. This question also served to test the format that was used for the case studies; to gather information on how UCD practices were applied to specific projects. Thus for each activity the participant had an option of selecting all three stages of the PDP (start, Middle and End). The UCD activities were obtained from ISO 13407 (User-centred design cycle). The responses to the activities showed a lot of similarities between the industries being investigated in terms of the types of UCD activities being performed and at which stages. However, there were a few activities (highlighted) where there were differences between the two industries.

- **Informal expert review**

For the Graphic & Advertising (GA) design industry, a clear majority of the participants reported performing this activity at the beginning of the PDP. However, for the Furniture & Interior (FI) design industry a small majority of participants failed

to do this activity; but for the participants that reported doing this activity it was done similarly at the start and middle of the PDP.

- **Set measurable criteria for the resultant (usability)**

All participants from the GA industry reported performing this activity equally on the three stages of the PDP. Participants from the FI industry that did not do this activity were the same number as the ones that performed this activity at the beginning of the PDP and the number declined as the PDP progresses. Thus, for the FI industry the importance of this activity declines as the PDP progresses.

- **Use of mock-ups**

Almost all participants performed this activity in the GA industry, with the majority reporting performing the activity equally at the start and middle of the PDP. However, a good majority of participants from the FI industry reported not doing this activity and the remaining participants did the activity in middle stage of the PDP.

- **Simulated tasks, (sketches, 3D models, collect user-feedback)**

For the GA industry this activity was performed almost equally at all stages of the PDP, with a slight majority at the middle stage. Good majority of participants from the FI industry reported doing this activity at the beginning of the PDP and then declines towards the end of the process.

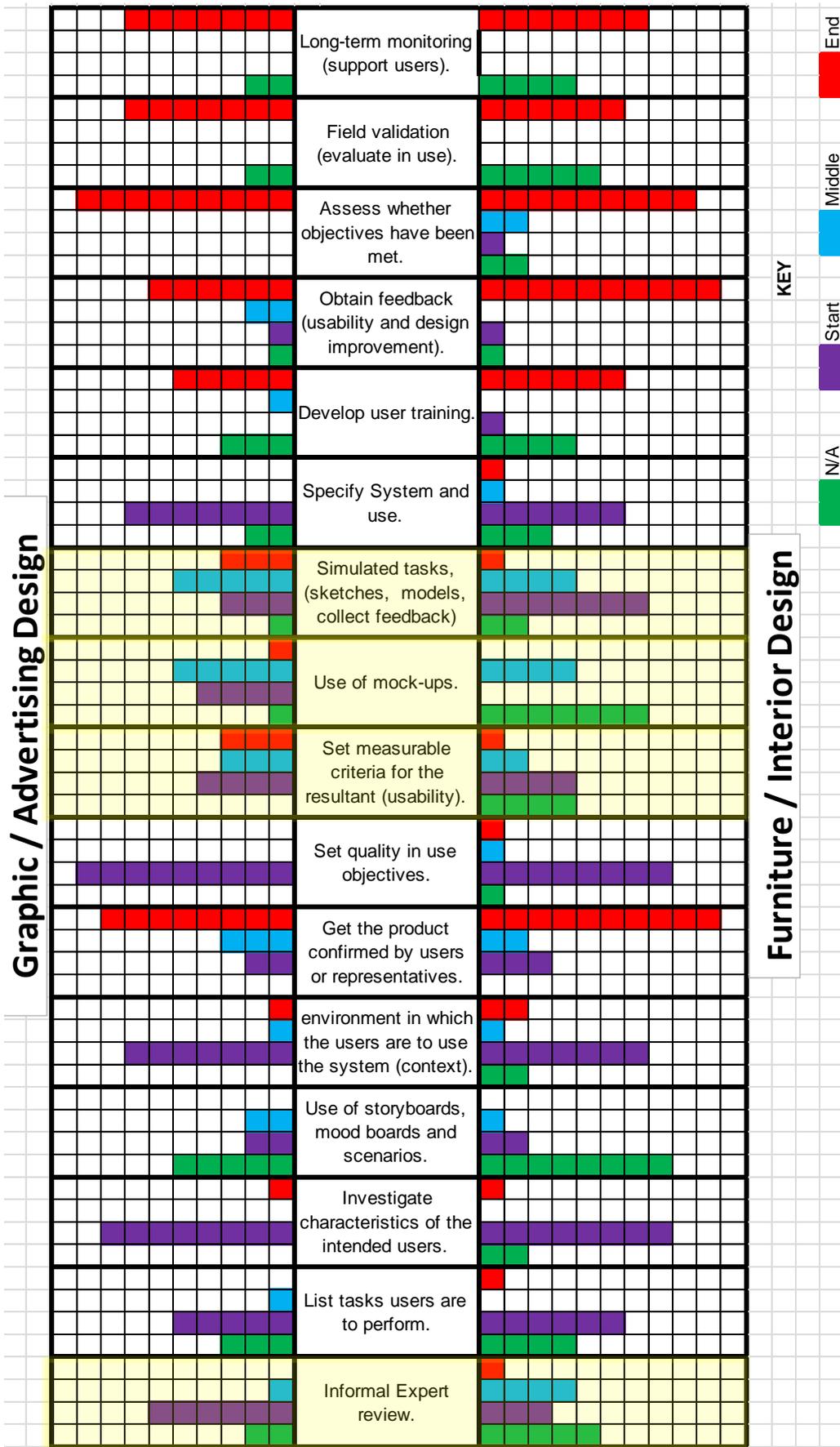


Figure 56: UCD activities.

## 7.5 Chapter Discussion

Design is viewed as a process or an act of planning which went against researcher's expectations of participants' primarily defining design in terms of aesthetics. Furthermore, usability and process were rated highly in terms of added value of design to the PDP. For the FI industry usability was at the top followed by process; while for the GA industry process was at the top followed by product aesthetics. A large majority of participants from the GA industry thought user involvement would help the creativity/ innovation of NPD teams. However, participants from the FI industry were equally divided over whether user involvement helps or hinders creativity/ innovation in NPD teams. FI industry benefited from industry standard measurements (anthropometry) i.e. standard height of tables/ chairs.

The majority of participants believed it was essential to involve users at the start stage of the PDP. Moreover, the cumulative calculations also show the "middle" stage as more important than the "end" stage in user involvement. This is what the researcher expected to be the most ideal way to involve the user in PDP. Furthermore, first choice and cumulative calculations show product usability mainly measured at the "start" stage of the PDP. However, GA industry seems to measure product usability substantially higher than the FI at the "end" stage of the PDP. This may be attributed to the fact that GA industries' final product form takes shape late in the PDP, compared to FI industry.

Participants from both industries reported "user reaction" as the most important measure of design effectiveness. The second most important measure of product success was "checking the final product against the objectives" for FI industry; and "product sales" for GA. Despite "user reaction" being the most important measure of design effectiveness. The first choice analysis for FI industry was "usability" followed by "process"; while GA's first choice was "process" followed by the "aesthetics". These observations can be attributed to the types of products produced by the two industries. The tangibility of the FI products made sense for "usability" to be a measure of design effectiveness (where the user interacts physically with the product). While for GA "aesthetics" as a measure of design effectiveness made sense since graphics and aesthetics can be evaluated visually.

Almost all participants reported the lack of market research departments in their companies. However, some of the participants reported doing some market research related activities which can be described as mostly less organized and hardly documented. Participants from both industries revealed monitoring trends and competition as the most used market research method. Targeting of potential clients was also significantly important to GA industry than in the FI industry. The lack of organised market research by the majority of the companies indicates less understanding of the user and the product. The researcher assumed the presence of market research represented some of UCD practices or greater understanding of the user and context. Thus companies that do market research would more likely to be selected for the next study.

First choice analysis show “talking” as the most preferred mode of communication and cumulative analysis show little difference in the preference between the three communication methods (talking, drawings and written). Both industries agree that consultation with the user is essential to incorporating user input into design decision-making. Thus, re-affirming “talking” as the most preferred mode of communication and part of the consultation process.

Participants reported the user as the most important stakeholder in both industries; however, investors, employees and investors can be considered equally important. The user is significantly important to the GA industry compared to FI industry. Suppliers seemed much more important to the FI than to GA and this may be attributed to the quality of materials greater influence on the quality of the product.

The majority of participants failed to document the PDP, the only documentation reported was on the product itself, dimensions, materials; and failed to document the knowledge and the processes followed. Given the lack of PDP documentation, it made sense for “user reaction” to be referred to as the most important measure of design effectiveness for both industries. The findings show user reaction being the main measure of design effectiveness and happy client being the main important measure of product success. A large majority of participants were not aware of ISO 13407; however, they were willing to incorporate it onto the PDP. Therefore, most of these companies were willing to incorporate UCD practices to NPD.

Data shows the “start” stage of the PDP to be where UCD practices are concentrated. And this observation agrees with what the researcher thought is an ideal way to apply UCD practices. That is, more UCD practices at the beginning of the PDP and then diminishing towards product delivery. The user was discovered to be more important compared to other stakeholders involved in the PDP. This is important as it shows the existence of UCD practices in the participating companies, thus providing a greater foundation to UCD incorporation in Botswana’s design industry. Consultation with the user was a preferred mode of communication chosen by participants as opposed to writing and drawing.

## **7.6 Chapter Conclusion**

The study method was effective since the researcher did the interviewing and transcription, there was a lot learn about the interviewing style and data analysis was more extensive. The researcher also kept a note pad during the transcription process to jot down notes of different observations and analysis perspective.

Due to time and budget constraints interviewees were not afforded a chance to verify the transcripts of the interviews. Selection of typical companies and companies from diverse parts of the country helped make this study more applicable to Botswana’s companies. Also, it was important to select companies from different parts of the country, for the study to get a better picture of the situation in Botswana. Debriefing was performed at the end of each interview to ease participants concerns and to reassure them of the confidentiality of the data. Participants often gave a lot of valuable information during debriefing, after interview materials were put away. This information was often written down before leaving the interview location.

Lack of online presence and published materials by the majority of Botswana companies, meant the researcher could have learnt more about the company prior to approaching it. Educational institutions have to take advantage of the industry’s willingness to give their time and information sharing.

### 7.6.1 What was learnt from this study

Results from the interview study had little influence on the case study questionnaire as the questionnaire was mostly derived from ISO 13407. Table 32 shows the themes derived from the interview study findings; the derived questions. The themes from the interview findings were also matched to the ISO 13407 activities for easier comparison with other data and the objectives of this study.

**Table 32: Themes from the interview study.**

Themes derived from the Interview study?	Derived questions for the next Study
The vast majority of the participants viewed design as a process and/ or an act of planning.	
Both industries highly rated usability and process improvement as the added value of design to NPD processes.	
Participants reported the user as the most important stakeholder in both industries; however, employees and investors can be considered equally important. The user is significantly important to the GA industry compared to FI industry. Suppliers are much more important to the FI than to GA.	
Participants reported a small number or no employees having been through a design school. The numbers of design trained employees range from 0–5.	
The majority of participants reported not documenting the PDP. However, the majority of participants reported documenting the product its self; product attributes (dimensions, materials, tools used) and customer needs/ wants. They failed to document the knowledge, the process behind the product.	Use retrospective case studies to investigate PDP/UCD documentation.
Participants reported “user reaction” as the most important measure of design effectiveness. The second most important measure of product success was “checking the final product against the objectives” for FI industry; and “product sales” for GA.	
Clearly a happy client is the most important measure of product success. Product reviews and sales/ profit can be considered equally important to determining the design effectiveness	
<ul style="list-style-type: none"> <li>• Based on the first choice participants believe talking is the most effective mode of communication and drawings were the second choice. When we look at the results from the cumulative ranking calculations, both industries show all three modes of communication relatively equally effective in sharing ideas.</li> <li>• Both industries participants agree that consultation with the user is essential to incorporating user input onto design decision-making.</li> <li>• Almost all participants reported the lack of market research departments in their companies. However, some of the participants reported doing some market research related activities which can be described as mostly less organized and hardly documented. Participants from both industries revealed monitoring trends and competition as the most used market research method. Targeting of potential clients was also significantly important to GA industry than in the FI industry.</li> <li>• A large majority of participants from the GA industry thought user involvement would help the creativity/ innovation of NPD teams. However, participants from the FI industry were equally</li> </ul>	<p><b>How do you plan the UCD process?</b> (Consists of six questions from ISO 13407)</p>

CHAPTER SIX: INTERVIEWS

<p>divided over whether user involvement helps or hinders creativity/ innovation in NPD teams.</p>	
<p>Majority of the participants from both industries measure product usability at the start of the PDP. More observations show GA industry measuring product usability substantially higher than the FI industry at the end of the PDP.</p>	<p><b>Do you evaluate designs against user requirements and user testing?</b> (Consists of 11 questions from ISO 13407)</p>
<p>UCD activities performed showed a lot of similarities between FI and GA industries in terms of types of activities being performed and at which specific stages.</p>	<p><b>How do you get specifications of context of use?</b> (Consists of five questions from ISO 13407) <b>How do you get specifications of the use and organisational requirements?</b> (Consists of seven questions from ISO 13407)</p>
<ul style="list-style-type: none"> <li>• A large majority of the participants involved the user at the start of the PDP; moreover all participants from the FI industry reported the criticality of involving the user at the start of the PDP.</li> <li>• Results show an overwhelming majority of participants willing to incorporate UCD activities onto their PDP and strongly believe these activities are essential for structuring business/ design practices.</li> </ul>	<p>How are UCD activities incorporated onto the PDP?</p>
<p>The majority of the participants reported educational institutions having more to learn from industry.</p>	
<p>Almost all participants from both industries were not aware of the UCD ISO standards. A large number of participants showed interest in learning more about these standards, including all participants from the FI industry.</p>	

CHAPTER EIGHT

**RETROSPECTIVE  
CASE STUDIES**

## **8 Retrospective case studies: Documentation Review and Interviews**

These case-studies focus on reviewing a recently completed project in the four companies being investigated. Two companies from each of the two industries Furniture & Interior (FI) design and Graphic & Advertising (GA) design were selected for the case studies. The study looked at the documentation of a recently completed project. The review of company's project documentation was followed by a semi-structured interview with a member of the NPD team.

In addressing these objectives, the simplified Basic design process (Start, Middle and End), ISO 9241-11 and ISO 13407 were used to investigate each of the four participating companies, see Appendix 12.5.1 for data extracted from the ISO standards for the questionnaire.

The participants' participation was strictly voluntary and they were assured that they could withdraw from the study at any time. All information collected was treated as confidential and remained anonymous. See Appendix 12.1 for the ethical compliance.

### **8.1 Aim of the study**

The aim was to find out exactly how the user was involved in the PDP on a recently completed project. Since, a UCD strategy is always built on top of a sound PDP, this investigation also investigated the effectiveness or presence of a PDP within the participating companies.

#### **8.1.1 Objectives**

- Investigate the effectiveness of the PDP being followed.
- Find out how the user is being incorporated / involved in the PDP.
- To establish to what extent the PDP and UCD practices are documented.

### **8.2 Questionnaire**

The basic design model was included in the questionnaire to enable the researcher to find out at which stage of the PDP each of the UCD practices was done, see Figure 15: Simplified PDP, derived from The Basic Design Cycle. Again, it also

provided a simple and a common PDP for all participating companies. The participants were already familiar with the basic design model from previous studies; therefore they may have been in a better position to focus on the UCD practices executed during the product development process.

In addition to the use of the Basic Design Process, the questionnaire was derived from ISO 9241-11 and ISO 13407. The use of ISO standards provided a consensus on internationally agreed guidelines by experts in the field. UCD practices provided by the ISO standard were converted into a 29 question questionnaire for the documentation review and the follow-up semi-structured interviews. See Appendix 12.5.2 for the final questionnaire. The questionnaire was categorised into five categories;

- Planning the UCD process.
- Specification of context of use.
- Specification of use and organisational requirements.
- Evaluation of designs against user requirements.
- Evaluation of designs against user requirements: user testing

The five categories represent the associated area of questioning and the guidelines to what ISO standards recommend for the question.

### **8.3 Analysis**

“Analysis is on-going throughout the study rather than being concentrated at the end”, Murphy (2001, p46). It starts during the data collection process through the analysis phase of the study.

### 8.3.1 Selected Companies

Table 33 show companies participating in the case studies, company name and description, and the nature of project under investigation.

**Table 33: Projects under investigation.**

<b>GA industry</b>	<b>FI industry</b>
<b>Name:</b> AD (0-2 years) <b>Number of designers with a degree:</b> 2 <b>Description:</b> Advertising design company <b>Project:</b> Brand revealing video <b>Project Cost:</b> £1972.79	<b>Name:</b> PJ (6-10 years) <b>Number of designers with a degree:</b> 1 <b>Description:</b> Furniture and Interior design <b>Project:</b> Kitchen cabinets <b>Project Cost:</b> £1727.97
<b>Name:</b> VP (6-10 years) <b>Number of designers with a degree:</b> 2 <b>Description:</b> Graphic Signage Design Company <b>Project:</b> Roadside billboard <b>Project Cost:</b> £31262.98	<b>Name:</b> MJ (over 10 years) <b>Number of designers with a degree:</b> 2 <b>Description:</b> Furniture and Interior design <b>Project:</b> Office partitioning and furniture <b>Project Cost:</b> £49845.31

### 8.3.2 Rationale

The data collection was structured through the use of checklists for easier comparison across all the four participating companies. The use of a checklist helped standardise the findings across the participating companies and ensure all relevant areas were addressed. The PDP and the order in which UCD practices done during this particular project were expected to show where the NPD team spent most of its efforts. Whether it is at the start, middle or end of the basic design cycle. The manner in which data was collected for the documentation review and semi-structured interviews were kept the same, to allow responses from both methods to be compared.

### 8.3.3 Procedure

The researcher was conscious to listen more than they spoke and show enthusiasm about the study. An effort was made to avoid leading questions especially on follow-up questions.

The documentation review was expected to reveal a realistic picture of how the project was actually conducted; however previous studies had shown little documentation of the PDP by the participating companies. Therefore, investigating

the most recent project made it easier for the participant to remember the PDP followed for the interview part of the retrospective case study.

#### **8.3.4 Transcribing**

Since the data collection involved a small number (four) of companies it made sense to transcribe all interviews in verbatim, except for repeated statements, examples, icebreakers etc. Full quotes were also written down while transcribing, these provided a window onto the participant thought process and added credibility to the analysis. The transcribed data was then uploaded into Nvivo (qualitative research software) for analysis.

#### **8.3.5 Transcript into Nvivo and coding**

Questions were interpreted as nodes in the software and then grouped into categories already established in the questionnaire. Additionally, instead of basing the analysis on individual questions, the researcher looked at the category level to reduce clutter. All 29 questions were categorised into a total of five categories, see Figure 57. The intent was to analyse responses to the nodes in each category and then come up with observations that will be representative of each category.

Name	Sources	References
[-] Evaluation of Designs Against User R	0	0
[-] Evidence of the appropriateness o	3	6
[-] Evidence that an appropriate eval	3	7
[-] HCD goals to be evaluated in this	4	7
[-] Who was responsible for the evalu	4	8
[-] Planning the Human-Centred Process	0	0
[-] Human-centred activities carried o	4	21
[-] individuals responsible for HCD ac	4	24
[-] milestones during the design and	4	13
[-] procedures for establishing feedba	4	25
[-] procedures that you followed for in	4	20
[-] suitable timescales to allow feedb	4	13
[-] Specification of Context of Use	0	0
[-] Evidence of conformation of conte	4	12
[-] Evidence of context of use being u	3	7
[-] Evidence of provision of context of	4	17
[-] Sources from which context of use	4	18
[-] specifications on the range of inte	4	16
[-] Specification of Use and Organisation	0	0
[-] Criteria against which the design c	4	25
[-] Evidence of conformation of the a	4	15
[-] Evidence that the requirements ha	4	11
[-] Priorities for the different requirem	3	8
[-] Range and relevance of users and	4	20
[-] Statement for the HCD goals	4	13
[-] Statutory or legislative requiremen	3	4
[-] User Testing	0	0
[-] Definition of context of use which	4	13
[-] Description of the product tested a	4	8
[-] Description of user and organizati	3	8
[-] Measurements undertaken, the us	4	16
[-] Methods and measures used and t	4	14
[-] Project was a pass or failure in rel	4	12
[-] Results and relevant statistical an	4	14

Figure 57: NVIVO screen shot showing the categories and the associated nodes/ questions.

### 8.3.6 Coding in Nvivo

Responses to each question were noted and other responses within a category were evaluated to see if they provided an answer to every other question within the category. This was done to reveal nodes/questions that received the most responses. Therefore, responses that answered the most questions were deemed important to the category and the study in general. This was also used to track answers that might have been given prior to and / or after the question was asked.

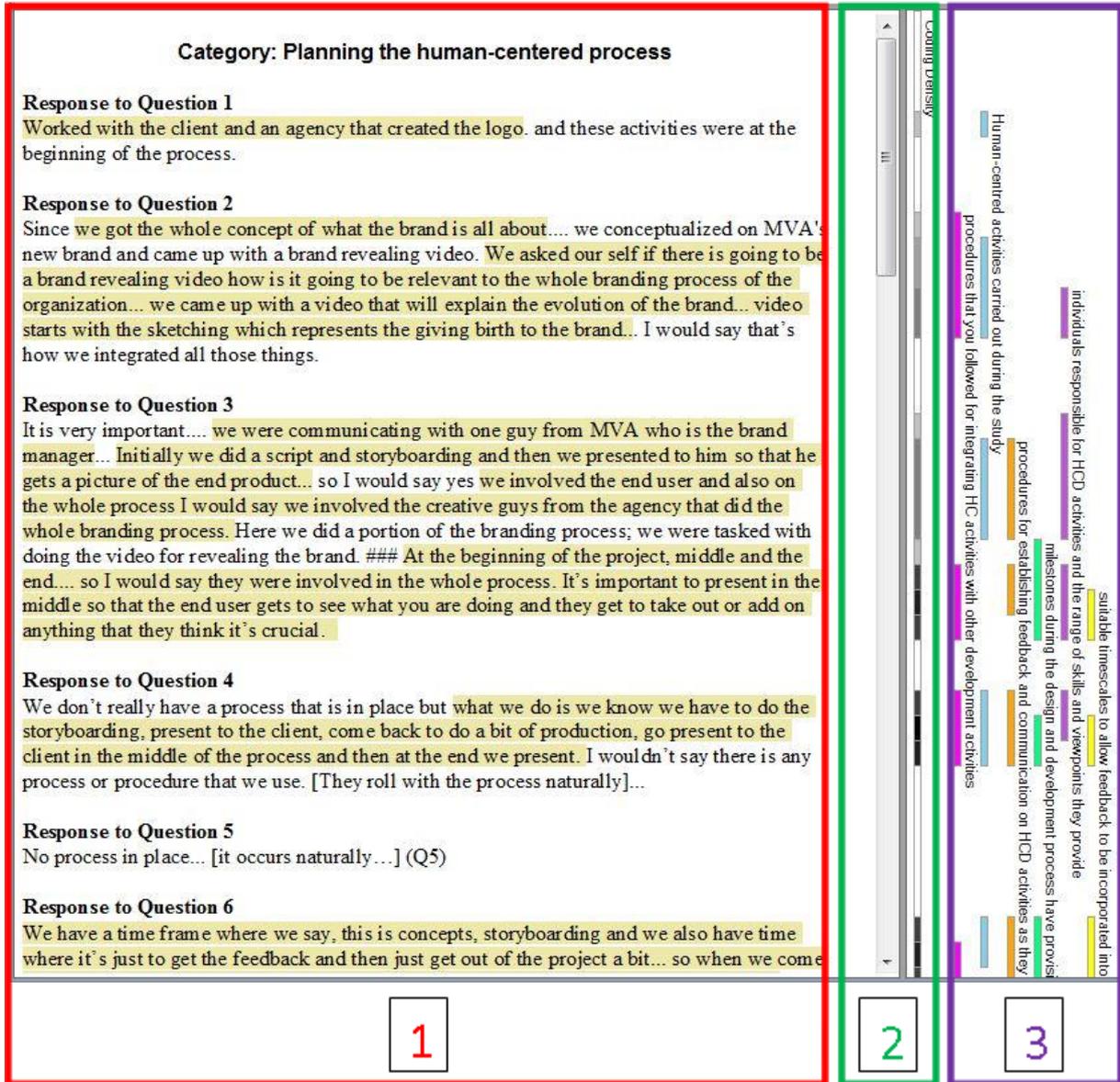


Figure 58: Coding process.

Figure 58 has been divided into three areas (1, 2 and 3) to explain the coding process and how the researcher extracted the most important information in each category. The area marked in red (1) shows part of the 'Planning the human-centered process' category of one of the transcribed case studies. Highlights show responses that answered one or more questions within the category. The area marked green (2) shows the coding density that helped guide the researcher to the most important highlighted response to the category in the red area. The darker the coding the more important the response is and vice versa. The purple area (3) is the nodes / questions colour coded against the transcribed responses. The more overlapping of the questions per response, the darker the coding density and therefore the more

important is the response. This same process was repeated on the rest of the categories and in all case studies recorded for this study.

**Table 34: Data comparison guide.**

		<b>Industries</b>	
		Graphic/ Advertising (GA) design	Furniture/ Interior (FI) design
<b>Companies</b>	<b>VP: Graphic Intensive</b>		<b>PJ: Furniture Intensive</b>
	<b>AD: Advertising Intensive</b>		<b>MJ: Interior and Furniture intensive</b>

Table 34, show participating companies and ways in which the data was analysed. First, the two companies within a category were compared to each other and afterwards the two industries were compared to each other.

## 8.4 Results

### 8.4.1 Individual Case Studies

The tables beneath the study categories show the number of questions (UCD activities) per category; the number of questions documented and how many of these activities were performed at each stage of the PDP (start, middle and end). Each UCD activity can be applied to all three stages of the PDP.

#### 8.4.1.1 AD Project

**Name:** AD

**Description:** Advertising design company

**Project:** Brand revealing video

Figure 59, is a word map showing words that were the most frequently repeated in the AD company case study. It is NVIVO generated from participant responses to the interview part of the data collection, the bigger the word the more often it was mentioned. The word map provided an overview on what the interviewee said, and in this particular study, 'brand', 'end', 'process', 'user' can be considered the most mentioned.



### Specification of the context of use

Number of Questions	Documentation		PDP (stage involved)		
	YES	NO	Start	Middle	End
5	0	5	4	4	5

Sources from which context of use is derived include, the agency that created the logo, the client and the end-user. Participant gathered data through interviews, both phone and one on one; the questionnaire was unscripted and the responses gathered were used to guide the production of the video.

### Specification of the use and organizational requirements

Number of Questions	Documentation		PDP (stage involved)		
	YES	NO	Start	Middle	End
7	0	7	3	1	1

The participant reported not having a specification of use and organisational requirements; however there was constant feedback from the end-user and the client's brand manager. "We come up with the concept we go to the client to give them a picture of the end product, then we come back to perfect it"; this was an iterative process that went on throughout the PDP with the users shown progress on the project and their feedback was incorporated into product development. However, the NPD team, the end-user, the agency that did the logo and client never met collectively to discuss the product being produced. Also, throughout this process there was no documentation these interactions between the NPD team and other stakeholders.

### Evaluation of designs against user requirements

Number of Questions	Documentation		PDP (stage involved)		
	YES	NO	Start	Middle	End
4	0	4	2	2	2

In addition to the NPD team evaluating the product, the client (brand manager) and the end-user were involved. Since user requirements were not scripted, the NPD team relied heavily on the guidance of the client towards the right product. The participant describes the brand manager (client) as "very strict when it comes to their

brand.” The client decided whether the product presented them was at par or relevant to their brand’s unveiling video expectations.

**Evaluation of designs against user requirements: User testing**

Number of Questions	Documentation		PDP (stage involved)		
	YES	NO	Start	Middle	End
7	1	6	1	1	2

The involvement of a proactive client (brand manager) and the end-user meant that the NPD team. The participant reported, “Didn’t have much problem identifying what we had to do for MVA.” The end-user was involved throughout the PDP; as a result it is assumed there was continuous testing. Since the NPD team didn't have a scale upon which the design could be tested, instead testing was more like an up or down decision. The final product was deemed a success since it was approved by the client.

**UCD practices’ incorporation onto the PDP**

It was important to investigate the relationship between UCD practices and the PDP; how UCD practices were applied on to the PDP. The difference in the UCD practices application in the PDP is relatively small; thus UCD application can be described as relatively similar throughout the PDP. However, data shows the use of UCD practices at the start of the project; see the pie chart on Figure 60.

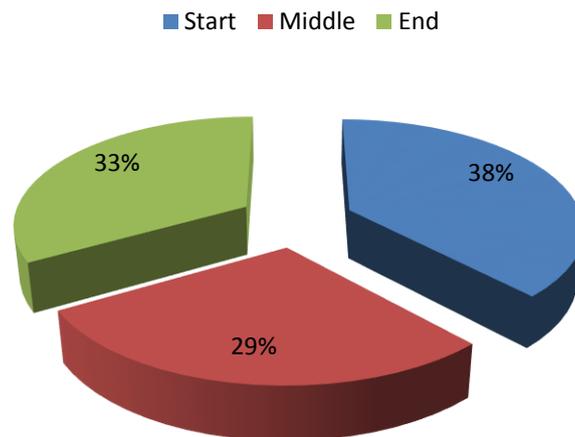


Figure 60: AD - PDP Stages and the associated UCD practices.

## Top ten UCD practices in AD case study (coding references)

Table 35 shows a closer look at the top 10 UCD practices performed by AD arranged to show which categories these activities belong to, see Appendix 12.6.1 for the original ©Nvivo generated graphic. ‘No.’ represents the order starting with the most coded (1) UCD activity to the least coded (10). Clearly there are more UCD practices at the “Planning the Human centred process” category; further the first and second rated UCD practices are also in this category.

**Table 35: Top 10 activities and the relevant category.**

Category	Activities	No.
<b>Planning the human-centered process</b>	The individuals and organization(s) responsible for UCD practices and the range of skills and viewpoints they provide.	1
	List human-centred activities carried out during the study.	2
	What are the procedures followed for integrating human-centred activities with other development activities.	5
	Are there procedures for establishing feedback and communication on UCD practices as they affect other design activities and methods for recording these activities?	6
<b>Specification of the context of use</b>	Where is the evidence of the provision of context of use information to the NPD team?	3
	How do you gather specifications on the range of intended users, tasks, equipment and environment?	8
	What are the sources from which the context of use is derived?	10
<b>Specification of the use and organizational requirements</b>	What were the CRITERIA against which the design can be tested?	4
	What is the range and relevance of users and other personnel in the design?	9
<b>Evaluation of designs against user requirements</b>		
<b>Evaluation of designs against user requirements: User testing</b>	Describe the measurements undertaken, the users and the methods used?	7



During the PDP, interaction with the client was mainly at the beginning and then diminishing towards the completion of the project. Moreover, there seems to be fewer rigors in finding out what the client actually wants from the project. The most important milestone seemed to be after the product has been delivered, “we only check those through the response of the client, what I mean by response of the client is that, if the client doesn’t come back for more business from you then you have to wonder. We only balance and check with the business that would come from the same client that we have given a product... only then we can check to see whether we are moving forward.” The thinking shows a company that is mostly worried about repeat business and does not bother to know why a client is not coming back for return business.

### Specification of the context of use

Number of Questions	Documentation		PDP (stage involved)		
	YES	NO	Start	Middle	End
5	5	0	5	3	3

The information necessary to understand the context of use was obtained from the client, “we would rather gather specifications from the client themselves.” The NPD team also relies on its expertise and the knowledge of the legal requirements. After consultation with the client, research is conducted and the findings passed on to the client for feedback. Also, Google earth was used to get an accurate aerial view of the area which helped to maximise the visibility of the billboard to traffic. Moreover, the participant asserts that in a way they “also use[d] Google earth to reach our customers.” After the contextual data was collected it was shared with the rest of the NPD team.

### Specification of the use and organizational requirements

Number of Questions	Documentation		PDP (stage involved)		
	YES	NO	Start	Middle	End
7	5	2	7	4	4

The participant thought the client’s contribution shouldn’t compromise the strength, the durability, safety and the orientation of the billboard with the only compromise being on the aesthetics. Early in the PDP the NPD team communicated and educated the client on the steps to be taken towards the final product. Furthermore,

the NPD team attempted to know as much as possible about the problem prior to starting the work.

“At the end of the day it’s up to the client”, what will be done or what won’t be done; at the beginning of the PDP designs have to be agreed and approved by the client and the NPD team. This particular project was designed to be interactive and to be seen first, “we just have to make sure it is going to be seen first”. The criteria for which the design was to be tested involved measuring “Distance from the centre of the road, size and height of the billboard”, provided by the city council. The manner in which the product is confirmed differs from client to client, “if it is advertising like big corporates will getting some signed paper to say we have agreed for you to execute this kind of thing, but if its other clients they will just tell you they agreed.”

### Evaluation of designs against user requirements

Number of Questions	Documentation		PDP (stage involved)		
	YES	NO	Start	Middle	End
4	3	1	2	0	2

The evaluation of the final design was based on the council guidelines, and this evaluation was done by both the NPD team and the municipality. The board size and the distance from the road were the primary requirements of the project; the secondary requirement involved achieving maximum visibility of the bill board.

### Evaluation of designs against user requirements: For user testing

Number of Questions	Documentation		PDP (stage involved)		
	YES	NO	Start	Middle	End
7	6	1	6	2	2

There was minimal user testing conducted during this project. After satisfying the council requirements and using Google Earth to orientate the bill board, the NPD team then made a judgement as to whether the billboard is correctly positioned to maximise the visibility. Furthermore, the area where the billboard is situated had to be better looking and the visibility of the billboard to the traffic flow was also essential to the usability of the billboard. The final design was deemed a success if advertising space is fully occupied.

## UCD practices' incorporation onto the PDP

In order to answer the question, when in the PDP the most UCD practices are performed? The researcher added UCD practices done at the start, middle and end parts of the PDP and the result was Figure 62. Clearly the start of the PDP is where the majority of the UCD practices are performed; therefore it can be considered the most important stage for VP. The activities were mostly at the 'Start' then followed the 'End' and then the 'Middle' stage; and this does not diminish towards the end as alluded to earlier in this analysis.

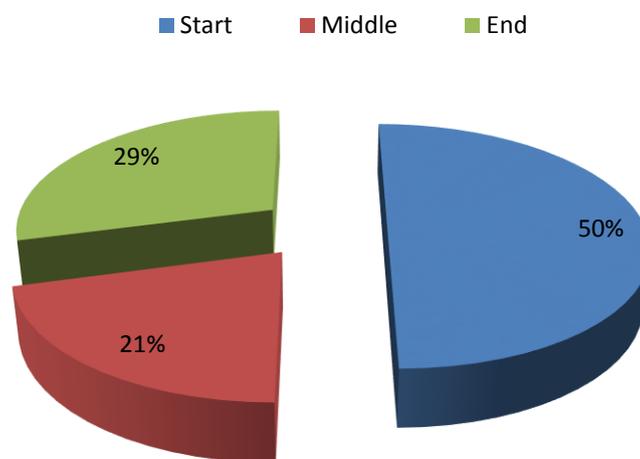


Figure 62: VP - PDP stages and associated UCD practices

## Number of coding references: Top ten UCD practices in VP case study

Table 36, shows the top 10 performed UCD practices placed within the respective categories, see Appendix 12.6.2, for the original ©Nvivo generated graphic. These are basically the questions that received the most answers from the participant, and represents emphasis or importance. 'No.' represents the order starting with the most coded UCD activity to the least coded.

Table 36: Top 10 activities and the relevant category.

Category	Activities	No.
<b>Planning the human-centered process</b>	The individuals and organization(s) responsible for UCD practices and the range of skills and viewpoints they provide.	1
	List human-centered activities carried out during the study.	10
	What are the procedures followed for integrating human-centered activities with other development activities.	8
	Are there procedures for establishing feedback and communication on UCD practices as they affect other design activities and methods for recording these activities?	2
<b>Specification of the context of use</b>	How do you gather specifications on the range of intended users, tasks, equipment and environment?	3
	Where is the evidence of conformation of context of use information?	7
	What are the sources from which the context of use is derived?	6
<b>Specification of the use and organizational requirements</b>	What were the CRITERIA against which the design can be tested?	4
	What is the range and relevance of users and other personnel in the design?	5
<b>Evaluation of designs against user requirements</b>		
<b>Evaluation of designs against user requirements: User testing</b>	What is the DEFINITION of the CONTEXT of use which was used as a basis for evaluation?	9

#### 8.4.1.3 PJ Project

**Name:** PJ

**Description:** Furniture design

**Project:** Kitchen cabinets

Figure 63, is a word map showing words that were most frequently repeated in the PJ case study. The word map provides an overview on what the participant said in this particular case study. Clearly, 'customer', 'project', 'product', 'process', 'ask' are the most mentioned words.



### Specification of the context of use

Number of Questions	Documentation		PDP (stage involved)		
	YES	NO	Start	Middle	End
5	2	3	2	0	0

The specification of context of use is derived from both the customer and the environment which the product to be used. The participant described the client “where they want all different things. Also, location of the wall sockets and the room layout has influence on how the project will be executed.” The wall sockets, doors and windows dictate where the kitchen appliances (stove, microwave, fridge etc.) are to be placed. The user is asked how they would like their product and where it should be. However, the consultation of the user is nothing that is planned; rather it is done when the designer feels they need clarification.

### Specification of the use and organizational requirements

Number of Questions	Documentation		PDP (stage involved)		
	YES	NO	Start	Middle	End
7	1	6	5	3	3

The specification of use and organisational requirements were derived from involving the user in producing or providing images of what they want. Moreover, the participant already had standardised dimensions of kitchen cabinets and sometimes the use of tape measures to show approximate heights to the customer. When asked for the statement for the UCD goals, the participant responded “we just work”. Furthermore, there does not seem to be continual learning of the industry standards and regulations; the interviewee’s response to the question was “we use the ones we know and if we do not know we just do it.”

### Evaluation of designs against user requirements

Number of Questions	Documentation		PDP (stage involved)		
	YES	NO	Start	Middle	End
4	0	4	0	0	2

The evaluation of the design against user requirements was not organised; product requirements were neither written down nor prioritised. Therefore, the little evaluation that is done during the PDP is not formalised. After the project is completed the NPDP

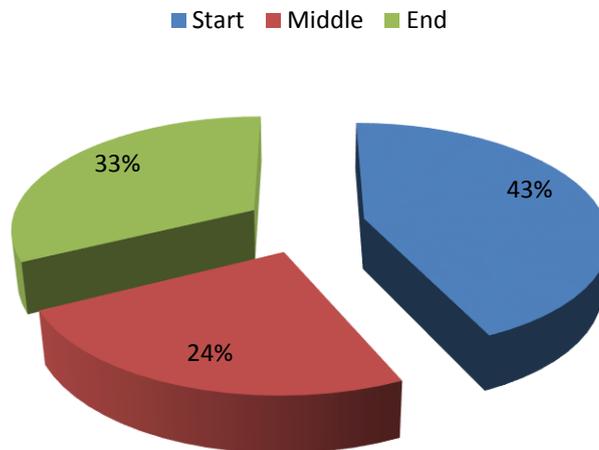
team evaluated the product at the workshop and then again after the product has been installed. The customer is then asked “is this what you requested?” if there are problems they had to be addressed after the project has been delivered.

**Evaluation of designs against user requirements: User testing**

Number of Questions	Documentation		PDP (stage involved)		
	YES	NO	Start	Middle	End
7	0	7	3	2	3

Both industry standards and customers’ opinion were used as guides to perform user testing. The customer was asked “to see whether everything is in place?” Additionally, whenever possible during the PDP, the customer was asked for suggestions or opinions. Since the product made it to the delivery stage it can be assumed it passed the prior stages. The company was happy with the outcome if the customer was happy with the final product. But it is important for the company to have its own evaluation requirements.

**UCD practices’ incorporation onto the PDP**



**Figure 64: PJ - PDP stages and the associated UCD practices.**

Figure 64 shows the three stages of the PDP (Start, Middle and End) and the relative UCD practices done at those stages. The results show the majority of the UCD practices done at the ‘Start’ stage of the PDP; followed by the ‘End’ stage and then the ‘Middle’ stage.

**Number of coding references: Top ten UCD practices in PJ case study**

Table 37 shows the top ten performed UCD practices, which received the most answers in all categories, see Appendix 12.6.3, for the original ©Nvivo generated graphic. ‘No.’ represents the most coded UCD practice to the least coded. The table shows a clear majority of performed UCD practices at the ‘Planning the human-centred process’ category and this includes the top four UCD practices. There were no UCD practices for the ‘Evaluation of designs against user requirements’ category.

**Table 37: Top ten performed UCD practices and the associated categories.**

Category	UCD practices	No.
<b>Planning the human-centered process</b>	The individuals and organization(s) responsible for UCD practices and the range of skills and viewpoints they provide. (6)	10
	List human-centered activities carried out during the study. (6)	3
	Did you have suitable timescales to allow feedback to be incorporated into the design schedule (including early stages)? (6)	4
	What are the procedures followed for integrating human-centered activities with other development activities. (6)	2
	Are there procedures for establishing feedback and communication on UCD practices as they affect other design activities and methods for recording these activities? (6)	1
<b>Specification of the context of use (ISO 9241-11:1998)</b>	Where is the evidence of the provision of context of use information to the NPD team? (7.2)	
	How do you gather specifications on the range of intended users, tasks, equipment and environment? (7.2)	5
	Where is the evidence of conformation of context of use information? (7.2)	
	What are the sources from which the context of use is derived? (7.2)	7
<b>Specification of the use and organizational requirements</b>		
	What is the range and relevance of users and other personnel in the design? (7.3)	6
<b>Evaluation of designs against user requirements</b>		
<b>Evaluation of designs against user requirements: User testing</b>	Describe the measurements undertaken, the users and the methods used? (7.5.74)	9
	What are METHODS and MEASURES used and rationale for their use? (7.5.7.1)	8



integrate UCD practices and other design activities; the whole process somehow just comes together.

This company presents a sketchy plan for the human-centred process; “within the first week of stage completion I have to be there to get feedback from the client... by the time the stage is complete the client would have already approved the next stage.” the process is iterative (built like stage gate) after each stage there was a go or no go decision to make. To obtain feedback the participant sat with the client at the project site and explains; what’s going on? What has to be done? And then go back to share with the NPD team. Both the customer and the end-user were consulted on what would be an ideal end product; their suggestions were incorporated in decision making. However, the participant explained that “clients are different thus we cannot follow the same route each time we have a project.”

**Specification of the context of use**

Number of Questions	Documentation		PDP (stage involved)		
	YES	NO	Start	Middle	End
5	4	1	5	3	3

The specification of context of use was tied to what will be going on inside the building. The specification of the context of use involved interviewing the client’s employees and if all is well “we can move ahead with the project.” However, these interviews were not planned adequately (unscripted) and not documented.

Images from the internet (i.e. dimensions and floor plans) were used to provide context and inspiration for the NPD team. For example, “I would rather go online and find out what’s the best environment for an IT person, (accountant, and stock exchange person) etc. In order to stay on track the NPD team kept close contact with the client and there was time allocated to incorporating the client’s feedback in the PDP (iterative process). This process was repeated until the customer was happy with the developments.

**Specification of the use and organizational requirements**

Number of Questions	Documentation		PDP (stage involved)		
	YES	NO	Start	Middle	End
7	2	5	4	4	4

Specification of use and organisational requirements were described as having to come from the client, as they are the ones who will be using the product and needed to be as comfortable as possible. As a result, when building the product we tried to make it “as user friendly as possible, so that occupants feel as if they are the ones who made it.”

During the PDP at the end of each stage the participant sat with the client and find out if they are happy with the progress or not. At the same time the client has to be aware of what is being proposed. For the NPD team to move from one stage of PDP to the next the client just needs to say yes, “if the client says yes, usually through an email... then we move forward.” The only PDP documentation done on the project was at the beginning, responding to the clients brief.

### **Evaluation of designs against user requirements**

Number of Questions	Documentation		PDP (stage involved)		
	YES	NO	Start	Middle	End
4	2	2	4	4	4

For evaluation of the design against user requirements, the work environment development was guided by the input from the user; the desks were customised for each worker. The NPD team investigated the behaviour of users in their context; they “start at the beginning by asking [our] selves when a person gets into the office what is their behaviour?” However, this process is not written down, thus the test procedure did not exist. “Obviously you get paid in stages; it called a ‘snag list’, the steps showing what you have achieved and what you haven’t achieved. If we both agree that we have achieved what was planned, then the payment is done without having to sign anything.”

After the delivery of the product, the NPD team went into every office and asked users if they were OK with the final product. The initial evaluation of the final product is done by the NPD team and the evaluation involves the client.

### **Evaluation of designs against user requirements: User testing**

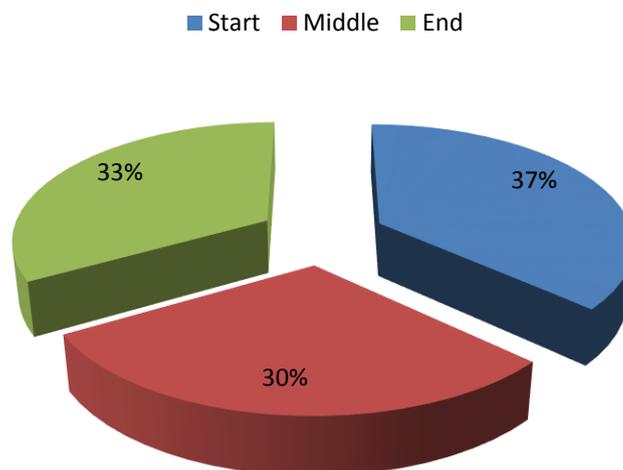
Number of Questions	Documentation		PDP (stage involved)		
	YES	NO	Start	Middle	End
7	3	4	4	2	4

The participant believed that for a product to be tested the PDP has to be complete and there has to be someone using it. Thus, after project implementation work was inspected and users were once again asked whether everything is in place. The user testing involved no method, as the interviewee explained, “You will find out that you have achieved the aim without writing one.” When setting the aim, the NPD team made sure they retained the flexibility to adjust as they learned more about the problem.

The process used to evaluate the final product involved the entire NPD team, the customer and then the user. Furthermore, the interviewee explained “You try not to make the end-user aware of what you are doing, but you know what you want to achieve.” Therefore, giving them just enough information and avoiding any confusion.

Since there were no requirements drafted at the beginning of the project, there was no criterion followed to evaluate the final product. This is emphasised by the participant saying the evaluation of the project is “more of a feel thing, you sit down over dinner if you are happy, I am happy.” The delivered product was deemed success, and the participant thought they delivered more than what was expected.

**UCD practices’ incorporation onto the PDP**



**Figure 66: MJ - PDP stages and associated UCD practices.**

Figure 66, shows the three stages of the PDP (Start, Middle and End) and the relative UCD practices done at each stage. The results show the majority of the UCD practices were at the ‘Start’ stage of the PDP; followed by the ‘End’ stage and

lastly the ‘Middle’ stage. However, the difference between the applications of UCD practices at stages of the PDP can be considered insignificant.

**Number of coding references: Top ten UCD practices in MJ case study**

Table 38, shows the top 10 performed UCD practices, which received the most answers in all categories, see Appendix 12.6.3 for the original ©Nvivo generated graphic. ‘No.’ represents the most coded UCD practice to the least coded. ‘No.’ represents the order starting with the most coded UCD practice to the least coded.

**Table 38: Top ten performed UCD practices and the associated categories.**

Category	Activities	No.
Planning the human-centered process	The individuals and organization(s) responsible for UCD practices and the range of skills and viewpoints they provide.	3
	List human-centred activities carried out during the study.	7
	Are there procedures for establishing feedback and communication on UCD practices as they affect other design activities and methods for recording these activities?	2
Specification of the context of use	Where is the evidence of the provision of context of use information to the NPD team?	10
	What are the sources from which the context of use is derived?	6
Specification of the use and organizational requirements	What were the CRITERIA against which the design can be tested?	1
	What is the STATEMENT for the UCD goals?	5
	What is the EVIDENCE of confirmation of the above by users and their representatives?	8
	What is the range and relevance of users and other personnel in the design?	4
Evaluation of designs against user requirements		
Evaluation of designs against user requirements: User testing	What are METHODS and MEASURES used and rationale for their use?	9

The table shows majority of performed UCD practices at the ‘Specification of the use and organizational requirements’ category, closely followed by ‘Planning the human-



Both companies failed to plan the UCD processes at the beginning of the PDP. AD failed to document activities under this category, while VP documented over half of the activities. However, AD was able to apply most of the activities across the PDP (start, middle and end) compared to VP that only managed to apply one activity across the PDP.

AD met with a lot of stakeholders and this includes periodically obtaining user-feedback and the agency that created the logo being revealed by AD's client. VP mainly involved the client at the beginning and at the end of the project; furthermore VP failed to follow up on unhappy clients to find out why they were not coming for more business.

### **Specification of the context of use**

The majority of the UCD processes in this category were carried out throughout the PDP by both companies. Moreover, information necessary to understand the context of use was obtained from the client but the procedure was not documented.

Again AD failed to document all of UCD processes within this category, while VP documented more than half of the activities. In addition to involving the client, VP followed the legal requirements and contextual data (Google Earth). However AD used more stakeholders (agency that created the logo, the client and end-user) to better understand the context of use.

### **Specification of the use and organizational requirements**

AD failed to produce specification of use and organisational requirements and VP only managed to gather the contextual specifications from the client at the beginning of the PDP. AD was fully guided by the client and the user; while VP guided and educated the user on the possibilities, and then allowed them to make decisions.

In both companies users helped make 'go or no-go' decisions at critical stages of the project. VP did most of the UCD processes mentioned in this category while AD failed to do the majority of them. Moreover, VP documented the majority of the UCD processes and AD failed to document the few activities completed.

### **Evaluation of designs against user requirements**

AD performed half of the UCD practices in this category while VP performed all activities under this category. However, for AD UCD practices that were performed were carried out throughout the PDP; while for VP, UCD practices were only performed at single stage of the PDP.

NPD teams from both companies evaluated the product prior to involving other stakeholders in the evaluation process. Moreover, the user was used by both companies to evaluate the final product. User and organisational requirements were not documented in both case studies and that left the client and / or user as the only means to product evaluation.

### **Evaluation of designs against user requirements: User Testing**

The VP case study shows minimal user testing, while AD involved client and user testing throughout the PDP. Additionally, AD failed to perform almost all UCD practices in this category whilst VP managed to perform all activities. Almost all activities done by VP were documented but the NPD team only managed to apply one activity throughout the three stages of the PDP.

Final evaluation for VP's final product was much more organised (for example, confirming adherence to regulations) compared to AD's final product where it was more like an up or down decision without a benchmark used to judge. Both participants believed the final product was a success, as they met client's expectations.

### **Documentation**

The documentation data of the project reveals the majority (59%) of the work that was done on this project was not documented for the GA industry. Figure 68 and Figure 69 show a breakdown of the documentation comparison of GA companies AD and PV.

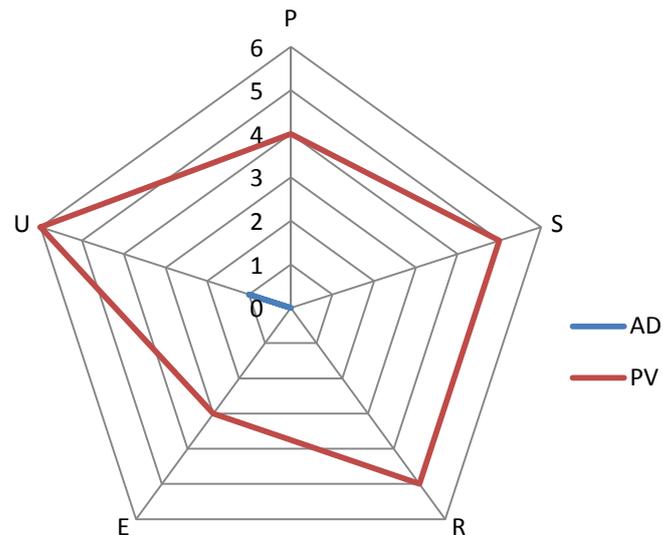


Figure 68: GA - YES Documentation.

Category description

- P = Planning the human centred process.
- S = Specification of the context of use.
- R = Specification of the use and organisational requirements.
- E = Evaluation of designs against user requirements.
- U = Evaluation of designs against user requirements: User testing.

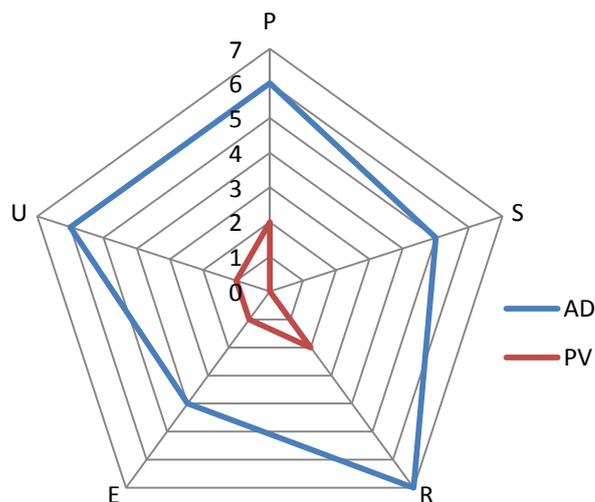
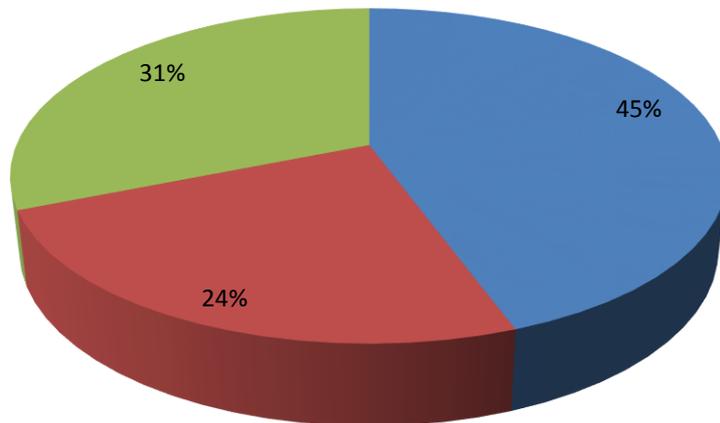


Figure 69: GA - NO Documentation.

The documentation by the two participating companies (AD and VP) from the GA had an inverse relationship. Figure 68 and Figure 69; show VP doing the majority of documenting, while AD documented the least. The average of these companies can be expected to cancel out and bring the resultant yes-documentation and no-documentation of GA curves much closer to each other.

**UCD practices’ incorporation onto the PDP**

■ PDP stage involved Start ■ PDP stage involved Middle ■ PDP stage involved End



**Figure 70: GA: PDP stages and associated UCD practices.**

Figure 70, shows the three stages of the PDP (Start, Middle and End) and the relative application of UCD practices at each stage. Results show the majority of the UCD practices in the GA industry were performed at the ‘Start’ stage of the PDP; followed by the ‘End’ stage and lastly the ‘Middle’ stage.

## Number of coding references: Top ten UCD practices in GA industry.

Table 39: Top ten common activities in the GA industry, and the relevant categories.

Category	Activities
<b>Planning the human-centered process</b>	The individuals and organization(s) responsible for UCD practices and the range of skills and viewpoints they provide.
	List human-centred activities carried out during the study.
	What are the procedures followed for integrating human-centered activities with other development activities.
	Are there procedures for establishing feedback and communication on UCD practices as they affect other design activities and methods for recording these activities?
<b>Specification of the context of use</b>	How do you gather specifications on the range of intended users, tasks, equipment and environment?
	What are the sources from which the context of use is derived?
<b>Specification of the use and organizational requirements</b>	What were the CRITERIA against which the design can be tested?
	What is the range and relevance of users and other personnel in the design?
<b>Evaluation of designs against user requirements</b>	
<b>Evaluation of designs against user requirements: User testing</b>	

Table 39, shows the 'Evaluation of designs against user requirements' and 'Evaluation of designs against user requirements: User testing' categories as the least important to the GA industry. There were no top 10 UCD practices in these categories common to both AD and VP. Clearly, the table show the most common UCD practices were in the 'Planning the human-centred process' category; thus making this category the most important to GA industry.



stakeholders are not planned; rather it is done whenever the NPD team feels it needs clarification. Moreover, the information collected is not documented.

MJ did a lot more documentation for this objective while PJ only did and documented two of the five activities. However, for PJ the room layout (wall sockets, windows, doors and wall sockets) also influenced the context of use. While images from the internet helped MJ to better understand context and as well inspire the team. “I would rather go online and find out what’s the best environment for an IT person, accountant, and stock exchange person etc.,” MJ.

### **Specification of the use and organizational requirements**

Both companies in the FI industry involved the user and the client in the PDP to guide product usability aspects and organisational requirements. The level of UCD activity documentation was done in a similar manner for both case studies. Also, these companies failed to prepare the statement for the UCD goals and had to rely on users or their representatives to confirm the product is what was envisioned at the inception of the project.

MJ tended to apply UCD practices to all phases of the PDP while PJ did not always apply activities to all phases of the PDP. Also, MJ’s PDP was more like a stage gate process, where in order for the NPD team to move from one stage to the next the client had to be happy with what was done.

### **Evaluation of designs against user requirements**

The process of evaluating user requirements was not documented nor organised in the FI industry. User feedback was important for evaluation in both companies; However MJ seems to involve the user more intensively compared to PJ. Thus the evaluation procedure was based on user feedback.

NPD teams from both companies evaluated the final product prior to leaving the workshop. Upon the delivery of the product the client is asked if the product is what they wanted. If there were problems with the product both companies were willing to address it.

MJ did all UCD practices under this category and each activity was done across all stages of the PDP. However, PJ did not do half of the UCD practices, the two that

were done were at the 'end' stage of the PDP. For MJ the process of evaluating the product produced a "snag list", showing what they have achieved and what needs to be done. However, PJ has no established process like this.

### **Evaluation of designs against user requirements: User testing**

PJ failed to document all UCD practices, while MJ documented almost half of the activities in this category. Users testing lacked structure since user requirements were not written down to guide the evaluation process. Therefore, users were simply asked if the final product is what they requested. In both case studies the NPD team continuously relied on the client / user to guide PDP and upon completion of the project the client was invited to test the product.

When setting the aim of the project MJ retained some flexibility, therefore enabling the NPD team to adjust as they learned more about the problem. Both companies were happy with the final product presented to the client.

### **Documentation**

The data gathered from the FI industry revealed that a majority (69%) of the UCD practices were not documented or not executed at all. Figure 72 and Figure 73 shows a detailed documentation of the involved FI industry case studies. It can be observed that MJ substantially documented more UCD practices than PJ; 'planning the human-centred processes was the only category that had equal documentation from both participating companies.

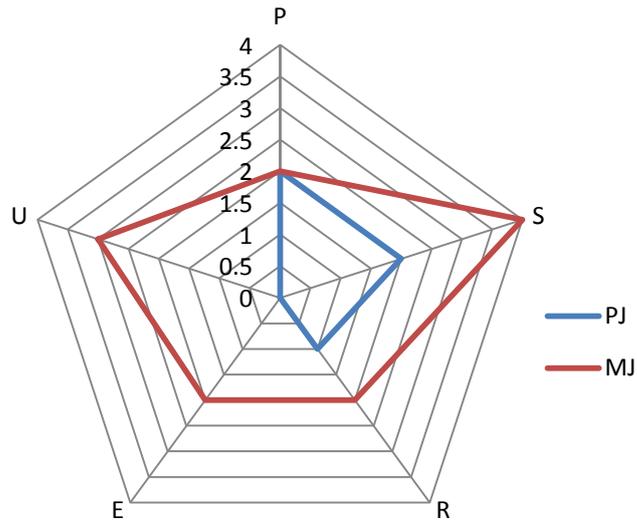


Figure 72: FI - YES Documentation.

### Categories

- P = Planning the human centred process.
- S = Specification of the context of use.
- R = Specification of the use and organisational requirements.
- E = Evaluation of designs against user requirements.
- U = Evaluation of designs against user requirements: User testing.

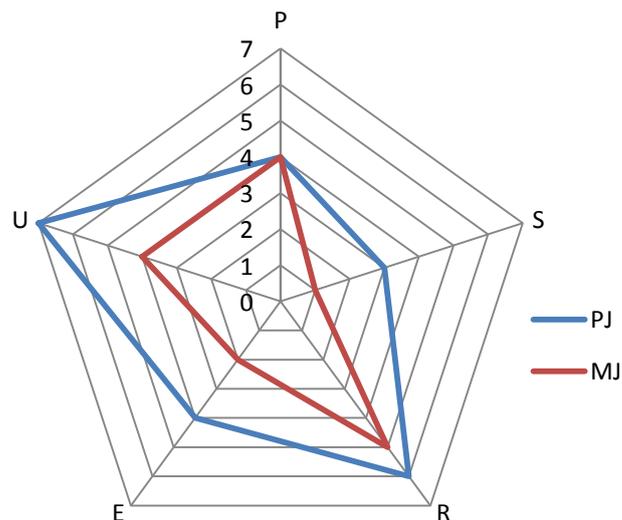


Figure 73: FI - NO Documentation.

Comparison of documentation at PJ and MJ also show an inverse relationship; but with less disparity compared to the GA industry comparison (AD and VP). Data show both companies failing to document the majority of the UCD practices performed, in some instances some activities were not done at all.

**UCD practices’ incorporation onto the PDP**

This industry also shows the majority of the UCD practices performed at the ‘start’ stage of the PDP, see Figure 74. The difference between the UCD practices at the ‘middle’ and ‘end’ stages of the PDP was negligible; thus it can be concluded that UCD practices are applied similarly at these stages.

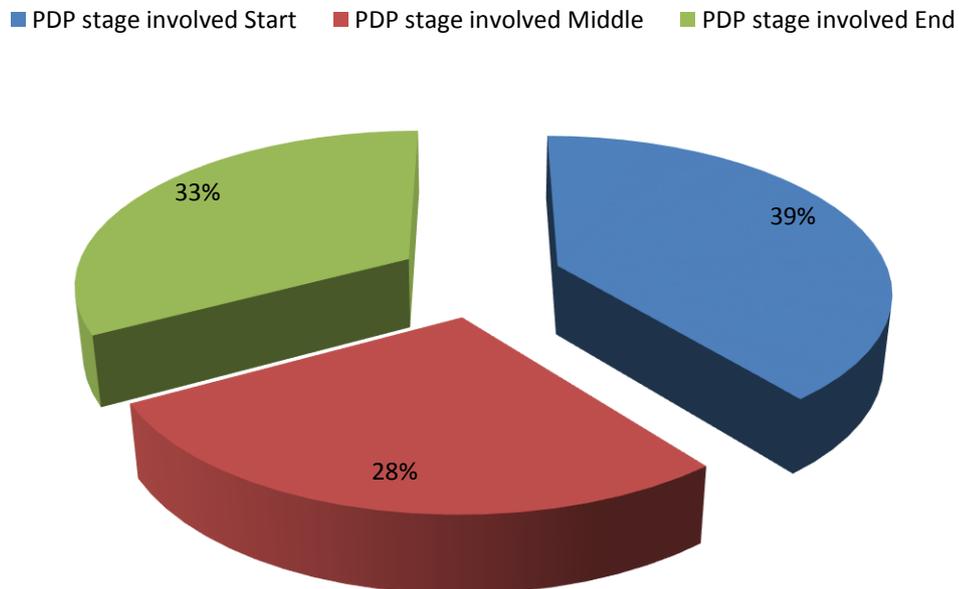


Figure 74: FI - PDP stages and the associated UCD practices.

The participating companies from the FI industry show much more similarities compared to GA. MJ’s incorporation of UCD practices in to the PDP was much more similarly applied across the three stages; compared to PJ where, the ‘Start’ stage is clearly most important.

## Top ten UCD practices in FI industry

Table 40 show the ‘Evaluation of designs against user requirements’ category as the least important to the FI industry case studies; there are no common top 10 UCD practices between MJ and PJ in this category. However, it is also clear that most of the common UCD practices are done at the ‘Planning the human-centred process’ category, followed by ‘Specification of the context of use (ISO 9241-11).’ Moreover, these two categories are at the ‘start’ stage of the PDP. The table shows a total of seven common UCD practices across four categories.

**Table 40: Top ten common activities in the FI industry, and the relevant categories.**

<b>Category</b>	<b>Activities</b>
<b>Planning the human-centered process</b>	The individuals and organization(s) responsible for UCD practices and the range of skills and viewpoints they provide.
	List human-centred activities carried out during the study.
	Are there procedures for establishing feedback and communication on UCD practices as they affect other design activities and methods for recording these activities?
<b>Specification of the context of use</b>	Where is the evidence of the provision of context of use information to the NPD team?
	What are the sources from which the context of use is derived?
<b>Specification of the use and organizational requirements</b>	What is the range and relevance of users and other personnel in the design?
<b>Evaluation of designs against user requirements</b>	
<b>Evaluation of designs against user requirements: User testing</b>	What are METHODS and MEASURES used and rationale for their use?

### 8.4.3 Graphic & Advertising and Furniture & Interior design Comparison

#### 8.4.3.1 Documentation

The results reveal that, the majority of the case studies failed to document the majority of the UCD practices. The table shows the majority (59%) of GA's UCD practices were not documented; while a greater majority (69%) of FI's UCD practices were not documented by the participating companies, see Figure 75. Both industries document the minority of the UCD processes, but GA's documentation was comparatively more than that of the FI.

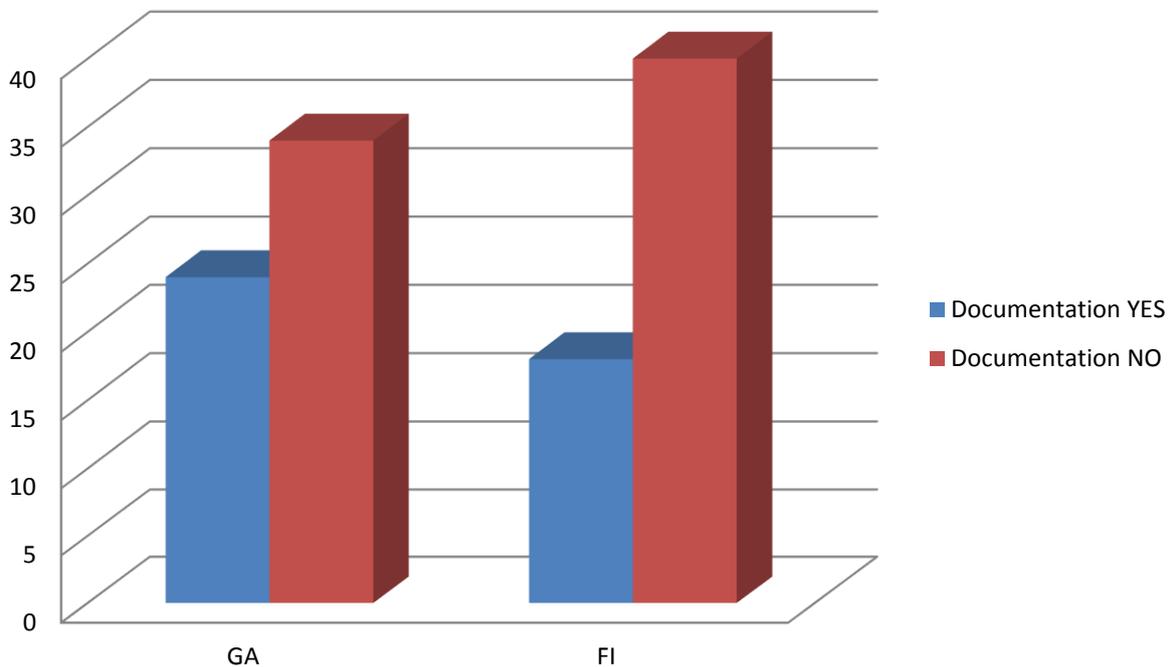


Figure 75: Documentation per industry.

Figure 76, shows the extent to which each category is documented in the GA industry. The most documentation was done at categories 'specification of the context of use' (S) and 'Evaluation of designs against user requirements: User testing: user testing' (U), where the YES-documentation and NO-documentation are equal. The majority of the categories were less documented.

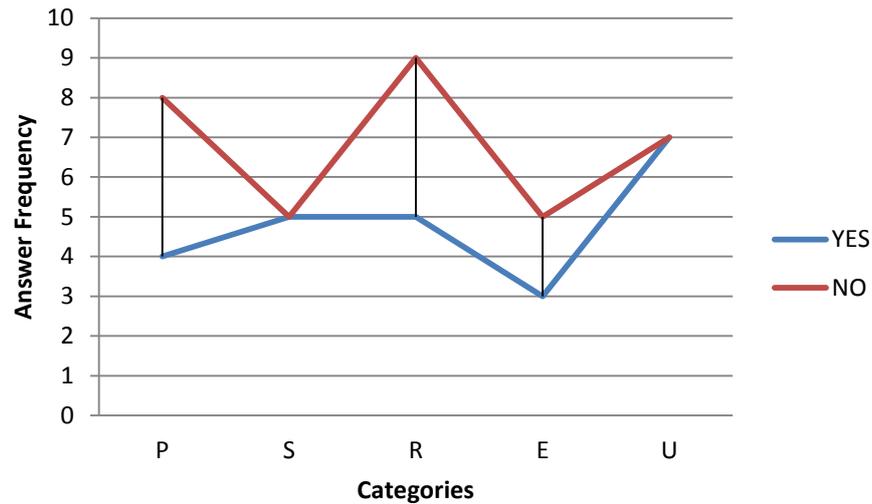


Figure 76: GA Documentation per category.

Categories

- P = Planning the human centred process.
- S = Specification of the context of use.
- R = Specification of the use and organisational requirements.
- E = Evaluation of designs against user requirements.
- U = Evaluation of designs against user requirements: User testing.

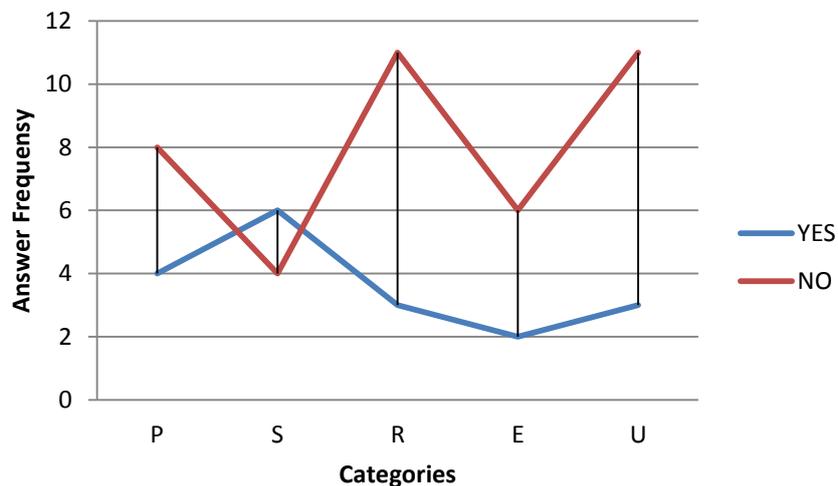


Figure 77: FI Documentation per category.

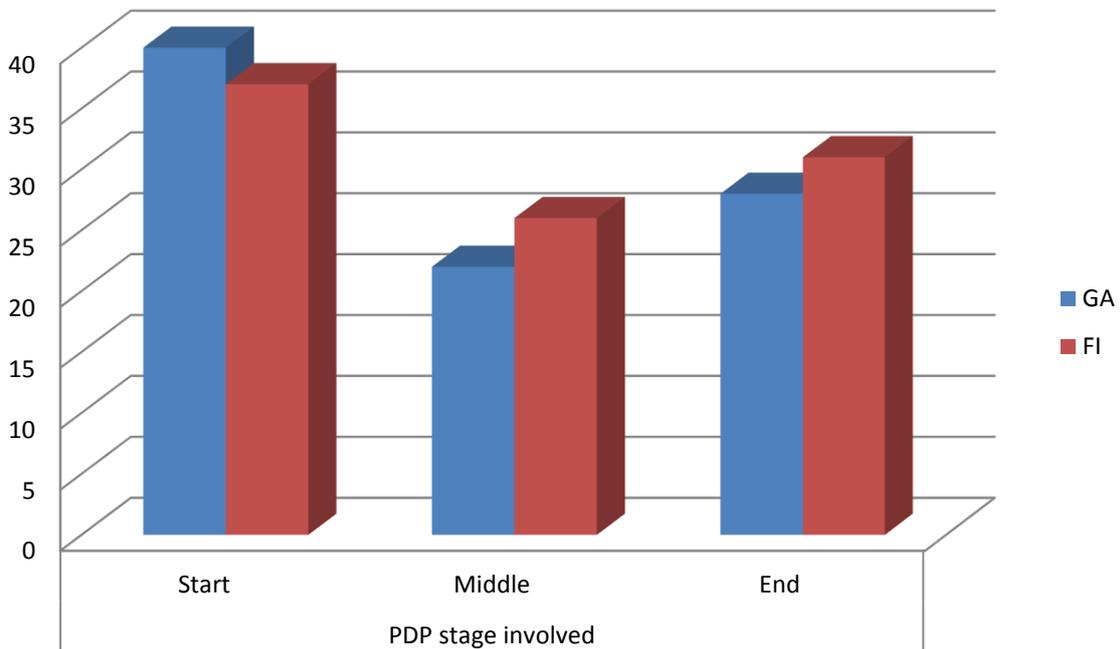
Figure 77, shows the extent to which each category is documented in the FI industry. Clearly 'specification of context of use' (S) was the most documented category in the FI industry; that is the only point at which the documentation curve is above the non-

documentation curve. The majority of categories/ UCD practices were also less documented.

FI industry seems to be doing much less documentation than the GA industry, the distance between the points on the YES and NO curves are more on the FI industry. Data from both industries show 'specification of context of use' (S) as the most documented (or most understood) category in this study. However, the majority of the UCD practices still remain less documented.

**8.4.3.2 UCD practices' incorporation onto the PDP**

Figure 78, shows the stages of the PDP (start, middle and End) and the extent of UCD practices associated with each stage from both industries. Clearly both industries show the same pattern, where most of the UCD practices were performed at the Start, followed by End and then Middle. However, the application of UCD practices on a PDP is more evenly distributed for the FI industry than GA industry.



**Figure 78: (GA and FI) PDP stages and associated UCD practices.**

### **8.4.3.3 UCD activity Categories**

Clearly case studies from companies in the FI industry have shown more similarities to how UCD practices are conducted as compared to the GA industry. This observation could be attributed to the similarities of the projects being investigated within the two industries. For the FI industry the two projects were; for MJ: design and fitting of an office space (partitioning and desks), while for PJ: was design and fitting of kitchen cabinets. However, the projects investigated for the GA industry had much less similarities; for PV: the design and installing of a (road side) billboard, and AD: the design of a brand revealing video.

#### **Planning the human-centred process**

Findings show all case studies failing to plan the human-centred process. As a result the NPD team had to depend on the satisfying nature of the PDP and user involvement to work on the problem at hand. MJ and PJ documented and followed UCD practices across the PDP in a similar manner. However, the documentation did not happen for the vast majority of the UCD practices.

Case studies show the user and contextual information influencing the approach to planning and implementation of the UCD. The level of user and context influence varied across the projects investigated; MJ and AD were primarily influenced by the client, while VP and PJ were mainly influenced by contextual data.

#### **Specification of the context of use**

The information collected points towards the client and other stakeholders being the source of better understanding of the context of product use. GA industry carried-out most of the UCD practices in this category throughout the PDP (start, middle and end). For the FI industry the specification of context of use was also derived from building itself and its use. PJ and AD did the least documentation in this category while VP and MJ did a lot more documentation.

VP, PJ and MJ obtained the bulk of their context of use information from the environment which the product will be used, i.e. window, door, wall sockets placement in the house or the road orientation at the billboard allocated space. In addition to the physical environment which the product will be used, MJ and VP used internet to better understand the product use environment. AD made use of more

stakeholders including an agency that created the logo and end-user to better understand the context of use.

### **Specification of the use and organizational requirements**

Data show the user involved in providing direction for the specification of use and organisational requirements in all case studies. Further, they also gave permission (a go ahead) at critical stages of the PDP.

### **Evaluation of designs against user requirements**

Naturally all participants reported evaluating the product prior to its delivery to the user. The user was then allowed to also evaluate the final product and offer suggestions; however, evaluations during the PDP varied between the case studies. Since user requirements were never written down at the beginning of the PDP, the user was essential to design evaluation against user requirements. MJ and VP did all UCD practices under this category while AD and PJ did about half; however only MJ performed all UCD practices across the three PDP stages.

### **Evaluation of designs against user requirements: User Testing**

In all case studies participants were happy with the final product and believed it was a success. The most common reason given for the success this evaluation was the client being happy with the final product.

#### **8.4.3.4 Number of coding references: Top ten UCD practices in all case studies**

Table 41 shows top ten UCD practices from the four investigated projects. The highlighted areas depict the common UCD practices to all case studies. When UCD practices for each case study were put together, it was clear that companies failed to do UCD practices in the “evaluation of designs against user requirements” category and this may be attributed to the failure to write down user requirements. However, it was clear that most of the UCD practices were performed at the ‘Planning the human-centred process’ category; also three of the five common UCD practices to all case studies were also in this category.

Table 41: Common top ten UCD practices to all case studies.

	AD	PV	PJ	MJ
<b>Planning the human-centred process</b>				
Are there procedures for establishing feedback and communication on UCD practices as they affect other design activities and methods for recording these activities?	6	2	1	2
The individuals and organization(s) responsible for UCD practices and the range of skills and viewpoints they provide.	1	1	10	3
List human-centred activities carried out during the study.	2	10	3	7
What are the procedures followed for integrating human-centred activities with other development activities.	5	8	2	
Did you have suitable timescales to allow feedback to be incorporated into the design schedule (including early stages)?			4	
<b>Specification of the context of use</b>				
What are the sources from which the context of use is derived?	10	6	7	6
Where is the evidence of the provision of context of use information to the NPD team?	3			10
How do you gather specifications on the range of intended users, tasks, equipment and environment?	8	3	5	
Where is the evidence of conformation of context of use information?		7		
<b>Specification of the use and organizational requirements</b>				
What were the CRITERIA against which the design can be tested?	4	4		1
What is the range and relevance of users and other personnel in the design?	9	5	6	4
What is the STATEMENT for the UCD goals?				5
What is the EVIDENCE of confirmation of the above by users and their representatives?				8
<b>Evaluation of designs against user requirements</b>				
<b>Evaluation of designs against user requirements: user testing</b>				
What are METHODS and MEASURES used and rationale for their use?			8	9
Describe the measurements undertaken, the users and the methods used?	7		9	
What is the DEFINITION of the CONTEXT of use which was used as a basis for evaluation?		9		

## 8.5 Chapter Discussion

The user and other stakeholders are important to understanding of the context of product use in both industries; furthermore the user and contextual information influenced the planning and implementation of the UCD. Moreover, user involvement provided direction for the specification of use and organizational requirements in all case studies.

The 'start' stage is the most important stage of the PDP and literature review concurs with this observation; further, study findings show the least user involvement at the 'middle' stage of the PDP. Having more UCD practices performed at the 'end' stage than the 'middle' was expected, as shown in previous studies. However, any faults with the product this late in the PDP will be costly (time and financially) since substantial investment would have been put on the product. Literature review points to an opportunity to do more UCD practices at the 'middle' stage to avert costly faults with the product at the 'end' stage.

The failure to document user expectations (requirements, specifications) might have left the NPD teams too reliant on the user for product evaluation and without their own independent evaluation mechanism. Also, the lack of documentation may have led to inconsistencies in the approach to projects within companies. This may have resulted in project delays as the NPD team and the user may not have had the same mental model of the problem. Therefore, without documentation, understanding the problem and the solution space within the NPD team may vary between team members.

Documentation and UCD practice distribution during the PDP were much more similar between MJ and PJ. Similarities to how MJ and PJ applied UCD practices and documentation can be attributed to the similarity in the investigated projects. Similarly, differences between PV and AD can be attributed to the nature the projects under investigation. Both industries show the most effort at the 'Start', followed 'End' and lastly 'Middle' stage. The number of coding references for each UCD practices helped shed light to where the NPD team put the most effort and planning the user-centred process was revealed to be the most important category.

The similarity of the FI industries investigated projects led to the PDP and UCD practices were applied and documented in a similar manner. However, for the GA

industry differences in the projects investigated meant PDP and UCD practices were not applied or documented in a similar manner.

## **8.6 Chapter Conclusion**

Investigating a recently completed project was a preferred data collection method as it made the whole exercise more predictable and reduced the time needed to collect data. By looking at the latest project, the researcher anticipated that participants would remember most aspects of how the PDP was conducted given the lack of documentation already observed.

The satisfying nature of the PDP makes it harder to effectively plan the UCD process. User involvement observed in these case studies can best be described as occurring naturally, and less organised. Furthermore, UCD practices are not built on top of a well-documented existing PDP structure. The majority of the UCD practices in all case studies were done at the 'start' stage of the PDP followed by the 'End' and the 'Middle' stages.

The lack of clearly documented user requirements at the beginning of the project resulted in the lack of justification to the appropriateness of the decisions. Instead of having user requirements for product evaluation, the participating companies depended on user approval for appropriateness. Documentation would have helped the user better appreciate the effort the NPD team put into a project and promoted design as a profession. Moreover, UCD is not about unlimited user involvement in the PDP, but rather about efficiency and professionalism in gathering relevant information and not about the number of times you communicate with the user. There has to be balance on the involvement of the user in the PDP; not every user has time to participate in NPD.

Some of the questions arising from this study include: What influences the project to be user or contextually focussed in planning the UCD? Is there a difference in the UCD activity application to tangible products and intangible products? Does the type of a project influence, UCD practice application?

### **8.6.1 What was learnt from this study**

Table 42 shows themes derived from the retrospective case studies. The themes were mostly used to compare results from the scoping study, survey and the

interviews and to validate if the data collected from previous studies was actually what was happening. After the gathered data was compared and merged, the study findings were compared to literature review for further analysis. The aim of these analyses was to identify what Botswana’s design industry did or did not do well.

**Table 42: Themes from retrospective case studies.**

<b>Themes from the retrospective case studies</b>
<p style="text-align: center;"><b><i>PDP/UCD documentation.</i></b></p> <p>The majority of participants failed to document the majority of UCD activities. 59% of the GA UCD activities were not documented; while a greater majority 69% of the FI UCD activities was not documented. Specification of context of use was the most documented category from both FI and GA.</p>
<p style="text-align: center;"><b><i>Planning the human-centered process.</i></b></p> <p>Data reveals all case studies failed to plan the human-centered process in these projects. Case studies revealed the user and contextual information influencing the approach to planning and implementation of the UCD. The level of user and context influence varied across the projects investigated.</p>
<p style="text-align: center;"><b><i>Evaluation of designs against user requirements.</i></b></p> <p>Naturally all case studies revealed companies evaluating the product prior to its delivery to the client and/or user. The client was then allowed to also evaluate the final product and offer suggestions. Since user requirements were never written down at the beginning of the projects, the client/ user were essential to evaluation of design against user requirements.</p> <p style="text-align: center;"><b><i>Evaluation of the designs against user requirements: user testing.</i></b></p> <p>In all case studies the companies were happy with the final product and believed it was a success. The most common reason given for this evaluation was the client being happy with the final product.</p>
<p style="text-align: center;"><b><i>Specification of context of use.</i></b></p> <p>Information collected points towards the client and other stakeholders being the source of better understanding of the context of product use. GA industry carried-out most of the UCD activities in this category across the PDP (start, middle and end). For the FI industry the specification of context of use was also derived from building itself and its use.</p> <p style="text-align: center;"><b><i>Specification of the use and organisational requirements.</i></b></p> <p>Data shows the user and/ or client involved in providing direction for the specification of use and organisational requirements in all case studies. Further, they also gave permission (a go ahead) at critical stages of the PDP.</p>
<p style="text-align: center;"><b><i>PDP and the associated UCD activities.</i></b></p> <p>Most of the UCD activities were performed at the Start of the PDP, followed by End and then Middle.</p>

CHAPTER NINE

# **DISCUSSION**

## 9 Discussion

The aim of this chapter was to consolidate data findings and then compare with the best practices to identify similarities and differences. The chapter leads to study contributions to knowledge.

### 9.1 Literature Summary

Increased competition between companies has led to the necessity to find balance between user needs and wants. It is essential to acquire product attributes from the user and ensure they are further translated into product specifications/ requirements. Early involvement of lead and typical users helps the NPD team make explicit innovation potential of the product under development. Communication between the user and the NPD team is important for team functionality and the PDP in general.

User-product interaction help in the selection process during the act of purchasing. Thus, the need to have the user represented in a NPD team and the use of product forms (models) as a means of communicating product ideas between the user and the NPD team. However, designers avoid excessive user participation because needs are usually more difficult and less profitable to satisfy compared to the user wants. Assessment of financial benefit (return) on investment (time) of a more complex UCD driven PDP is not easy. Furthermore, the inability of the user to articulate the required functionality and benefits of a proposed product made NPD more time consuming and expensive. It is important to understand that the user is not a designer; thus, the user's contributions have to be add-ons to an ongoing PDP.

At BoP, design has to be connected to a broader context, political systems, economic models and cultural situations in order to be effective. To measure usability and functionality, product evaluation has to be done with an aid of performance requirements. Governments, industries and individual companies must have some kind of product standard rules to regulate industries and protect the user. Even though Botswana has product standard rules administered by Botswana Bureau of Standards (BoBS), there is still a lack of Design Policy to guide product development.

### **9.1.1 Botswana**

In an effort towards economy diversification Botswana government has come-up with the following initiatives; Botswana Development Corporation (BDC) and Citizen Entrepreneurial Development Agency (CEDA) invests on new and existing companies on behalf of the government. CEDA provides financial and technical support to promote viable and sustainable citizen owned business enterprises. Local Enterprise Agency (LEA) was formed to nurture more opportunities for private sector and wealth creation; it provides development and support services to the local industry needs of SME's. In addition, part of LEA's strategy requires businesses to use readily available raw materials; which on its own provides a niche for the companies involved. There has also been an establishment of the Botswana Innovation Hub (BIH) provides a suitable infrastructure and support the incubation facility for high-tech start-up companies. Objectives of BIH do not include design as one of the promoted professions; however design stakeholders can find creative ways to be involved.

Sub-Saharan Africa's economy is expected to grow better than the world average and it provides a potential market for Botswana produced products. A regional body like Southern African Customs Union (SACU) has a mandate to facilitate free flow of goods between the member states (South Africa, Lesotho, Swaziland, Namibia and Botswana and provides a bigger market (61 million people) for Botswana produced products. Design application for the BoP means targeting the majority of the global population in both developing and developed nations; more than 4 billion people living on incomes less than \$3260 a year.

Literature points to previous attempts to modernise manufacturing at the BoP failed due to imposing westernised industrial models based on mechanisation of processes and homogenisation of products, Chang (2009). Stakeholders at the BoP had to be involved early in the NPD for the project to be sustainable and for the shareholders to take full ownership of the product. This observation created the need for this study to improve what is done well by industry and replacing what was not done well with the best global practices from the literature review. Keeping what was done well was meant to provide some familiarity with the new proposed UCD practices for Botswana's design industry.

Hofstede's power distance index shows a high probability of high power structure in countries like Botswana. Top down high pyramid power structure meant most of the design decisions were done by a person at the top and failed to involve an entire NPD team in the decision making. The decision not to involve an entire NPD team in the decision-making may negatively affect NPD team's project ownership, commitment to the project and result in a less desirable product for the user.

## 9.2 Methodology Summary

The grounded theory approach was a good fit for this study as it provided the flexibility to respond to data as it was being collected. Every subsequent data collection was based on the analysis of the previous data and the study objectives (see Figure 79).

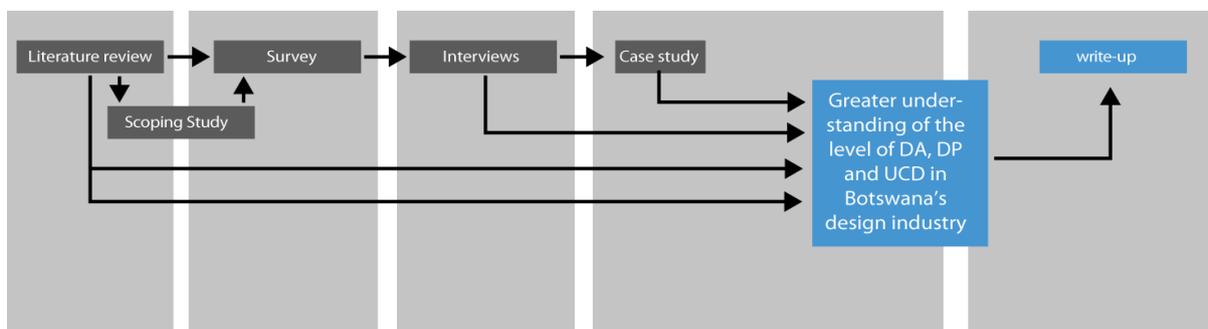


Figure 79: Final Methodology.

Travel to and around Botswana was very costly and time consuming so the researcher had limited time in each location for data collection. The use of snowball technique to identify participants was due to the lack of a reliable industry listing database. With extra time more companies would have been identified.

The aim of this study was to identify the positives in how Design Awareness (DA), Design Practice (PD) and User-centred design (UCD) are applied in Botswana's industry; and then use best global practices to optimise what is already being done. The majority of designers were found in furniture, interior design, graphic design and advertising industries. The other design professionals that participated in this study were graphic and interior designers.

The basic design cycle (Figure 15) had to be simplified for this study to have a common PDP for all participating companies and the data collection methods. This

was important as it allowed comparison of data from different companies; also it was essential for participants without design education to understand.

Important findings were identified and compared to the literature review chapter for similarities and differences. Global best practices replaced data findings that were contradictory or non-existent. This led to a guide for evaluating the case studies and future follow-up studies. This way NPD teams can better relate to the proposed modified processes since it is not entirely new.

### **9.3 Data collection method association with each objective**

Table 43, is the basis of analysing to what extent the different objectives have been satisfied by the different data collection methods, i.e. scoping study, survey, interviews and case studies. For example, Objective 1 and 3 were investigated by all data collection methods utilised in this study. Objective 2 was covered by all methods except the scoping study; while objective 4 was only covered by the scoping study.

The overlaps in the responses given from the data collected by different methods prompted the merging of objective 2 and objective 3; into a single objective (2 and 3) "Understanding of UCD and training needs.

Since all data collection questions were associated with an objective; it was easier to connect questions to each objective, followed by identifying answers to each question. Responses within each objective were all summarised into a single statement representing a response to the objective. Similar questions were put in the same row for easier analysis.

Table 43: Study objectives and the correlating data collection methods.

Objectives		Data Collection Methods			
		Scoping study	Survey	Interviews	Case Studies
Objective 1: <i>Determine the level of design awareness in Botswana's companies.</i>		✓	✓	✓	✓
Objective 2: <i>Ascertain current understanding of UCD.</i>	<i>Understanding of UCD and training needs.</i>		✓	✓	✓
Objective 3: <i>Explore the training needs of companies in Botswana in relation to UCD.</i>		✓	✓	✓	✓
Objective 4: <i>Explore the teaching of UCD in industrial design training institutions in Botswana.</i>		✓			

### 9.3.1 Objective 1: Determine the level of design awareness in Botswana's companies

Table 44, shows the definitions of design given from the interview study include the following phrases, process/ planning, user-friendliness and product aesthetics. The vast majority of the participants viewed design as a process and/ or an act of planning. However a higher percentage of GA industry participants thought process/ planning is the most integral part of the definition of design. Additionally, design definitions from the scoping study revealed the following keywords; innovative, usable, (improve people's lives), (satisfying a need).

**Table 44: The level of design awareness in Botswana's design industry: Objective 1.**

Scoping Study	Survey	Interviews	Case Studies
<u>What is design?</u> Satisfying a user need by providing an innovative product that improves people's lives. Key words include, innovative, usable, (improve people's lives), (satisfying a need)		<u>What is your definition of design, designer and designing?</u> The definitions included the following phrases, process/ planning, user-friendliness and product aesthetics. The vast majority of the participants viewed design as a process and/ or an act of planning.	
<u>What are advantages and added value of design?</u> Meeting clients' expectations through product and/ or process improvement. Themes include, (meeting client expectations), (systematic way of doing things), (process and product improvement), (appropriate solutions)	<u>What is the importance of design in a PDP?</u> A large majority of the participants in this study responded to this question and the responses were further clustered into two groups; meeting customer needs (26/41) and help do the jobs right (15/41).	<u>What is an added value of design?</u> Both industries rated usability and process high in the added value of design to NPD processes. For the FI industry usability was at the top followed by process; while for the GA industry process was at the top followed by product aesthetics.	
	<u>Rate the importance of the following people to the product development process. (investors, suppliers, employees and users)</u> The majority agree that all stakeholders (investors, suppliers, employees and the user) are equally important to PDP. However the results failed to show a clear hierarchy (the most important to the least important stakeholder) that the researcher was aiming for.	<u>Rank the following stakeholders in terms of importance to PD, (investor, supplier, user and employees).</u> Participants reported the user as the most important stakeholder in both industries; however, investors, employees and investors can be considered equally important. The user is significantly important to the GA industry compared to FI industry. Suppliers are much more important to the FI than to GA.	
<u>To what extent are companies using the right people?</u> Companies have few qualified design personnel and in-house trained staff. In most Design in these companies is not led by people with design background; therefore design only applied at low levels of a company.	<u>Does your company employ qualified designers for design related work?</u> The results show the majority of participants (73%) reporting employing services of a qualified designer: (63% of the designers were in-house, 11% external designers and the rest utilised both in-house and external designers.	<u>How many employees have been through a design school?</u> Varied per company (number was given per company). Participants reported a small number or no employees having been through a design school. The numbers of design trained employees range from 0 – 5.	
<u>At which stage of product development is design used?</u> Scoping interviews revealed that the user is mainly involved at the beginning of the PDP and then randomly afterwards.	<u>How important is design at the following stages of the PDP?</u> The findings show the vast majority of participants viewed design as important to all stages of the product development processes. However the results do not present a clear distinction between the different stages.		
<u>How professionally does the company organise the design process?</u> The use of design processes for most of these companies is project specific and do not use any company approved process as a base for approaching different projects.	<u>Does your company document the PDP?</u> 60% of the participants reported documenting the PDP, 35% reported not documenting the PDP and the remaining 5% were not sure whether their companies documented the PDP.	<u>How is your product development "process" documented?</u> The majority of participants interviewed reported not documenting the PDP. However, the majority of participants reported documenting the product its self; product attributes (dimensions, materials, tools used) and customer needs/ wants. They failed to document the knowledge, the process behind the product.	<b>PDP/UCD documentation.</b> The majority of participants failed to document the majority of UCD activities. 59% of the GA UCD activities were not documented; while a greater majority 69% of the FI UCD activities were not documented. Specification of context of use was the most documented category from both FI and GA.
<u>How do you measure the design effectiveness?</u> Themes include: (More contracts and repeat orders), (User appreciation), (Field testing) and (Feedback from non-design staff within the company)		<u>How do you measure the design effectiveness?</u> Participants reported "user reaction" as the most important measure of design effectiveness. The second most important measure of product success was "checking the final product against the objectives" for FI industry; and "product sales" for GA.	
	<u>Please list different ways you use to measure product's success.</u> Participants listed; happy client/customer (16/45), product reviews (18/45) and sales/profit (22/45). Response distribution between the three groups was relatively the same.	<u>Which one of the following measures of product success is the most important? (product reviews, sales/ profit and a happy client)</u> Clearly a happy client is the most important measure of product success. Product reviews and sales/ profit can be considered equally important to determining the design effectiveness	
	<u>How is ease of product use measured during and after the PDP?</u> Ease of product use is mostly measured during the PDP; designer-product interaction and user-product interaction. After PDP; after sale follow-up.		
	<u>How do you plan to improve the design of your products over the next few years?</u> The responses were clustered in to four groups namely; research (14/47), technology (17/47), acquiring qualified designers (16/47) and product development process (8/47).		

The majority of participants from the survey study thought design was important to the PDP. The reasons given were that design helps, meet customer need and do the job right. Furthermore, a good majority of the participants reported employing the services of qualified designers for design related work; with the majority having in-house designers and the minority having external designers. Participants reporting not having qualified designers saw their trades as sufficient for the needed design work and a small number could not afford a designer.

The vast majority of survey participants also viewed design as important to all stages of the product development processes; stakeholders (investors, suppliers, employees and the user) are considered equally important to PDP. However, the majority of participants interviewed reported not documenting the PDP. Furthermore, the majority of participants in the case studies also reported not documenting the majority of the UCD activities. The most documentation was done during the specification of the context of use in both case studies. Most of the documentation involved the product its self; product attributes (dimensions, materials, tools used) and customer needs/ wants.

Survey study points towards ease of product use as mainly measured during the PDP, moreover the amount of user testing done at the 'start' and 'end' stage PDP was equally important to the participating companies. Responses from the interview study show both industries rating usability and process/ planning high in the added value of design to PDP. For the FI industry usability was at the top followed by process /planning; while for the GA industry process/ planning was at the top followed by product aesthetics.

The measure of product success has been shown by the survey data to equally involve a happy client/customer, product reviews and sales/profit. However, the interview data show both industries (GA and FI) seeing the user reaction as the most important measure of design effectiveness. Furthermore, the second most important measure of product success for the FI industry was "checking the final product against the objectives"; while for the GA industry it was product sales. In support of the user-reaction being the most important measure of design effectiveness participants from both industries FI and GA consider a happy client as most important measure of product success.

Survey results show companies planning to improve the design of their products in the near future by; doing more research, the use of latest technologies, acquiring qualified designers and improving PDP.

### **9.3.2 Objective (2 and 3): Understanding of UCD and training needs.**

The scoping study interviews revealed that two thirds of participants did little or no market research; instead, they relied on word of mouth for marketing and publicity. The survey results show participants doing some kind of market research; however most of the research seemed to be ad hoc and not organized. Majority of participants from both industries (GA and FI) revealed monitoring of trends and competition as the most used market research method for both industries, see Table 45. Targeting potential individual clients was also significantly important to GA industry than in the FI industry. However, almost all follow-up interview participants reported the lack of market research departments in their companies. Market research was important as it shows willingness of a company to know more about the user or customer; therefore more likely to incorporate UCD activities to the PDP. Two thirds of the participants in the pilot interviews had Botswana government as a major client.

The majority of survey participants agree that incorporating the user into the PDP was important and that the user can effectively share ideas with a PDP. Results from the interviews show the majority of participants willing to incorporate UCD activities onto their PDP and strongly believe these activities are essential for structuring business/ design practices. The vast majority from the interviewed groups (FI and GA) made their first choice involving the user at the start of the PDP. All participants from the FI industry reported the criticality of involving the user at the start of the PDP. Moreover, the cumulative view at the responses also show user involvement at the 'start' of the PDP was also important; however 'middle 'and 'end' stages of the PDP were more or less similarly viewed. GA industry carried-out most of the UCD activities in this objective throughout the PDP (start, middle and end). For the FI industry the specification of context of use was also derived from building itself and its use. Two thirds of the scoping study (interviews) participants indicated that the management encouraged interaction with the user/ client. All participants stated the importance of involving the user at the beginning of the design process.

Table 45: Understanding UCD and training needs of the design industry: Objective (2 and 3)

Scoping Study	Survey	Interviews	Case Studies
	<p><b>Are there efforts to go beyond the purchaser and get in-touch with the end-user?</b></p> <p>The majority (56%) of participants reported going beyond the purchaser and getting in touch with the end user to obtaining user-needs and educate the end-user. However, participants that failed to go beyond the purchaser thought; customer is the user and (customer and industry standards provided sufficient information).</p>		<p><b>Planning the human-centred process.</b></p> <p>Data reveals all case studies failed to plan the human-centred process in these projects. Case studies revealed the user and contextual information influencing the approach to planning and implementation of the UCD. The level of user and context influence varied across the projects investigated.</p>
	<p><b>Do you think the user can effectively share ideas with the NPDT?</b></p> <p>Participants believe the user can effectively share ideas with PDT.</p>	<p><b>How can the user/ customer best share ideas?</b></p> <p>Based on the first choice participants believe talking is the most effective mode of communication and drawings were the second choice. When we look at the results from the cumulative ranking calculations, both industries show all three modes of communication relatively equally effective in sharing ideas.</p> <p><b>What is the best way to incorporating user's ideas into design decision-making?</b></p> <p>Both industries participants agree that consultation with the user is essential to incorporating user input onto design decision-making. Participants from the FI industry also thought education of the user was important while a small number from the GA industry also mentioned the discussion of user needs.</p>	
<p><b>Does the company do the market research?</b></p> <p>The majority of companies (2/3) did little or no market research; instead, they relied on word of mouth for marketing and publicity.</p>	<p><b>Does your company undertake market research?</b></p> <p>The majority of participants reported doing some kind of market research.</p>	<p><b>How is your market research conducted?</b></p> <p>Almost all participants reported the lack of market research departments in their companies. However, some of the participants reported doing some market research related activities which can be described as mostly less organized and hardly documented. Participants from both industries revealed monitoring trends and competition as the most used market research method. Targeting of potential clients was also significantly important to GA industry than in the FI industry.</p>	
<p><b>Who are the most important stakeholders?</b></p> <p>Two thirds of the interviewed companies have Botswana government as a major stakeholder.</p>	<p><b>How important is incorporating the user into the PDP?</b></p> <p>Almost all participants recognize the importance of incorporating the user in the PDP.</p>	<p><b>What do you think are the implications of incorporating user on creativity and/ or innovation of NPD teams?</b></p> <p>A large majority of participants from the GA industry thought user involvement would help the creativity/ innovation of NPD teams. However, participants from the FI industry were equally divided over whether user involvement helps or hinders creativity/ innovation in NPD teams.</p>	
<p><b>How is UCD success measured?</b></p> <p>The majority (two thirds) of companies measured the effectiveness of UCD at the end of the PDP (site visits and field tests). Other means of measuring UCD success included, repeat jobs and more contracts.</p>		<p><b>At which stage of the product development cycle do you measure product usability?</b></p> <p>Majority of the participants from both industries measure product usability at the start of the PDP. More observations show GA industry measuring product usability substantially higher than the FI industry at the end of the PDP.</p>	
<p><b>How are user needs obtained?</b></p> <p>Methods used to collect data included questionnaires, interviews, baseline survey and site visits. The data collected included ergonomic, finish (colour, material etc.), functionality and usability.</p>	<p><b>How does your PDT know what the user wants in a product?</b></p> <p>A large majority thought consultation was important to knowing what the user wants and a few thought the designer knows what the user wants.</p> <p><b>How does your PDT know what the customer wants in a product?</b></p> <p>A large majority thought consultation was important to knowing what the user wants and a few thought the designer knows what the user wants.</p> <p><b>How do you know what product to develop?</b></p> <p>The responses to this question show a clear majority 94% of the participants having their products developed through product commission. While the rest had batch production where the same product is made in large quantities for organisations.</p>	<p><b>Do you do any of the following UCD activities?</b></p> <p>The responses to the activities showed a lot of similarities between FI and GA industries in terms of types of activities being performed and at which specific stages.</p>	<p><b>Specification of context of use.</b></p> <p>Information collected points towards the client and other stakeholders being the source of better understanding of the context of product use. GA industry carried-out most of the UCD activities in this category across the PDP (start, middle and end). For the FI industry the specification of context of use was also derived from building itself and its use.</p> <p><b>Specification of the use and organisational requirements.</b></p> <p>Data shows the user and/ or client involved in providing direction for the specification of use and organisational requirements in all case studies. Further, they also gave permission (a go ahead) at critical stages of the PDP.</p>

Cont. Table 45...

Scoping Study	Survey	Interviews	Case Studies
<p><b>When in the product development process is the user involved?</b> The user is mainly involved at the beginning of the product development process and randomly afterwards.</p>	<p><b>Rate the importance of involving the user at different stages of the PDP.</b> The majority of participants thought the user is important at all stages of the PDP.</p> <p><b>Do you get your customers involved in the product development process?</b> A large majority reported involving the user (beginning and end) while the rest thought standards and anthropometry data as sufficient.</p>	<p><b>When is it most crucial to involve the user in the PDP?</b> A large majority made their first choice to involve the user at the start of the PDP; moreover all participants from the FI industry reported the criticality of involving the user at the start of the PDP. Cumulative responses show involving the user at the 'start' of the PDP was also important; however 'mid' and 'end' were more or less viewed similarly by both industries.</p> <p><b>Are you willing to incorporate UCD activities to PDP?</b> Results show an overwhelming majority of participants willing to incorporate UCD activities onto their PDP and strongly believe these activities are essential for structuring business/ design practices.</p>	<p><b>PDP and the associated UCD activities.</b> Most of the UCD activities were performed at the Start of the PDP, followed by End and then Middle.</p>
<p><b>Is UCD part of the training given to employees?</b> The majority of participants indicated that the management encouraged interaction with the client</p> <p><b>Are there links with training institutions?</b> Besides offering students internships, participants reported not having ties with training or institutions; apart from.</p>	<p><b>Does your company have links with training and/ or educational institutions?</b> About half of participants reported not having links with educational institutions. Participants viewed educational institutions as not offering the needed skill for their individual needs. Others thought their small size hindered having increased commitments; while others were not aware they could have links with educational institutions. The other half provided internship positions for the students; bringing fresh ideas and providing additional staff as well as learning from each other.</p>	<p><b>Besides, offering internships what type of a relationship would your company like to have with educational institutions?</b> The majority of the participants reported educational institutions having more to learn from industry. The suggested relationships were clustered into two groups; Learning from Universities and Learning from Industry.</p>	
		<p><b>Are you aware of the standards ISO 18529 (Human-centred design processes and practices) and ISO 13407 (User-centred design cycle)?</b> Almost all participants from both industries were not aware of the UCD ISO standards. A large number of participants showed interest in learning more about these standards, including all participants from the FI industry.</p>	

The information collected points shows the user and other stakeholders as primary sources to better understanding of the context of product use. Moreover, data shows the user and / or client involved in providing direction for the specification of use and organisational requirements in all case studies. Contextual information also influences the approach to planning and implementation of the UCD. However this information is not written down.

Two thirds of participants from the scoping study measured the effectiveness of UCD at the end of the PDP; with the key words being “site visits” and “field tests”. The means for measuring UCD effectiveness included, repeat jobs and more contracts. Results from the interviews also show majority of the participants measuring product usability at the start of the PDP. Moreover, GA industry measured product usability substantially more than the FI industry at the end of the PDP. Additionally, the case studies revealed evaluation just prior to product delivery.

The findings show the vast majority of participants from the GA industry thought user involvement will help the creativity/ innovation of NPD teams; however participants from the FI industry were equally divided on whether user involvement helps or hinders creativity/ innovation in NPD teams. Most of the UCD activities were performed at the Start, followed by End and then Middle; however, a large majority of the participants believe it is important to involve the user at all stages of the PDP.

Overwhelming majority of the respondents reported involving the client in the PDP. They are mostly involved at the beginning and at the end of the PDP; to basically get the client’s needs and to validate the final product. 56% of the surveyed participants made an effort to go beyond the client to get in-touch with the end-user to obtain user-needs and to also educate the end-user. The rest of the participants failed to go after the end-user because the customer is the end-user and that the customer/ industry standards gave sufficient information.

Responses from the survey (39/46) show client/customer consultation important for the NPD team to know what the user wants in a product. Similarly, first choices clearly show participant’s belief in talking/ consultation as the most effective mode of communication, while drawings/images were the second choice. Cumulative ranking calculations show talking and drawing as equally effective. Additionally, participants from the FI industry also thought education of the user was important to

incorporating user needs into design decision making. A small number of participants from the GA industry also mentioned the discussion of user needs with the participants.

Data reveals all case study companies failed to plan the human-centred process in these projects. Naturally all case studies revealed companies evaluating the product prior to its delivery to the client and / or user. Next, the client was then allowed to also evaluate the final product and offer suggestions. Since user requirements were never written down at the beginning of the projects, the client / user were essential to evaluation of design against user requirements. Thus the reason given for product success was the client being happy with the final product.

The scoping study reveals two thirds of participants reporting not having any other ties with training institutions; besides offering students internships. Additionally, the survey results show a slight majority, 52% participants reported not having links with educational institutions. Overall, the majority of survey and interview participants reported educational institutions not offering the needed skills and having more to learn from industry.

Almost all participants were not aware of the ISO 13407 standard for human-centred processes. A large number of participants showed interest in learning more about these standards, including all participants from the FI industry.

### **9.3.3 Objective 4: Explore the teaching of UCD in industrial design training institutions in Botswana.**

The researcher's perspective on this objective was to attain basic understanding of what is offered at industrial design training institutions in Botswana. Thus, the study focussed less on the training institutions, as it was more important to focus on the industry; and data from the industry is supposed to inform design training. This process also follows UCD practices, where the user is industry; employee is a product while the NPD team is the training institution. The majority of data for this objective was collected during the scoping study.

Table 46, shows a snapshot of the training at the industrial design programs at University of Botswana and Limkokwing University of Creative Technology. Students are encouraged to solve real life problems with problem owners to consult with. Like

the industry the user is mainly involved at the beginning and at the end of the product development process in student projects.

It is also observed that the design schools introduce UCD practices into the curriculum, late in the design education. Both industrial design programs claim their programs are influenced by industry need, but also admit this relationship can be improved.

### 9.3.4 Objective 5: Subsequent studies selection criteria [Company Background data]

Table 47, shows questions and responses that were used to better understand the participating companies and will help in the sampling for subsequent studies.

Table 46: Explore the teaching of UCD at training institutions: Objective 4.

Scoping Study (Interviews)	Survey	Interviews	Case Studies
<b>How many students graduate every year?</b> Each university graduates approximately 10 students each year.			
<b>What are the levels of training?</b> Bachelor's degree			
<b>How is UCD incorporated into student projects?</b> By encouraging students to involve users and understand product context prior and during the PDP.			
<b>At what study level is UCD introduced to students?</b> Students graduate with two years (UB) and a one-year (Limkokwing) of UCD experience respectively.			
<b>How is UCD measured in student work?</b> Both design schools measure UCD in student work through a comparison of the final solution to the user needs and the context analysed at the beginning of the project.			
<b>To what extent is the training influenced by industry need?</b> Both industrial design programs claim their programs are influenced by industry need, but also admit the relationship can be improved. The Industrial Design program coordinator at UB asserts that about 30 – 40% of student training to be influenced by industry need.			

Table 47: Subsequent studies selection criteria: Objective 5

Scoping Study (Interviews)	Survey	Interviews	Case Studies
	<p><b>On average, how many projects does your company run at the same time?</b> Majority of participants reported running more than six products at a time.</p>		
	<p><b>What is an average time spent on a typical project?</b> A good majority of participants reported their projects taking less than four weeks.</p>		
<p><b>Where do you see the company/institution in 5 years?</b> Interviewed companies saw themselves as market leaders regionally, grow brand image, and transform methodologies, use of latest technologies and less reliance on government.</p>	<p><b>Where do you see your company (future plans) in 5 years?</b> Participants reported growing their businesses and producing a better product.</p>		

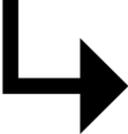
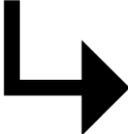
## 9.4 Findings

The consolidated data findings from Chapter 8 were compared to the literature review (global best practices). This was important as it allowed the identification of areas where Botswana’s design industry was lacking; the comparison was done within the study focus areas.

### 9.4.1 Data findings compared with the literature review from the study focus areas

In order to compare the data findings to the literature review, this comparison had to be done within the initial study boundaries, see Figure 4. Table 48, further shows the study areas and their importance relative to each other. Context that supports NPD is essential and basic step needed to attain Design Awareness, followed by Design Practice (PDP) and then UCD.

**Table 48: Study areas and their hierarchy.**

<p><b>Context:</b> Background on Botswana. Socioeconomic factors that provide a decent environment for business to thrive.</p>  <p><b>Design Awareness:</b> Was necessary to understand the level of design understanding in Botswana. Do they know what design is?</p>	<p><b>External:</b> these are ways to optimise UCD approach, that are beyond the company's control.</p>
 <p><b>PDP:</b> These are established product development processes used by a NPD team. A good PDP lays a foundation for introducing UCD to the design process.</p>  <p><b>UCD:</b> this is the involvement of the user in the PDP to guide the product towards what they want and to add to the diversity of the NPD team.</p>	<p><b>Internal:</b> these are ways to optimise UCD approach, that a company can control.</p>

UCD is dependent on an organised PDP and an organised PDP is only possible if there is sufficient Design Awareness and lastly, none of these can happen if the context (socioeconomic factors) is not conducive for business.

Table 49 presents an example to show how literature review and the data collected from industries could be used to come-up with UCD practices suitable for Botswana's design industry. Keep what is already being done well by Botswana's design companies and then introducing UCD best practices to fill-in the gaps, to come-up with a set of new UCD practices to be used by Botswana's design industry. The gaps in the data collected are UCD practices that were not performed by Botswana's design industry. The arrows show the best practices used to fill the gaps in the UCD practices practiced by Botswana's design industry.

**Table 49: Example of how best practices were used to fill-in the gaps in Botswana's UCD practices.**

	UCD practices						
	1	2	3	4	5	6	7
Best Practices UCD (Literature review)							
		↓			↓	↓	
Botswana's UCD practice (from all data collected)							
		↓			↓	↓	
<b>New UCD practices for Botswana's design industry</b>							

#### 9.4.1.1 Design Awareness (DA)

An overview of Table 43, clearly show less than average agreement with the literature review or the best practices. References from the literature review agreeing or disagreeing with the data findings are also shown in Table 50. Literature review (global best practices) and Botswana's definitions of design are much more similar to each other, see (Design definition: Chapter 2.3.3.1) the definition derived from the literature review. It is described as a process involving planning and executing to come-up with a product. However, the Botswana definition failed to cover the satisfying nature of design and the need for industrial production. Majority of participants believe the user can effectively share ideas with the NPD team and are interested in user-product interaction during the PDP, which was important according to Franscara (1997). Moreover, user involvement enhances idea generation through conceptualization, form alignment and transformation of design challenge. Furthermore, Hertenstein, et al. (2005) raises the importance of NPD team's understanding of the importance of design to profit margins. Context and user are considered important to understanding product requirements, Veryzer and Borja de Mozota (2005).

Data shows the common communication methods within design teams included, talking, writing, drawing and modelling/ prototyping; in their order of effectiveness. Data shows participant preference for talking as a preferred mode of communication with the user. However, literature considers visualisations as more effective as they are easier to understand and they allow both the design team and the user to

confirm they have the same mental model for the problem at hand. Participants need to spend adequate time in the ideation process, exploring and experimenting with different ideas prior to settling on a possible solution to a problem, Szenasy (2003). As part of a design team, data shows the user was mostly involved at the beginning of the PDP and was able to provide guidance to a product being developed. Literature further shows continuous user integration leading to increased project profitability, through guidance of the PDP by customer requirements and through relevance checks. Established PDP was non-existent for most of the participating companies. The majority of participant's design experience is focussed on product aesthetics and does not consider new social, political and how the product will be perceived, Simanis and Hart (2006). Like data findings, literature review show products developed at the BoP are influenced by the global trends, Southoff (2004).

Table 50: Comparison between data findings and Design Awareness literature.

Study areas of interest	Data findings compared to Global best practices (Literature review)	Global best practices (replacement)
General/ intro	☺ The case studies clearly show participants increasingly interested in user-product interaction during the PDP. ( <i>Franscara (1997)</i> )	
	☺ Like the literature, participants identified context/ environment and user as important to understanding product requirements. ( <i>Veryzer and Borja de Mozota (2005)</i> )	
	☺ Participants understand the importance of design to profit margins. ( <i>Hertenstein, et al. (2005)</i> )	
	☺ Case studies show participants had substantial access to the user. ( <i>Sudijc (2008)</i> )	
	☹ PDP were virtually non-existent for the majority of the participants, with only two participants reporting having a functional PDP and continuously improving the process.	There needs to be an establishment of PDP's in the majority of the participating companies. ( <i>Roozenburg (2008)</i> )
What is design, designer and designing?	☺ Design definition of design from the data findings is similar to the 'Global Best Practices' definition; however, the Botswana definition failed to cover the satisfying nature of design and the need for industrial production. Moreover, a small number of companies had industrial production capacity, but most had ambitions. ( <i>Design definition: Chapter 2.3.3.1</i> )	
	☹ For the majority of the companies, design work is limited to product development and does not exist at the strategy and branding levels of the companies.	Design needs to be applied in everyday running of the company instead of being limited to PDP. How products are made has to be part of the overall company strategy; however, participating companies had rudimentary strategies and branding efforts. ( <i>Southoff (2004)</i> )
	☹ There is limited ideation process and most of the drawings observed during data collection were technical, with no evidence of multiple idea exploration prior to arriving at the final idea. Issues of sustainability and product experience in product development were non-existent for the majority of the participating companies.	Participants need to spend adequate time in the ideation process, exploring and experimenting with different ideas prior to settling on a possible solution to a problem. ( <i>Szenasy (2003)</i> )
Design education	☹ Participants from design education report being influenced by industry need, but some of the data collected contradicts this statement. Also, the majority of participating companies reported the only relationship they have with the schools was offering internship and failed to discuss PDP.	The relationship between design education and industry needs to be strengthened; furthermore, interviews show both parties agreeing to the need for a closer relationship. In addition to offering internships, some of the suggestions include, industry training (e-learning), industry participating in student projects and guest lecturing, student industry visits etc. ( <i>Bush (2003)</i> )
	☹ UCD is introduced late in design education.	UCD will have to be introduced to students earlier in higher design education.
	☺ Students get a chance to interact with the problem owner, therefore getting some practice in locating, isolating and identifying problems. ( <i>Papanek (1984)</i> )	
Relationship between PDP and design research	☺ NPD research does not exist in the majority of participating companies. Therefore, value orientation, cultural cognition and strategic integration aspects of NPD are not considered by the vast majority of the participants. ( <i>Tomiyama (2009)</i> )	Companies needs to start doing thorough design research (user, product and context) to better understand a problem at hand prior to PDP. Additionally, understanding the link between design research and PDP contributes to further development of design theory and methodology.
	☹ About half of the participants reported going beyond the customer to get in-touch with the user to better obtain user needs and educating the user. ( <i>Sato (2009)</i> )	

- ☺ = represents areas where data findings matched the literature review.
- ☹ = represents areas where data findings did not match the literature review.

Cont. Table 46...

Study areas of interest	Data findings compared to Global best practices (Literature review)		Global best practices (replacement)
<b>Design application (Chapter)</b>	⊗	The survey shows the majority of participating companies had government as major target market.	The majority of the target market for the companies has to be private (individual) clients to reduce the risk associated with having few big clients (Government, NGO's). Furthermore, outsourcing some aspects of PDP across local community also helps the business risk and spreads the wealth. ( <i>Thomas (2006), Rocchi (2006) and Thomas (2006)</i> )
<b>Design education</b>	⊗	Design as a field is not well understood in Botswana's general population.	Companies need to better understand how design can add value to NPD. The need for design policy and for the design fraternity in the country needs to make an effort to promote the profession. ( <i>Thomas (2006)</i> )
	⊗	Botswana graduates about 20 industrial designers every year.	( <i>UCD: design education has to be informed by industry (user)</i> ) The number of students graduating with a design degree will have to be tied to the projected industry need.
	⊗	Both design schools are not involved in the well-being and income generating capacity for poor people.	Design academics and students will have to make an initiative and identify problems/ needs of poor communities to resolve. Involving the community provides an income generating capacity and may also help in promoting design as a field. ( <i>Thomas (2006)</i> )
<b>Lessons learned from BoP</b>	⊗	The majority of companies were not using latest technologies.	Companies will have to investigate latest technologies and understand their pros and cons. Despite the high up-front costs in the long run they become cheaper as they improve product quality and PDP efficiency.
<b>Product character</b>	⊗	The design experience is focused on product aesthetics for the majority with little effort to consider, new social, political and how the product will be perceived.	Since products from the developed world influence NPD at the BoP. In order to have a more Botswana appropriate product, it is essential for BoP companies to consider, social, political and product perception when designing a new product. ( <i>Southoff (2004) and Simanis and Hart (2006)</i> )
	☺	Products from developed nations do influence products produced at the BoP. Majority of participants mentioned studying trends on-line and in stores to benchmark their products. ( <i>Southoff (2004)</i> )	
<b>Design policy</b>	⊗	Botswana does not have a design policy which can help guide and regulate the design industry.	There is need for Botswana to have a design policy to create the awareness and lays the groundwork for the design industry to develop. Participation of many stakeholders, design practitioners, academicians and local communities, play an important role in influencing design policy. UCD policy will also be necessary to target people's needs and interests. Additionally, product development could deliver regional benefits by bridging the gap between policy and implementation. ( <i>Baker and Hall's (2011) and Amir (2004)</i> )
	⊗	Furthermore design policy will help guide design education to training for present and tomorrow's jobs.	Design can be expected to align design practitioners and academicians to work towards the same goals. ( <i>Amir (2004)</i> )

- ⊗ = represents areas where data findings matched the literature review.
- ☺ = represents areas where data findings did not match the literature review.

Design as a field is not well understood in Botswana, both design schools failed to be involved in the wellbeing and income generating capacity for poor people, Thomas (2006). The majority of the participating companies directly or indirectly had Botswana government as a major customer/ client, and literature is against having large entities (Government and NGO) as the primary target market Rocchi (2006) and Findlater (2009). UCD education is introduced late in the design education. The relationship between education and industry needs to be improved; furthermore both universities report students interacting with problem owners on some projects.

NPD research is does not exist in the majority of the participating companies. However, half of the participants reported making an extra effort to go beyond the customer/ client to get in touch with the product user. Participants failed to research new technologies and in most cases they are not affordable for most. There is need for Botswana to create a Design Policy to structure the design profession and provide a target to reach for.

#### **9.4.1.2 Design Practice (DP)**

Design Practice (DP) is poorly practiced by the participating companies and a small number of UCD practices in this study focus are applied by the participating companies. Redstrom (2005) observes design being viewed as a matter of physical form, rather than user product perception, environmental impact and experiences. Users at the BoP are already accustomed to the western (global) design, thus it is viewed as a standard for good design. PDP has no connection to company's business strategy; instead it is focussed on "Product thinking". Therefore, PDP needs to extend to a broader context of the product. Participating companies often attempt to do exactly what the user wants; they however fail to document user needs and therefore lack their own independent evaluation measure, this is the same observation made by Poggenpohl (2009). They focus on product's physical form and functionality without considering user-product perception and experiences; (Rocchi (2006)) advocates for more focus on the user's perception of the product and their practices. The majority of participants spent less time exploring problems and possible solutions. References from the literature review agreeing or disagreeing with the data findings are also shown in Table 51.

Case studies failed to show the link between design problem and solution, due to the lack of documentation by majority of the participants; Balke-Schaub et al. (2010) views the link between design problem and design solution as important to understanding the success of a PDP. The evaluation is based on user reaction to the final product and not product requirement checklist. For validity the relationship between design industry and education has to be strengthened to allow free flow of information, (De Jong (2002) and Park (2011)) thought a better relationship between the two would allow more design research. Critical PDP decisions are made at the top and then executed by the NPD team; as observed by (Sato (2009)) and Hofstede's cultural dimensions.

Table 51: Comparison between data findings and recognised good practices in DP.

Study areas of interest	Data findings compared to Global best practices (Literature review)		Global best practices
General/intro	⊗	Design is primarily driven by client's wants and profit instead of client need.	Design has moved away from primarily being about product physical form and functionality to including experiences, perception and environmental impact. ( <i>Papanek (1984) and Redstrom (2005)</i> )
	⊗	Design is still viewed as a matter of physical form, rather than user product perception, environmental impact and experiences.	
Design Thinking	⊗	Less time is spent in exploring problems and possible solutions.	Design thinking is necessary to problem understanding and allows thorough exploration of the solution space allowing possible solutions are explored, developed and evaluated in an iterative process. ( <i>Steen (2013) and Cross (2011)</i> ).
Implicit/ tacit knowledge: experience, internal processes	⊗	The case studies failed to show the link between the design problem and the solution could not be established since the majority of the participants failed to document the PDP.	Understanding the relationship between the proposed design problem and the resultant solution may lead to better understanding of the PDP, <i>Balke-Schaub et al. (2010)</i> . Therefore, it is essential to document the PDP to gain information on both explicit and tacit knowledge. Furthermore, similarities between the proposed product and the final product show the degree to which NPD is successful. Knowing more about the user allows a company to participate in mass-customization, <i>De Jong (2002)</i> .
	⊗	The evaluation is primarily based on user reaction to the final product and not product requirement checklist.	
	⊗	Competition is still primarily concerned with product functionality, resulting in less focus on product differentiation.	
NPD teams in design practice	⊗	Product development is top-down, where majority of the NPD team are not involved in decision making. They simply, implement what has been decided at the top.	PDP decision making has to be done by multidisciplinary teams; this helps as each team member take ownership of the project and more information is shared amongst team members, <i>Sato (2009, p30)</i> . Within a NPD team the designer has to be in a position to justify their design views and solutions; PDP documentation provides material to do so.
Design as Science: Validity	⊗	In order to validate design as a science, PDP has to be documented in order to be reviewed. However, the overwhelming majority of the participants failed to document the PDP.	Extensive research and collaboration are important towards validating design as a science. Furthermore, PDP documentation allows design stakeholders to identify recurrence within the methods used, thus in a better position to understand the profession better. ( <i>Poggenpohl (2009), De Jong (2002) and Park (2011)</i> )
	⊗	The weak relationship between design industry and education has to be strengthened, to allow design research to make its way to industry and vice versa.	
DP at BoP	⊗	The relationship between design research and practice is limited to offering internship and does not involve the sharing of ideas for mutual benefit.	There has to be a close relationship between design practice and research to facilitate design acceptance and use, <i>Southoff (2004, p44)</i> . This may lead to increased sharing of ideas and grounding of the design profession. Simply transferring technologies to the BoP takes away ownership and familiarity from the locals. While targeting the poor is essential, the effort to attaining a cheaper product takes away the custom in a product. Design practitioners have to move towards integrated PDP; where contributions contexts of culture and use are clarified.
	⊗	Users and designers are already conditioned to western design and therefore considered normal. (-)	
	⊗	Only one participant revealed their company strategy as primarily targeting the poor.	
	☺	Participating companies seemed to primarily focus on "Product Thinking" with a bit of "System Thinking"; and failed to tie the PDP to the company's overall strategy. ( <i>Rocchi, (2006, p7)</i> )	
	☺	Participants considered the immediate context (user-product interaction) of the product. However, needs to extend to a broader context of the product. ( <i>Southoff (2004, p49)</i> )	

- ☺ = represents areas where data findings matched the literature review.
- ⊗ = represents areas where data findings did not match the literature review.

### 9.4.1.3 User-Centred Design

Understanding and use of UCD practices in this focus area generally less than average of the recommended global practices, see

Table 52. References from the literature review agreeing and disagreeing with the data findings are also shown in Table 52.

All participants consulted with the client/ customer, but failed to adequately apply UCD activities to the PDP as also observed by Veryzer (2000) and Sato (2009); the main part of the problem was the lack of documentation of the consultations. The clients/ customer were treated as a subject and/or informant; and no participant was treated as a co-operation partner, this has also been observed by Cain (2005) at the BoP. For the majority of participants user-involvement was not built on top of a sound PDP, this observation was also made by Sandmeier, et al. (2010).

Participants agree that user involvement was essential to PDP and believed the user can help improve creativity, innovation and understanding of user context, Saeed et al. (2013). Moreover, they believe the user can effectively share ideas with the NPD team. An overwhelming majority of participants were not aware of the term UCD, see UCD definition: (Chapter 2.5.1). A small number of participants thought of the use of ISO 13407 as difficult and less profitable to satisfy as reported by Papanek (1984). Despite not being aware of the term UCD, majority of participants still carried functionality and usability testing; despite the lack of planning and documentation. Norman (2003) speaks of the need for performance requirements documentation to allow product testing without the presence of the end-user.

A greater majority of participants preferred talking over writing and drawing as a medium of communication with the client. None of the participants reported the production of low functionality versions of the final product during the PDP. However, Park (2011) and Cross (2000) advocate for the use of drawings as the primary mode of communication between the NPD team and the end-user.

Comparison of the data findings to how UCD practices are applied at BoP was difficult because of lack of adequate UCD data at the BoP. Lessons learnt at the BoP included cautioning against having government and/or NGO's as major clients/

customers. Findlater (2009) finds this dependence as stifling creativity and organisational growth.

Table 52: Comparison between data findings and recognised good practices in UCD.

Study areas of interest	Data findings compared to Global best practices (Literature review)	Global best practices
General/ Intro	☺ Participants made consultations with clients. ( <i>Saeed et al. (2013)</i> )	Applying some kind of UCD to PDP was always going to be hard for the participants because the majority of the companies lacked an established PDP, ( <i>Veryzer (2000) and Sato (2009)</i> ). Companies need to better formulate and more clearly articulate the emphasis on user focus. Additionally the diversity of NPD teams is essential to giving multiple perspectives to PDP, <i>Veryzer and Borja de Mozota (2005)</i>
	⊗ Almost all participants failed to efficiently apply UCD in their PDP's.	
	⊗ Majority of the NPD teams were small and not multidisciplinary.	
UCD definitions	⊗ The overwhelming majority of participants were not aware of the term UCD. ( <i>UCD definition: Chapter 2.5.1</i> )	Even though participants were not aware of the term UCD, some of the elements of UCD were applied in an unorganised manner to the PDP. This can be evidenced by functionality and usability testing by the majority of the companies, however there is still a need for the participants to fully embrace UCD in their PDP.
	☺ Functionality and usability testing were performed by the majority of the participants, despite the lack of organisation. ( <i>Tu et al. (2011)</i> )	
ISO 13407	⊗ Almost all participants were not aware of the Human-Centred Design standard: ISO 13407.	Participants have an obligation to familiarise themselves with the UCD ISO standard and apply it to everyday running of the company. It helps efficiently make appropriate products and also provides internationally acceptable product standard.
Levels of user involvement	☺ The investigation shows the user being treated as subjects and/ or informants during PDP. ( <i>Cain (2005)</i> )	Participants are already involving users as subjects and informants in the PDP process. However there is need to involve users as part of the NPD team (cooperation partners) in order to reconcile the paradox of what the user wants and what they need, <i>Cain (2005)</i> . Furthermore it helps save time and costs associated with NPD. Companies have to be more organised and plan how UCD can be best applied to the existing PDP, <i>Sandmeier, et al. (2010)</i> .
	⊗ No participant treated the user as a co-operation partner, where the user is treated as part of the design team.	
	⊗ Also, most of the companies especially in the FI industry just did what the user wanted regardless of the intellectual property violations.	
	⊗ User involvement was not built into the PDP; the user was involved whenever the NPD team needed clarification.	
User-NPD team communication	⊗ The majority of the participants preferred talking as opposed to (writing and drawing) as medium of communication with the user/client.	Communication between the user and NPD team has to also involve more of drawings and writing as opposed to predominantly talking; which doesn't provide evidence of what was agreed upon, <i>Veryzer and Borja de Mozota (2005, p134)</i> . Moreover, communication can also include the use of low functionality versions of the final product (models) for feedback purposes, <i>Sandmeier, et al (2010, p92)</i> . Companies need to use techniques like Quality Function Deployment (QFD) and scenarios to learn and manage what the user wants from a product. ( <i>Park (2011) and Cross (2000)</i> ).
	⊗ No participating company produced low functionality version of the final product during the PDP.	
	⊗ The NPD team knew what the user wanted through consultation (talking), than through writing and drawings. No participant used scenarios or quality functional development (QFD) to learn and manage what the user wants from a new product.	
Benefits of UCD	☺ Survey and interview findings show participants agreeing that user-involvement was essential to PDP. Moreover, they believed the user can help improve creativity and innovation during PDP; and can effectively share ideas of what they want with NPD teams. ( <i>Saeed et al. (2013)</i> )	Majority of participants understood the importance of UCD to PDP, but had no organised way to manage UCD. Sensitivity to user reaction to products affects the direction of PDP, success of the final product and helps differentiate products from the competition, <i>Borja de Mozota (2006)</i> . This can be done through user involvement in conceptualisation, form alignment and the evolution of the design challenge. Documentation is essential to UCD as it allows the NPD team not only to look professional but to also engage the user when it is absolutely necessary. ( <i>Norman (2003)</i> ).
	☺ Participants had a lot of contact with the client, but failed to neither organise nor document them. ( <i>Veryzer and Borja de Mozota (2005)</i> )	
	☺ For the majority of the participants, clients were continuously involved in the PDP and they all thought user involvement helps them better understand the context of product use. ( <i>Sandmeier, et al. (2010) and Tu, et al. (20110)</i> )	
	⊗ The FI industry failed to differentiate their products, while the GA industry strived to differentiate their products to come-up with original products.	
	⊗ A small number of participants mentioned covering the needs of a human being is usually more difficult and less profitable to satisfy. One participant mentioned if this was an industrywide requirement they will gladly involve the user more. ( <i>Papanek (1984)</i> )	
	⊗ For the majority of participants, usability and functionality were measured without performance requirements mainly due to lack of PDP documentation.	
UCD at BoP	⊗ The majority of the companies have to wean themselves away from having the government or an NGO as a major customer/client.	There is a need to have the majority of product sales coming from private individuals as it forces companies to satisfy wants from diverse individuals, <i>Findlater (2009)</i> .

- ☺ = represents areas where data findings matched the literature review.
- ⊗ = represents areas where data findings did not match the literature review.

#### **9.4.2 Process Documentation**

The documentation of the PDP and UCD practices is thought to allow re-use and continual improvement processes followed during product development. Further, it is suggested that the identification of recurrence within these methods as an important step towards building theories for the design practice. The majority of participants preferred talking as a mode of communication and sharing of ideas with the user; furthermore, case studies showed little documentation of the PDP and UCD practices. There seems to be a correlation between the preference of talking and the lack of documentation. The lack of written PDP was prevalent in the majority of participating companies; they relied on memorised processes. Without an established PDP, UCD practices become much harder to be used effectively during product development.

The little documentation was done early (start) in the PDP and was primarily on product context, product dimensions, materials to be used etc. Data from the case studies show 'planning the human centred process' part of the PDP as having the most UCD practices; while the most documented part of the PDP as 'specification of context of use'. The most UCD practices show the importance of the "Start" stage of the PDP; 'specification of context of use' being the most documented, shows an attempt by majority of participants to know more about user, product and environment which the two interact. It is a positive sign that the 'planning the human centred process' was perceived important and had it been documented it would have improved the application of UCD practices in the later stages of the PDP (evaluation). The lack of documentation denied the NPD team an opportunity to show the user how PDP evolved towards the final product; in order to appreciate the amount of work and money put into the project. Moreover, this may help improve the awareness of the design profession in Botswana.

Design is still yet to be fully integrated at a strategy level and every day running in Botswana's design industry; where design drives all business activities. Design teams in these companies are aware of the advantages of design but the upper management is yet to be sold on the idea. The PDP is hardly organised with little to no process being followed. For smaller companies having a written PDP processes may not be very important as there are fewer people to co-ordinate projects; while

for larger companies are forced to have some sort of PDP process in order to coordinate projects in a bigger NPD team.

Less time is spent in exploring problems and possible solutions, thus shortening the iterative process. Additionally, design profession is not aligned with Botswana's strategic aims and the industry has little or no regulation. Additionally, the lack of design policy also means the lack of a common goal, to which all design industry stakeholders (i.e. government, user, design companies) in Botswana can work towards.

## **9.5 Where is Botswana right now**

The investigation shows poor design awareness, lack of design practices and poor UCD practices; by Botswana's design industry. Surprisingly, UCD is an area where participant reporting revealed the most similarities (6/13) with the literature review, while design practice had the least (1/4) and design awareness with (7/22).

### **9.5.1 What participating companies did well per study area**

These are activities/ practices from the data findings from the field that are similar to the literature review.

#### **9.5.1.1 Design Awareness**

- Participants showed general understanding of design as well as good knowledge of the product being produced. Furthermore, they exhibited an interest in user-product interaction during the PDP and despite the user not being treated as a co-operation partners, there was substantial access to the user.
- Students get a chance to interact with the problem owner.
- Participants understood the need to interact with the actual user; however more companies need to follow this practice.
- The findings show products being influenced by the global trends.

#### **9.5.1.2 Design Practice (DP)**

- Participants reported the design focus on "Product Thinking" and "System Thinking", but failed to apply it to overall company strategy. The focus seems to be on the immediate context (user-product interaction) of the product.
- Users and designers are already conditioned to western design and therefore considered normal.

### 9.5.1.3 UCD

- Functionality and usability testing were performed by the majority of the participants, despite the lack of organisation.
- The investigation shows the users being treated as subjects or informants during PDP and not as co-operation partners where they are part of the NPD team.
- Participants agree user-involvement is essential to PDP, moreover, they believe the user can help improve creativity and innovation and can effectively share ideas of what they want with NPD teams. The user is continuously involved in the PDP and thought the user helps understand the context of product use.

### 9.5.1.4 UCD practice hierarchy and responsibility

Table 53, shows UCD practices that are in agreement with the literature review; and they have been ranked in order of importance. The ranking is based on the number of study areas (DA, DP and UCD) a UCD practice appears in, the more the higher in the ranking. The researcher also considered the number of times an activity appears within a study area. The most important UCD practice involves “interest in user-product interaction and access to the user,” as this practice was seen in all the three study areas of interest, also Table 45 shows this UCD practice being investigated by all data collection methods. This finding is important as it shows participant interest in the use of UCD practices and what is needed is an organised UCD practice implementation strategy that would be suitable for an individual company. Responsibility refers to who is responsible for the activity/ practice, whether the responsibility is internal or external;

- **Internal:** refers to UCD practices that are a responsibility of an individual company.
- **External:** refers to the UCD practices that are a responsibility of government, an industry body and design education. These are done to affect an industry and not just targeted towards an individual company.

The study areas (DA, DP and UCD) in bold and parentheses, shows which study area(s) the activity or practice appears in.

**Table 53: Hierarchy of UCD practices in agreement with the literature review.**

Rank	UCD practices in agreement with Literature review (Best Practices)	Responsibility (Internal/external)
1	Participants exhibited interest in user-product interaction during the PDP; there was substantial access to the user to help understand the context of product use. (DA, DP&UCD)	Internal
2	Participants agree that user-involvement is essential to PDP; moreover, they believe the user can help improve creativity and innovation and can effectively share ideas of what they want with NPD teams. (DA &UCD)	Internal
2	Users and designers are already conditioned to western design and findings show products being influenced by the global trends. (DA&DP)	Internal/ External
4	Participants showed general understanding of design as well as good knowledge of the product being produced. (DA)	External
4	Students get a chance to interact with the problem owner. (DA)	External
4	Participants reported the design focus on “Product Thinking” and “System Thinking”, but failed to apply it to overall company strategy. (DP)	Internal
4	Functionality and usability testing were performed by the majority of the participants, despite the lack of organisation. (UCD)	Internal

### 9.5.2 What participating companies did not do well per study area

These are instances where the data collected is dissimilar to the literature (Global best practices). This is where we expect to identify opportunities to enhance DA, DP (PDP) and UCD.

#### 9.5.2.1 Design Awareness

- A large majority of participants reported the lack of an established PDP used on all products being developed.
- Definitions of design were similar to the best practices, despite failing to cover “the satisfying nature of design” and “the need for industrial production”.  
Furthermore, companies failed to spend adequate time on the ideation process where different product possibilities are explored.
- The relationship between design education and the industry needs to go beyond internships. UCD also needs to be introduced earlier in design education.
- Companies need to start documenting the PDP to allow design research in the industry.
- The studies reported the overreliance on the government as target market and needs to be shifted to private client.

- Design field is still less understood by the general population and design schools are not involved in poor community projects. The number of design graduates need to be increased.
- Most of the companies use old technologies and fail to keep up-to date with technology evolution.
- Design has a narrow focus within a company and does not influence the everyday running of the company.
- Botswana lacks a design policy to promote awareness and provide direction to stakeholders involved in design. Furthermore, design training can be influenced by industry need.

#### **9.5.2.2 Design Practice**

- In addition to product form and functionality, NPD team needs to include experiences, perception and sustainability issued to PDP decision making.
- NPD teams spend minimal time in exploring problems and possible solutions.
- The case studies failed to show the link between the design problem and the solution could not be established since the majority of the participants failed to document the PDP. Product requirement checklist does not exist for a large majority of participants. Competition is primarily concerned with product functionality rather than product differentiation.
- Product development is top-down, where majority of the NPD team are not involved in decision-making. They simply, implement what has been decided at the top.
- In order to validate design as a science, PDP has to be documented in order to be reviewed. However, the overwhelming majority of the participants failed to document the PDP. The weak relationship between design industry and education has to be strengthened, to allow design research to make its way to industry and vice versa.
- The relationship between design research and practice is limited to offering internship and does not involve the sharing of ideas for mutual benefit. Only one participant revealed their company strategy as primarily targeting the poor.

### 9.5.2.3 UCD

- Almost all participants failed to efficiently apply UCD in their PDP's. The majority of the NPD teams were small and lacked the skill diversity.
- Participants preferred talking with clients, than writing or drawing.
- The majority of participants were not aware of the term UCD.
- Almost all participants were not aware of the Human-Centred Design standard: ISO 13407.
- No user was treated as a co-operation partner (part of the design team), the little involvement they had was not built on top of an organised PDP. The majority of the FI industry just did what the user wanted without considering intellectual property violations.
- The preferred mode of communication was talking instead of writing or drawing. There was minimal experimentation with possible solutions to the problem. A large majority of participants used consultation to find out what the user wants, however these wants were not processed further for better understanding.
- The majority of participants, measured usability and functionality without performance requirements mainly due to lack of PDP documentation. GA industry strived to differentiate their products in order to come-up with more original products.
- The majority of the companies have to wean themselves away from having government or a NGO as a major client.

### 9.5.2.4 UCD practice hierarchy and responsibility

Table 54, show UCD practices that are not in agreement with the literature review; and they have been ranked in order of importance. The ranking is based on the number of study areas (DA, DP and UCD) a UCD practice appears in, the more the higher in the ranking. The researcher also considered the number of times an activity appears within a study area. The most important problem is clearly the lack of documentation, as it was also reported by all data collection methods (Scoping study, survey, interviews and case studies) see Table 44 and appears in all areas of study. Responsibility refers to who is responsible for the activity/ practice, whether the responsibility is internal or external;

- **Internal:** refers to UCD practices that are a responsibility of an individual company.
- **External:** refers to the practices that are a responsibility of government, an industry body and design education. These are done to affect an industry and not targeted towards an individual company.

**Table 54: Hierarchy of UCD practices in disagreement with the literature review.**

Rank	UCD practices different to Best Practices (Literature Review)	Responsibility (Internal/ external)
1	The <b>lack of documentation</b> impedes design research in industry; documentation provides a link between a design problem and solution. Documentation of the PDP is also important to provide an ability to be reviewed and therefore validating design as a science. Furthermore, PDP documentation provides information necessary to validate the product. <b>(DA, DP&amp;UCD)</b>	Internal
2	The relationship between design education and the industry needs to go beyond internships and does not involve the sharing of ideas for mutual benefit. Furthermore, design research has to be shared between industry and academia. <b>(DA&amp;DP(x2))</b>	Internal/ External
2	In addition to product form and functionality, NPD team failed to include experiences, and perception issues to PDP decision-making. <b>(DP(x2)&amp;UCD)</b>	Internal
4	Participants failed to spend adequate time on the ideation process where different product possibilities are explored. <b>(DA&amp;DP)</b>	Internal
4	The majority of the companies have to wean themselves away from having government or a NGO as a major client. <b>(DA&amp;UCD)</b>	Internal/ External
6	A large majority of participants reported the lack of an established PDP used on all products being developed. <b>(DA)</b>	Internal
6	Definitions of design were similar to the best practices, despite failing to cover “the satisfying nature of design” and “the need for industrial production”. <b>(DA)</b>	Internal/ External
6	Design field is still less understood by the general population and design schools are not involved in poor community projects. The number of design graduates need to be increased. <b>(DA)</b>	External
6	Most of the companies use old technologies and fail to keep up-to date with technology evolution. <b>(DA)</b>	Internal
6	Design has a narrow focus within a company and does not influence the everyday running of the company. <b>(DA)</b>	Internal
6	Botswana lacks a design policy to promote awareness and provide direction to stakeholders involved in design. Furthermore, design training can be influenced by industry need. <b>(DA)</b>	External
6	Product development is top-down, where majority of the NPD team are not involved in decision-making. They simply, implement what has been decided at the top. <b>(DP)</b>	Internal
6	Almost all participants failed to efficiently apply UCD in their PDP's. The majority of the NPD teams was small and lacked the skill diversity. <b>(UCD)</b>	Internal
6	The majority of participants were not aware of the term UCD and the Human-Centered Design standard: ISO 13407. <b>(UCD)</b>	Internal/ External
6	The majority of the FI industry just did what the user wanted without considering intellectual property violations. <b>(UCD)</b>	Internal/ External
6	The preferred mode of communication was talking instead of writing or drawing. There was minimal experimentation with possible solutions to the problem. A large majority of participants used consultation to find out what the user wants, however these wants were not processed further for better understanding. <b>(UCD)</b>	Internal

The study areas (DA, DP and UCD) in bold and parentheses, shows which study area(s) the UCD practice appears in.

### **9.6 Response validity**

Literature observes a rift between design practice and research as inhibiting design acceptance and use; also data from Botswana industry and education shows no other relationship besides providing internship for students. The lack of professional relationship between research and education does not help the credibility and growth of design as a profession, (Southoff (2004)). Information is not shared amongst the design industry stakeholders.

The grounded theory meant the data collection methods were applied in linear manner, where the next study was influenced by the previous. To avoid information loss during the data collection, findings that were not investigated for further analysis in the next data collection were still utilised in guiding the intervention for this study. The study relied on the participants' honesty. The four data collections were meant to have enough data to make informed decisions, as to how UCD practices are practiced by Botswana's industry. To some extent the study is self-validating as participants were often asked to comment on their responses to previous studies. Also, questions phrased slightly different helped in confirming the accuracy of previous responses.

### **9.7 Design education**

Industry seems to have less knowledge of the programs offered by the design schools; furthermore, there was ignorance on the capabilities of an industrial designer and how they can positively influence PDP. Industry seemed to have little to no influence on the teaching of design and this is out of line with the theme of this study; where product development needs user involvement for a more appropriate product. The user in this context is the industry and the educational institution is the NPD team.

The design schools introduce UCD activities late in their degree programs and graduate a total of 20 industrial design students. Both design schools claim their programs are influenced by industry need; however majority of the industry reported their relationship with design education as primarily offering internship to students. It

does not involve the sharing of ideas to improve design awareness and the profession as a whole.

Like the industry, educational institutions primarily interact with the user at the “start” stage and at the end of the PDP. Survey data showed a large majority of participants reporting involvement of a qualified designer during PDP; however follow-up interviews reported a small number to no employees having been through a design school. Therefore, participating companies with employees that have been through the design school were selected for the next data collection. Links between industry and design education were weak as expected, the only time the two had contact with each other involved student internship. But the vast majority of participants were willing to have more interaction with educational institutions. For example, for generating vector graphics the researcher discovered the majority of industry using (©CorelDraw) while educational institutions taught (©Adobe).

## **9.8 Limitations**

- The study was carried from the NPD team’s perspective, thus user-perspective is still essential to validating the findings of this study.
- Lack of information on the application of UCD practices in Botswana’s industry.
- The lack of written PDP’s in majority of companies meant that UCD practices were not grounded to some permanent process; and this made it harder to evaluate the application of UCD activities. Therefore, validating the PDP followed lacked a validating mechanism as it was solely based on participant responses.
- Protection of company secrets may have prompted participants to filter information that was disclosed for this study. However, trade secrets have been known to hinder the progression of the design profession; the result is the incessant re-invention of the wheel.
- The vast majority of participants reported the lack of company established or written PDP followed. An established PDP is essential to a well-functioning UCD strategy.
- The researcher focused on PDP’s and could have collected more background information on the participating companies for easier sampling.
- Despite the FI industry having a substantial number of Chinese owned companies; all contacted companies declined to participate in this study. There

seemed to be a language barrier, but then how are they able to conduct business?

- The results are primarily generalizable to Botswana's design industry; with more testing in different industries it can be applicable to most of Botswana's industry.
- Distance between the participants and the researcher did not provide easier opportunity for back and forth correspondence.
- Time and financial constraints affected the sampling and the amount of time spent analysing the data.

### **9.9 Chapter Summary**

The level of similarities (positives) between the data collected and the literature is relatively the same amongst the three study areas (DA, DP and UCD). However, it is also evident that UCD practices were not performed methodologically. When it comes to what was done well (positives) DA findings provided the most similarities with the literature; when it comes to what was not done well (negatives) again DA had the most differences with the literature. This observation can be explained by the fact that UCD and DP are considered subsets or parts of DA in this study; therefore a lot of UCD practices within the DA study area, See Table 48.

Important findings were identified and passed through the literature review chapter to find out what the literature says about these findings. Thus positive and negative; where data contradicted the literature would be replaced by the best practices to create a guide to be used for evaluating and conducting additional case studies.

The majority of the UCD practices can be considered an internal responsibility of each company. Furthermore, to some extent internal responsibilities are part of the external responsibilities; therefore the decision to assign responsibility to activities/practices is not as straightforward.

CHAPTER TEN

**CONCLUSIONS AND  
FUTURE WORK**

## 10 Conclusions and Future Work

### 10.1 Introduction

The aim of this study was to explore approaches to PDP and UCD practices in Botswana's industry. Ideally it will demonstrate how a user-centred approach may lead to useful, functional, and successful products. Information gleaned will provide insight into such questions as: Who is the user? When and how do we effectively involve the user in the design process? The premise was that there was an opportunity to define the benefits of PDP & UCD practices in optimising and structuring user involvement in Botswana's industry.

Despite the majority of participants not being aware of the term UCD, most companies thought it was common sense to involve the client in the PDP. Participants overwhelmingly referred to the 'user' as a 'customer' or 'client', thus in this instance UCD can be referred to as customer/client-centred design (CCD). The majority of the participants reported following exactly what the user wants, with most of the input on materials and attributes. The NPD team's creativity may be limited by the user demanding specific products already on the market. Furthermore, given the low product complexity of the investigated products from the case studies, there was little need to have contact with the client to the extent they did.

The basic design cycle was simplified and used as the basis for the PDP; the simplification helped participants without design education background to quickly understand the PDP. A common design methodology also made it easier for the researcher to compare data gathered between participants.

The late discovery of ISO 9241-210 which is a replacement to ISO 13407 which has been used extensively in this study; prompted a closer comparison of the ISO 9241-210 and ISO 13407. The comparison showed the difference between the two was that ISO 9241-210 also offers requirements and recommendations; everything else is the same. ISO 13407 was viewed as the most reasonable consensus of the global experts. However the standards are too broad and have to be customised for each industry; where each industry takes only what it needs (nothing extra) to reduce the clutter.

## 10.2 Conclusion on Industry

What the client wants was rarely challenged, despite the risk of infringing on intellectual property rights and not tackling sustainability issues. Additionally, the lack of adequate ideation and iterative PDP in these companies do not help the situation either, as the final products were less refined. NPD teams seem to concentrate on product functionality and aesthetics, and fail to consider user-product emotional interaction.

More user involvement is necessary for better understanding of the user, but it has to be organised to be effective. What the user needs may not necessarily be what they want; however, an optimal product for the user lies in finding the balance between user wants and needs. Needs are what an optimised product ought to be and wants are the customisation/ personalisation aspect of product development. It takes much more than minor modifications to existing products to penetrate the next market. NPD planning has to be much broader than just the product development level; it has to be at the product strategy level, where spending on design is considered investment similar to expenditure on capital equipment. For example, QFD can be used as a solution to help participating companies structure and convert user needs into product requirements. Thus, allowing these companies to be in a better position to develop a more appropriate product/service for the user.

The individualistic culture where the user demands products made for them has led to the increase in the demand of customised products which are expensive and time consuming to develop. However, custom products do not have to be expensive and the role of design is to cut the cost of customised products. The inability of the 'user' to articulate the required functionality and benefits of a new product makes it harder to attain a more appropriate product.

Figure 80 shows the current relationship between the NPD team and the end-user, where client or customer is treated as a proxy to the end-user. Figure 81 shows the proposed relation between the NPD team, client/ customer and the end-user. The proposed relationship show direct relationship between the NPD team and the end-user, but also maintains the NPD team – client/ customer relationship currently being practiced.



Figure 80: Current relationship between NPD team, client/ customer and the end-user.

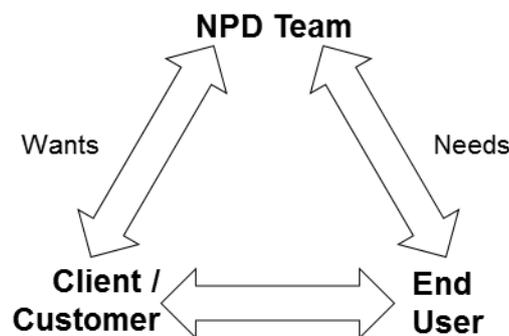


Figure 81: Proposed relationship between the NPD team, client/ customer and the end-user.

### 10.3 Conclusion on Education

Exploration of the teaching of UCD in design training institutions in Botswana received less attention as it was more important to understand industry need and then use it to inform design training in Botswana. This aligns well with the theme of this study where product development is informed by the user; where the company is the user and the employee being the product. The relationship between design industry and education has to be strengthened to allow free flow of information and to allow the advancement of the design profession and greater public awareness.

### 10.4 Conclusion on Study Methods

Data collection in Botswana gets difficult at the end of each month and at the end of the year (December); companies are busy with the salaries and closing for end of the year. Low number of potential companies to participate in the study, in order to

avoid high non-return of completed questionnaires the researcher had to be on the ground to build rapport for future studies. End of month and December proved not to be the best time to do data collection, because there is a lot more going on in the companies and it is harder for the researcher to get the necessary attention.

### **10.5 Reliability of research results**

Construct validity was performed on all case studies by running pilot studies prior to each data collection. Pilot studies were run on colleagues at Loughborough Design School and University of Botswana's Industrial Design and Technology Department. For the survey and interview studies, the researcher ran pilot studies on companies that were deemed to have less significance to the study. Since this was a grounded theory approach, data collected was able to validate and guide the next study; the nature of the data needed for the next study was influenced by previously collected data. Additionally, the methodology involved an iterative process where the researcher learns more about the problem in the process of solving it. The study focus was to understand how participating companies went about UCD practices and PDP. As a result the researcher failed to broaden the information collected on the companies, which would have provided better background on the participating companies.

The occasional clarification from English to Setswana language for some participants had no effect on the results of the study because the researcher is proficient in both languages. Standardised language was used across data collection, for consistency. The lack of documentation at the interviewed companies means the researcher had less evidence of what actually transpired during the majority of the projects investigated. However, the selection of smaller companies allowed easier access to the right participant. This study was primarily dependent on the participant's honesty in responding to the questionnaire.

The researcher was also able to investigate how the three areas (DA, DP and UCD) of interest were actually applied in a specific project. The aim was to compare what participants reported in the scoping study, survey study and interview study with how it was actually applied in a specific project. The use of Post-It notes during cutting and sorting process during data analysis from the scoping study and the survey allowed the researcher to get hands-on with the data. Moreover, manual cutting and

sorting gave the researcher better understanding of what happens behind ©Nvivo's interface when analysing data from interviews and case studies.

The methodology followed was reasonable and dependable; it allowed the researcher to gather the required data and also provided an opportunity to follow-up unresolved areas of interest for clarification. The sampling process was methodological and average companies selected were representative of the design industry in Botswana. The information obtained started broad (survey study) and sensible sampling procedures allowed the selected participating companies to be representative of the initial sample of Botswana's design industry from the survey study.

Given the subjectivity of design problems, no two problems within a company are the same and this adds to the difficulty of generalising the findings of the study. It was clear that whatever the intervention to the study would have to cover multiple problem scenarios. Findings from this study are not be generalizable to the entire Botswana's industry and are only applicable to the participating design industries. Furthermore, the researcher's Industrial design background may have influenced the interpretation of data. Data interpretation was subject to the researcher's interpretation; however the researcher realised more than one person are needed for data interpretation in order to add more validity to the study.

The study can be considered a success as it fulfilled the researcher's personal and professional goals; developing a deeper understanding of the "Fuzzy Front End" of the PDP and identifying my research area of interest and further study areas to explore to explore in the future.

## **10.6 Data Findings connected to the study objectives**

### **10.6.1 Objective 1: Determine the level of design awareness in Botswana's companies.**

1. The majority of participants from the survey study thought design was important to the PDP; furthermore, stakeholders (investors, suppliers, employees and the user) are considered equally important to PDP. A good majority of the participants reported employing the services of qualified designers for design related work and viewed design as important to all stages of the PDP. The basics

seem to be in place in Botswana's design industry; now the need is to better understand how to better manage all components involved in NPD. Even though participants understood the importance of design to a PDP; they still failed to apply design at a corporate level of the company.

2. The vast majority of the participants viewed design as a process and/ or an act of planning. This was a positive observation and also surprising as the researcher expected the responses to be predominantly about product aesthetics and features. Furthermore, this shows some level of design awareness by the participants.
3. The survey study shows ease of product use as mainly measured during the PDP, moreover the amount of user testing done at early PDP and late PDP was equally important to the participating companies. Again, the researcher expected user involvement to be front heavy on the PDP and then diminishing towards the end of the PDP.
4. The measure of product success has been shown by the survey data to equally revolve around a happy client/customer, product reviews and sales/profit. The researcher had expected sales/ profit to be the most prevalent product success measure; however, participants thought happy client/ customer was slightly more important than the rest in measuring product's success (which is a good thing).

#### **10.6.2 Objective (2 and 3): Understanding of UCD and training needs.**

The two objectives were merged after the researcher realised responses from both objectives had a lot of overlaps, see Table 43.

1. An overwhelming majority of respondents reported involving the client in the PDP. They are mostly involved at the beginning and at the end of the PDP; to basically get the client's needs and to validate the final product. However, the vast majority from the participating industries (FI and GA) made their first choice involving the user at the start of the PDP. All participants from the FI industry reported the criticality of involving the user at the start of the PDP. Involving the user at this stage the PDP, attempts to understand what the user wants from the product; thus the start stage can be considered critical to user involvement.
2. Lack of documentation of PDP's and UCD practices during NPD; this was widespread but yet important to reviewing and improving PDP's and UCD

practices. Further, data reveals all case study companies failed to plan the human-centred process in these projects.

3. The majority of survey participants agree that incorporating the user into the PDP and that the user can effectively share ideas with a PDP. This is a positive point because going forward the researcher will only have to deal with how to best incorporate the user in a PDP. However, the customer/ client is widely used as a proxy to better understanding the end-user and the majority of participants fail to go to go beyond the customer/ client to get in touch with the end user.
4. Data shows the user and other stakeholders being the source of better understanding of the context of product use. However,  $\frac{3}{4}$  of case study participants reported investigating the context of product use themselves in addition to asking stakeholders. Furthermore, responses from the survey (39/46) show client and/or customer consultation important to for the NPD team to know what the user wants in a product.
5. The findings show the vast majority of participants from the GA industry thought user involvement will help the creativity/ innovation in NPD teams. The GA industry seemed to be more open to involving the user in the PDP compared to the FI industry; it is not clear whether the nature of the product contributed to this observation.
6. Almost all participants were not aware of the ISO 13407 standard for human-centred processes, but were interested in learning about it.
7. The scoping study (interviews) revealed that two thirds of participants did little or no market research; instead, they relied on word of mouth for marketing and publicity. Investigating whether participating companies did market research was supposed to shed light into company's willingness to better understand what the user wants out of the product.
8. The scoping study reveals two thirds of participants reporting not having any other ties with training institutions; besides offering students internships. Overall, the majority of survey and interview participants reported educational institutions not offering the required skills and having more to learn from industry. This is not good because a better relationship between industry and education institution may lead to easier sharing of information and advances the design field as a whole.

### **10.6.3 Objective 4: Explore the teaching of UCD in industrial design training institutions in Botswana.**

1. Students are encouraged to solve real life problems with problem owners to consult with. Like in industry the customer/ client is mainly involved at the beginning and at the end of the product development process in student projects. The client is usually a proxy to the user needs and wants; and the message may be lost in the in the transmission.
2. It is also observed that the design schools introduce UCD into the curriculum late in the design education and this result in graduates with little experience of UCD practices. Students need to get familiar with the UCD practices earlier in the design education; where the success will be measured by the degree to which UCD practices are considered a permanent part of the PDP.
3. Both design schools measure UCD in student work through a comparison of the final solution to the user needs and the context analysed at the beginning of the project. This was a positive point for design education as the majority of the industry failed to document user and contextual needs of a product which are necessary to make this comparison.
4. Both industrial design programs claim their programs are influenced by industry need, but also admit the relationship can be improved.
5. Each university graduates approximately 10 students each year with a Bachelor's degree.

## **10.7 Contribution to knowledge**

The work in this thesis has provided a basis to understanding how UCD is practiced by Botswana's design industry and offers suggestions to how UCD practices can be improved.

### **10.7.1 Greater understanding of UCD use in Botswana's Design Industry**

The findings brought greater understanding of the level of Design Awareness (DA), Design Practice (DP) and User-centred design (UCD) in Botswana's design industry. Knowledge obtained from this study can be developed into a tool/ methodology to be used to facilitate UCD practices in NPD, in Botswana's design industry.

### **10.7.2 No one has done a detailed study on the use of UCD activities in Botswana industry.**

Knowledge gained from this research will contribute towards better understanding of the design theory, research and ultimately inform education and best practices in the design industry. There is a need for an established PDP in each company in order to effectively implement UCD practices.

### **10.7.3 Potential use of ISO 13407 for evaluating and guiding UCD activities in Botswana's Industry.**

- The questionnaire (derived from ISO 13407) from the retrospective case studies can be used as basis for a tool for evaluating and guiding UCD activities in Botswana's design industry and possibly to broader Botswana industry. More case studies in multiple design industries will lead to the evolution of the case study questionnaire to a tool or intervention for incorporation of UCD practices to PDP in Botswana's design industry and beyond.

### **10.7.4 The study identified the most important industry needs**

- Lack of documentation. The researcher views documentation as fundamental to improving the PDP and overall efficiency in the company.
- Client used as proxy representing the user. Lack of end user engagement during the PDP was observed and most got user data through the client.
- Poor links between educational institutions and industry. The only link identified was offering internship. Educational institutions and the industry need to develop this relationship in order to move the design profession forward. For example, company sponsored student projects, where companies get to have their problems solved while students gain invaluable experience.
- Poor knowledge of international standards and the lack of researching new ways to improving NPD. ISO standards should be viewed as a competitive advantage and not as a hindrance to NPD.

## 10.8 Recommendations

Table 55 represents study recommendations and the stakeholders (policy makers, educators and industry) responsible for each recommendation.

(PM = Policy Makers, EDU = Educators and IND = Industry)

**Table 55: Recommendations and responsibilities.**

<b>Recommendations</b>	<b>PM</b>	<b>EDU</b>	<b>IND</b>
Getting the earliest low functionality version of the product in the user's hands at the earliest opportunity (by FI industry) will lead towards more accurate and relevant customer feedback; hopefully leading to a better conceived product.			
Although the role of government in UCD policy formulation remains important, it is also important to have an established design policy to provide a foundation, which UCD policy can thrive.			
The adoption of ISO 13407 by the relevant stakeholders may lead to an organised user-involvement in NPD. However, the subjectivity of the design profession makes having a single standard for the whole design industry ineffective. Therefore, there is a need for ISO 13407 to be customised within the design industries.			
Design and UCD has to be at the core of Botswana Innovation Hub (BIH) objectives as it can act as an interface between the products produced and the end-user.			
The design industry in Botswana need to document PDP and UCD practices, this puts a company in a better position to review and improve design processes. Sometimes small companies work organically as there are fewer people (NPD teams); while larger companies are forced to have some sort of company centric process.			
UCD practices have to be distributed across the PDP, to provide an easier guideline for companies to follow as to when and how UCD practices in NPD. It is important to attach UCD practices to individual company PDP, for less complexity and more compatibility with the company.			
The majority of participants reported the lack of PDP's in their companies. For UCD practices to be applied successfully in NPD; PDP has to first be established and then UCD practices are implemented on top. This way the NPD team can just concentrate on optimising UCD practices. The responsibility of establishing a company-centric PDP lies with an individual company or entity as they have a better understanding of the product offering.			
There is a need for an organised documentation of PDP during NPD; reducing clutter and allowing easier access and review of the collected data.			
Establishment of a design policy that would help raise design awareness and the use of UCD practices in NPD. Furthermore, design policy may also facilitate funding for design research and drive economic diversification that has eluded Botswana. The researcher and educational institutions will have to lead the way to the establishment of the Design Policy in Botswana.			

## 10.9 Future Work

- Case studies will need to be conducted on a live project, where the researchers are observing what NPD team actually does and questions asked to clarify the observations. However, this approach needs involvement of more than one researcher to accommodate the potential vast amount of data produced and help in the analysis. The presence of the researcher may influence the way the NPD team approaches the project. Case studies on live projects are a primary responsibility of the researcher, educational institutions, future work academics, government and industry. This is because the case studies have to be organized and methodological in order to allow rigor and allow meaningful contribution to knowledge in this area.
- The responsibility to create a tool to facilitate the UCPDP lies in the collaboration of the researcher, educational institutions, individual companies and the industry. The researcher and educational institutions are in a position to provide information on the best practices (latest literature); while the industry and individual companies offer on-the-ground experience (PDP's and the application of UCD practices).
- The responsibility to merge the PDP's and UCD practices to come-up with UCPDP (User Centred Product Development Process) lies in the researcher's continuation of this study and the willingness of industry to adopt new PDP's. Given the subjectivity of the design process, it is important for the UCPDP to be customised for different sections of an industry to be effective. Company's own initiative to create its own UCPDP will ensure greater ownership of the change and hopefully lead to better results.
- Repeat the study on different Botswana industries to validate results from the case studies. The testing of the study findings will be done by the researcher and future work academics. This is expected to identify different industry patterns and then establish better ways to integrate PDP and UCD practices in different parts of industries.

- Since this study was based on the NPD team's perspective, it will have to be repeated from the user's perspective and then the results compared. Conducting the study from the user's perspective will be essential to verifying the results of this study; however this process will not be easy given the subjectivity of individual projects, but in the long run patterns in the data are expected to emerge. The use of ©Nvivo will be essential to easily compare old and new data. The responsibility to conduct these studies is with the researcher, educational institutions and future work academics.
- The results will be shared with companies that participated in the study and the relevant stakeholders. The researcher has the responsibility to share the results of this study, with the interested participants. The researcher will be attached to specific projects with interested companies in order to apply findings of this study and have a testing measure to allow the before and after comparison. Additionally, through LEA (Local Enterprise Authority), the researcher can also give seminars and find more ways to further test the study findings with companies at LEA's incubation centres across the country.

## **10.10 Conference papers written**

### **10.10.1 Paper 1**

Ollyn, M.G., Bibb, R.J., Torrens, G.E. and Molwane, O.B. **Determine the level of design awareness and investigate user-centred design (UCD) approaches in Botswana's companies.** Proceedings of the 2013 Gaborone International Design Conference (GIDEC 2013) Design Future: Creativity, Innovation and Development 24–26 September 2013, University of Botswana, Gaborone, Botswana.

### **10.10.2 Paper 2**

Ollyn, M.G., Bibb, R.J. and Torrens, G.E. **Is UCD approach applied by industry within Botswana? Case Studies on application of participatory approach to NPD.** Proceedings of the 2014 Design, Development and Research Conference with the conference theme: Design for participation: connecting disciplines, people and ideas will be held from 8-10 September 2014, Cape Peninsula University of Technology, Cape Town, South Africa.

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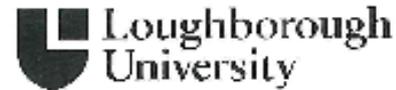
## **12 Appendices**

### **12.1 Ethics Clearance Documentation (LDS)**

## 12.1.1 Ethical Clearance Checklist

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ETHICAL ADVISORY COMMITTEE



### Ethical Clearance Checklist

(TO BE COMPLETED FOR ALL INVESTIGATIONS INVOLVING HUMAN PARTICIPANTS)

**If your research is being conducted off-campus and ethical approval has been granted by an external ethics committee, you may not need to seek full approval from the University Ethical Advisory Committee. However you will be expected to provide evidence of approval and the terms on which this approval has been granted.**

If you believe this statement applies to your research, please contact the Secretary of the Ethical Advisory Committee for confirmation.

**If your research is transferring into Loughborough University and approval was obtained from your originating institution, there is a requirement on the University to ensure that appropriate approvals are in place.**

If you believe this statement applies to your research, please contact the Secretary of the Ethical Advisory Committee with evidence of former approval and the terms on which this approval has been granted.

**It is the responsibility of the individual investigators to ensure that there is appropriate insurance cover for their investigation.**

If you are at all unsure about whether or not your study is covered, please contact the Finance Office to check.

### Section A: Investigators

#### Title of Investigation

**Optimising user-centred approaches to design practice in Botswana:  
Challenges for the Industry and Education Institutions**

#### **Name, Status and Email Address of Senior Investigators (University Staff Research Grade II and above):**

Mr. Matthews Olyn (PhD student), M.G.Olyn@lboro.ac.uk; Office: +44 1509 226971, Mobile: +44 7864154532

Dr. Richard Bibb, R.J.Bibb@lboro.ac.uk, +44 1509 228333

Mr. George Torrens, G.E.Torrens@lboro.ac.uk, +44 1509 222664

Loughborough Design School

Loughborough University, Loughborough, Leicestershire, LE11 3TU, UK

**Department:** Loughborough Design School

**Name, Status and Email Address of Other Investigators (other University Staff and Students):**

N/A

**Department:** N/A

A1. Do investigators have previous experience of, and/or adequate training in, the methods employed?

Yes  No<sup>†</sup>  <sup>†</sup>If No, Please provide details below

A2. Will junior researchers/students be under the direct supervision of an experienced member of staff?

Yes  No<sup>†</sup>  <sup>†</sup>If No, Please provide details below

A3. Will junior researchers/students be expected to undertake physically invasive procedures (not covered by a generic protocol) during the course of the research?

Yes<sup>†</sup>  No  <sup>†</sup>If Yes, Please provide details below

A4. Are researchers in a position of direct authority with regard to participants (eg academic staff using student participants, sports coaches using his/her athletes in training)?

Yes<sup>†</sup>  No  <sup>†</sup>If Yes, Please provide details below

**If you have selected one of the answers above marked with an † please provide additional information on how you intend to manage the issues (please continue onto a separate sheet if required), then submit this checklist to the Secretary to the EAC:**

## Section B: Participants

### Vulnerable Groups

Will participants be knowingly recruited from one or more of the following vulnerable groups?

- B1. Children under 18 years of age Yes<sup>†</sup>  No   
(please refer to published guidelines)
- B2. People over 65 years of age Yes<sup>†</sup>  No
- B3. Pregnant women Yes<sup>†</sup>  No
- B4. People with mental illness Yes<sup>†</sup>  No
- B5. Prisoners/Detained persons Yes<sup>†</sup>  No
- B6. Other vulnerable group (please specify \_\_\_\_\_) Yes<sup>†</sup>  No

**# If the procedure is covered by an existing generic protocol which refers specifically to the vulnerable group(s), please insert reference number here**

**If the procedure is not covered by an existing generic protocol, please submit a full application to the Ethical Advisory Committee**

### Chaperoning Participants

If appropriate, e.g. studies which involve vulnerable participants, taking physical measures or intrusion of participants' privacy:

B7. Will participants be chaperoned by more than one investigator at all times?

Yes  No\*  N/A<sup>1</sup>  <sup>1</sup>If N/A, please provide details below

B8. Will at least one investigator of the same sex as the participant(s) be present throughout the investigation?

Yes  No\*  N/A<sup>1</sup>  <sup>1</sup>If N/A, please provide details below

B9. Will participants be visited at home?

Yes\*  No  N/A<sup>1</sup>  <sup>1</sup>If N/A, please provide details below

\* Please submit a full application to the Ethical Advisory Committee.

**If you have selected one of the answers above marked with an + please provide additional information on how you intend to manage the issues (please continue onto a separate sheet if required), then submit this checklist to the Secretary to the EAC:**

## Section C: Methodology/Procedures

To the best of your knowledge, please indicate whether the proposed study:

C1. Involves taking bodily samples Yes\*  No   
(Please refer to [published guidelines](#))

C2. Involves procedures which are likely to cause physical, psychological, social or emotional distress to participants Yes\*  No

C3. Is designed to be challenging physically or psychologically in any way (includes any study involving physical exercise) Yes\*  No

**# If the procedure is covered by an existing generic protocol, please insert reference number here**

**If the procedure is not covered by an existing generic protocol, please submit a full application to the Ethical Advisory Committee**

C4. Exposes participants to risks or distress greater than those encountered in their normal lifestyle Yes\*  No

- C5. Involves collection of body secretions by invasive methods **Yes\***  **No**
- C6. Prescribes intake of compounds additional to daily diet or other dietary manipulation/supplementation **Yes\***  **No**
- C7. Involves testing new equipment **Yes\***  **No**
- C8. Involves pharmaceutical drugs **Yes\***  **No**   
(please refer to [published guidelines](#))
- C9. Involves use of radiation **Yes\***  **No**   
(please refer to [published guidelines](#)). Investigators should contact the University's Radiological Protection Officer before commencing any research which exposes participants to ionising radiation – e.g. x-rays).
- C10. Involves use of hazardous materials **Yes\***  **No**   
(please refer to [published guidelines](#))
- C11. Assists/affects the process of conception in any way **Yes\***  **No**
- C12. Involves methods of contraception **Yes\***  **No**
- C13. Involves genetic engineering **Yes\***  **No**

**\* If you have answered 'Yes' to any of the above please submit a full application to the Ethical Advisory Committee**

### Section D: Observation/Recording

- D1. Does the study involve observation and/or recording of participants?  
**Yes**  **No**  **If No, please go to Section E**

**If Yes,**

- D2. Will those being observed and/or recorded be informed that the observation and/or recording will take place? **Yes**  **No\***

**\* Please submit a full application to the Ethical Advisory Committee**

### Section E: Consent and Deception

- E1. Will participants give informed consent freely?  
**Yes**  **If yes** please complete the **Informed Consent** section below.  
**No\***  **\*If no,** please submit a full application to the Ethical Advisory Committee.

*Note: where it is impractical to gain individual consent from every participant, it is acceptable to allow individual participants to "opt out" rather than "opt in".*

#### **Informed Consent**

- E2. Will participants be fully informed of the objectives of the investigation and all details disclosed (preferably at the start of the study but where this would interfere with the study, at the end)? **Yes**  **No\***

E3. Will participants be fully informed of the use of the data collected (including, where applicable, any intellectual property arising from the research)?

Yes  No\*

E4. For children under the age of 18 or participants who have impairment of understanding or communication:

- will consent be obtained (either in writing or by some other means)?

Yes  No\*  N/A

- will consent be obtained from parents or other suitable person?

Yes  No\*  N/A

- will they be informed that they have the right to withdraw regardless of parental/guardian consent?

Yes  No\*  N/A

E5. For investigations conducted in schools, will approval be gained in advance from the Head-teacher and/or the Director of Education of the appropriate Local Education Authority

Yes  No\*  N/A

E6. For detained persons, members of the armed forces, employees, students and other persons judged to be under duress, will care be taken over gaining freely informed consent?

Yes  No\*  N/A

**\* Please submit a full application to the Ethical Advisory Committee**

### Deception

E7. Does the study involve deception of participants (ie withholding of information or the misleading of participants) which could potentially harm or exploit participants?

Yes  No  If No, please go to Section F

If yes,

E8. Is deception an unavoidable part of the study? Yes  No\*

E9. Will participants be de-briefed and the true object of the research revealed at the earliest stage upon completion of the study? Yes  No\*

E10. Has consideration been given on the way that participants will react to the withholding of information or deliberate deception? Yes  No\*

**\* Please submit a full application to the Ethical Advisory Committee**

### Section F: Withdrawal

F1. Will participants be informed of their right to withdraw from the investigation at any time and to require their own data to be destroyed? Yes  No\*

**\* Please submit a full application to the Ethical Advisory Committee**

### Section G: Storage of Data and Confidentiality

Please see University guidance on [Data Collection and Storage](#)

G1. Will all information on participants be treated as confidential and not identifiable unless agreed otherwise in advance, and subject to the requirements of law?

Yes  No\*

G2. Will storage of data comply with the Data Protection Act 1998?

(Please refer to [published guidelines](#))

Yes  No\*

G3. Will any video/audio recording of participants be kept in a secure place and not released for use by third parties?

Yes  No\*

G4. Will video/audio recordings be destroyed within six years of the completion of the investigation?

Yes  No\*

G5. Will full details regarding the storage and disposal of any human tissue samples be communicated to the participants?

Yes  No\*

**\* Please submit a full application to the Ethical Advisory Committee**

## Section H: Incentives

H1. Have incentives (other than those contractually agreed, salaries or basic expenses) been offered to the investigator to conduct the investigation?

Yes<sup>†</sup>  No  <sup>†</sup>If Yes, Please provide details below

H2. Will incentives (other than basic expenses) be offered to potential participants as an inducement to participate in the investigation?

Yes<sup>†</sup>  No  <sup>†</sup>If Yes, Please provide details below

**If you have selected one of the answers above marked with an † please provide additional information on how you intend to manage the issues (please continue onto a separate sheet if required), then submit this checklist to the Secretary to the EAC:**

## Section I: Work Outside of the United Kingdom

G1. Is your research being conducted outside of the United Kingdom?

Yes  No

If Yes, you may need additional insurance cover/clearance for your research.

If, having completed this checklist, you will be making a full application to the EAC this issue will be checked for you as a part of the process. If however you do not need to complete a full application please contact Hiten Patel ([H.Patel@lboro.ac.uk](mailto:H.Patel@lboro.ac.uk)).

## Section I: Declarations

### Checklist Application only:

If you have completed the checklist to the best of your knowledge without selecting an answer marked with an \* or †, your investigation is deemed to conform with the ethical checkpoints and you do not need to seek formal approval from the University's Ethical Advisory Committee. Please sign the declaration below, and lodge the completed checklist with your Head of Department or his/her nominee.

#### Declaration

I have read the University's Code of Practice on Investigations on Human Participants. I confirm that the above named investigation complies with published codes of conduct, ethical principles and guidelines of professional bodies associated with my research discipline. *Please sign below*

### Checklist with additional information to the Committee:

If, upon completion of the checklist you have **ONLY** selected answers which require additional information to be submitted with this checklist (indicated by a †), please ensure that all the information is provided in detail and send this checklist to the Secretary to the EAC.

### Full Application Needed:

If on completion of the checklist you have selected one or more answers which require the submission of a full proposal please download the relevant form from the Committee's [web page](#).

**A copy of this checklist, signed by your Head of Department should accompany the full submission to the Ethical Advisory Committee.**

Signature of Responsible Investigator

  
.....

Signature of Student (if appropriate)

 M.G. O'LEARY  
.....

Signature of Head of Department or his/her nominee

  
.....

Date

21/10/11  
.....

#### Advice to Participants following the investigation

##### Investigators have a duty of care to participants.

When planning research, investigators should consider what, if any, arrangements are needed to inform participants (or those legally responsible for the participants) of any **health related (or other) problems previously unrecognised in the participant**. This is particularly important if it is believed that by not doing so the **participants well being is endangered**. Investigators should consider whether or not it is appropriate to recommend that participants (or those legally responsible for the participants) seek qualified professional advice, but should not offer this advice personally. Investigators should familiarise themselves with the guidelines of professional bodies associated with their research.

## 12.1.2 Cover Letter

Loughborough Design School  
Loughborough University, Leicestershire, LE11 3TU, UK  
Tel: +44 (0)1509 226900 Fax: +44 (0)1509 226990  
E-mail: [DSoffice@lboro.ac.uk](mailto:DSoffice@lboro.ac.uk) [www.lboro.ac.uk/lbs](http://www.lboro.ac.uk/lbs)



Direct Line: +44 (0)1509 22654  
Fax: +44 (0)1509 226930  
E-mail: [g.g.torrens@lboro.ac.uk](mailto:g.g.torrens@lboro.ac.uk)  
<http://www.lboro.ac.uk/departments/ds/staff/academic/george-torrens.html>

21 October 2011

### To Whom It May Concern:

This letter serves to inform you that Mr. Matthews G. Olyn is PhD student at Loughborough University's Design School under the supervision of Dr. Richard Bibb and Mr. George Torrens. He has been with Loughborough Design School since April 2011 is expected to complete his research study sometime mid 2014.

Matthews is in a process of conducting a research study entitled, **Optimising user-centred approaches to design practice in Botswana: Challenges for the Industry and Education Institutions**. The study's objectives are to understand the current level of design awareness in Botswana and to investigate user involvement in the product development process in organizations and educational institutions. The study involves a series of interviews with government and industry associations, parastatals, manufacturers (furniture and building), and the industrial design schools (University of Botswana and Limkokwing University of Creative Technology). The intended participants will be 18 - 67 years old (above Botswana's age of consent and below the retirement age), employed, mentally stable, and able-bodied people.

The Ethical Advisory Committee at Loughborough University has cleared this study and all data will be held in compliance with the Data Protection Act (1998). All information collected on participants in this study will be treated as confidential and not identifiable unless agreed otherwise in advance. The results of the study will be shared with the participants, if they are interested.

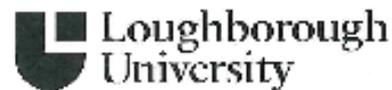
Matthews, is a lecturer at University of Botswana (Industrial Design and Technology Department) and is at Loughborough Design School on full scholarship from the University of Botswana. Your positive response regarding this matter is highly appreciated. Thank you for your co-operation.

Yours sincerely

A handwritten signature in blue ink, appearing to read 'G. Torrens'.

Mr. George Torrens

### 12.1.3 Participant Information Sheet



#### **Optimising user-centred approaches to design practice in Botswana: Challenges for the Industry and Education Institutions**

##### **Participant Information Sheet**

Mr. Matthews Olyn (PhD student), [M.G.Olyn@lboro.ac.uk](mailto:M.G.Olyn@lboro.ac.uk); +44 1509 226971, Mobile: +44 7864154532

Dr. Richard Bibb, [R.J.Bibb@lboro.ac.uk](mailto:R.J.Bibb@lboro.ac.uk), +44 1509 228333

Mr. George Torrens, [G.E.Torrens@lboro.ac.uk](mailto:G.E.Torrens@lboro.ac.uk), +44 1509 222664

Loughborough Design School

Loughborough University, Loughborough, Leicestershire, LE11 3TU, UK

##### **What is the purpose of the study?**

Optimising user-centred approaches to design practice in Botswana: Challenges for the Industry and Education Institutions

The aim of this pilot study is to understand current level of design awareness in Botswana and investigates the involvement of the user in the product development process in organisations and education institutions. It aims to investigate the introduction or optimisation of user-centred design (UCD) within the product design process in Botswana. The intended participants will be 18 - 67 years old (above Botswana's age of consent and below the retirement age), employed, mentally stable, and able-bodied people.

Objectives of the study are:

- Exploring attitudes/ awareness in the use of design.
- Exploring the training needs of companies in Botswana in relation to user-centred design (UCD).
- Exploring the teaching of UCD in Botswana's industrial design schools.

The investigators hope to attain some understanding of the level of design awareness in Botswana, explore how and the intensity at which an organization or company involves the user in the product development process, and lastly to find out user-centred design is taught or incorporated into Botswana's design education.

##### **Who is doing this research and why?**

The research, in the form of interview and observation will be conducted by Mr. Matthews Olyn. The supervisors are Dr. Richard Bibb and Mr. George Torrens. This study is a part of a student research project funded by Loughborough University.

##### **Once I take part, can I change my mind?**

Yes, if at any time, before, during or after the sessions you wish to withdraw from this study please contact the main investigator. You can withdraw at any time, and you will not be asked to explain your reasons for withdrawing.

**Will I be required to attend any sessions and where will these be?**

No other sessions will be required.

**How long will it take?**

Each interview is expected to last between 10 – 40 minutes.

**Is there anything I need to do before the sessions?**

Participants are not expected to do any preparations prior to the interview sessions.

**Is there anything I need to bring with me?**

Nothing additional is needed.

**Who should I send the questionnaire back to?**

To Mr. Matthews O'lynn, by email using [M.G.O'lynn@lboro.ac.uk](mailto:M.G.O'lynn@lboro.ac.uk) or by post at Loughborough Design School, Loughborough University, Loughborough, Leicestershire, LE11 3TU, UK

**What will I be asked to do?**

This is a single, semi-structured interview. The participants will be asked to answer questions relating to the above stated objectives and the attached questionnaire. Audio, photographs and video will be recorded at the participant's permission; the recorded material will be transcribed for further analysis.

**What personal information will be required from me?**

Name (optional):  
Position:  
Company/ organization:  
Industry/ products:

**Are there any risks in participating?**

There are no risks anticipated in this study, and your identity will be kept confidential.

**Will my taking part in this study be kept confidential?**

- Discuss the informed consent form.
- Information on participants will be treated as confidential and not identifiable unless agreed otherwise in advance.
- All written, audio, photographic or video records will be kept securely, used with written permission from you, and not given to any third parties.
- All data will be held in compliance with the Data Protection Act 1998 (United Kingdom).

**What will happen to the results of the study?**

Data collected (including photographic and audio recordings) will be used to define important issues highlighted by Botswana's manufacturers and design practitioners, alongside government officials. This information will inform further studies in this field.

**What do I get for participating?**

You will be informed about the outcomes of the study and aspects relevant to design practice in Botswana.

**I have some more questions who should I contact?**

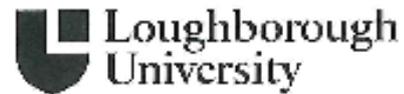
Mr. Matthews Olyn or other investigators listed at the beginning of this document. (Contact details as above)

**What if I am not happy with how the research was conducted?**

*The University has a policy relating to Research Misconduct and Whistle Blowing which is available online at [http://www.lboro.ac.uk/admin/committees/ethical/Whistleblowing\(2\).htm](http://www.lboro.ac.uk/admin/committees/ethical/Whistleblowing(2).htm).*

*A hard copy will be available at the interviews.*

#### 12.1.4 Informed consent form



### **Optimising user-centred approaches to design practice in Botswana: Challenges for the Industry and Education Institutions**

#### **INFORMED CONSENT FORM**

**(To be completed after Participant Information Sheet has been read)**

The purpose and details of this study have been explained to me. I understand that this study is designed to further scientific knowledge and that all procedures have been approved by the Loughborough University Ethical Advisory Committee.

I have read and understood the information sheet and this consent form.

I have had an opportunity to ask questions about my participation.

I understand that I am under no obligation to take part in the study.

I understand that I have the right to withdraw from this study at any stage for any reason, and that I will not be required to explain my reasons for withdrawing.

I understand that all the information I provide will be treated in strict confidence and will be kept anonymous and confidential to the researchers unless (under the statutory obligations of the agencies which the researchers are working with), it is judged that confidentiality will have to be breached for the safety of the participant or others.

I agree to participate in this study.

Your name \_\_\_\_\_

Your signature \_\_\_\_\_

Signature of investigator \_\_\_\_\_

Date \_\_\_\_\_

## 12.2 Scoping study interview framework

### 12.2.1 Scoping Study: Interview Framework

Government and industry organizations: PO: Patent Office, BIE: Botswana Institute of Engineers, AAB: Architecture Association of Botswana, BOCCIM: The Botswana Confederation of Commerce, Industry and Manpower, Botec: Botswana Technology Centre, RIIC: Rural Industries Innovation Centre.

**Industrial Design Education:** LUCT: Limkokwing University of Creative Technology, **UB:** University of Botswana (Industrial Design and Technology Department)

Interview Framework														
Objectives	Questions	Follow-up Questions	Government and industry organizations							Industrial Design Education		Manufacturing (Private Sector)		
			BOBS	BIE	AAB	PO	BOCCIM	Botec	RIIC	Limkokwing	UB	CEDA	LEA	Furniture & Building
Explore attitudes/ awareness in the use of design. (The design Ladder)	What is design?													
	What are advantages and added value of design?	What is the importance of design in a product development process?												
	To what extent are companies using the right people?	What are the qualifications of the personnel tasked with product development process in your organization?												
	At which stage of product development is design used?	Is design used at the beginning (planning), middle (development) or in preparation for product launch?												
	How professionally does the company organise the design process?	Who manages the product development process?												
	How do you measure the design effectiveness?	Successful products; What are the success factors?												
Explore the training needs of companies in Botswana in relation to UCD.	Is UCD part of the training given to companies?	How are companies taught or advised to incorporate users in their product development process?												
	How is UCD success measured?	After product launch is there follow-up on the product's performance on the market?												
	How are user needs obtained?	How do you decide which projects to pursue? How is relevant information obtained from the user?												
	Are there links with training institutions?	What type of employees are you looking for? Do you give feedback to training institutions?												
	When in the product development process is the user involved?	How is the user involved in a product development process?												
Explore the teaching of UCD in industrial design courses.	How many students graduate every year?													
	What are the levels of training? (Degree type)													
	How is UCD incorporated into student projects?	Is UCD introduced at the beginning (product need validation), product development or prototype testing?												
	At what study level is UCD introduced to students?	At graduation, how many years of UCD experience do the students have?												
	How is UCD measured in student work?	How is the use of UCD in student projects assessed?												
	To what extent is the training influenced by industry need?	Are there links with the industry and are there efforts directed at establishing these links?												

**Manufacturing (Private Sector):** CEDA: Citizen Entrepreneurial Development Agency, LEA: Local Enterprise Authority.

## 12.3 Survey Study Questionnaire

### 12.3.1 User-Centred Design Survey

You have been invited to participate in our study entitled,

#### **Implementing optimised user-centred approach to design practice in Botswana: Challenges for the Industry and Education Institutions**

##### *Definitions*

- **User** is a person that actually uses a product.
- **User-centred design (UCD)** is the involvement of the user in a product development process.

This survey is expected to take approximately 12 minutes. Please read each question carefully before answering on the spaces provided. We are interested on your personal experiences and opinions, thus there is no right or wrong answer. The study's objectives are to;

- Determine the level of design awareness in Botswana's companies.
- Ascertain current understanding of UCD in Botswana.

Your participation is strictly voluntary and you are allowed to withdraw from the survey if uneasy at answering any of the questions. The Ethical Advisory Committee at Loughborough University has cleared this study and all data will be held in compliance with the Data Protection Act (1998). All information collected on participants in this study will be treated as confidential and will remain strictly anonymous. The results of the study will be shared with the participants, if they are interested. The University has a policy relating to Research Misconduct and Whistle Blowing which is available online at [http://www.lboro.ac.uk/admin/committees/ethical/Whistleblowing\(2\).htm](http://www.lboro.ac.uk/admin/committees/ethical/Whistleblowing(2).htm).

Below are the researchers involved with this study;

Principal researcher: Mr. Matthews Olyn (PhD Researcher), M.G.Olyn@lboro.ac.uk; +44 1509 226971, Mobile: +44 7864154532; +267 72810901

Co-principal researchers: Dr. Richard Bibb, R.J.Bibb@lboro.ac.uk, +44 1509 228333  
Mr. George Torrens, G.E.Torrens@lboro.ac.uk, +44 1509 222664  
Loughborough Design School, Loughborough University,  
Loughborough, Leicestershire, LE11 3TU, UK

## Questionnaire

### 1. Participant

a. Name: \_\_\_\_\_

b. Gender:

Male

Female

c. Position in the company: \_\_\_\_\_

d. Education level (optional):

Certificate

Diploma

Bachelors

Masters

Doctorate

Other \_\_\_\_\_

e. Contact:

• E-mail: \_\_\_\_\_

• Tel: \_\_\_\_\_

### 2. Company

a. Name: \_\_\_\_\_

b. Number of employees:

1 – 10

11 – 20

21 – 30

31 and above.

c. How many years has the company been in business?

0 - 2 years

3 – 5 years

6 – 10 years

over 10 years

d. Location: \_\_\_\_\_

e. Website: \_\_\_\_\_

### 3. Does your company employ **qualified designers** for design related work?

YES

NO

a) If YES, are these designers **In-house, External or Both** (in-house and external)? Please choose one of the following options.

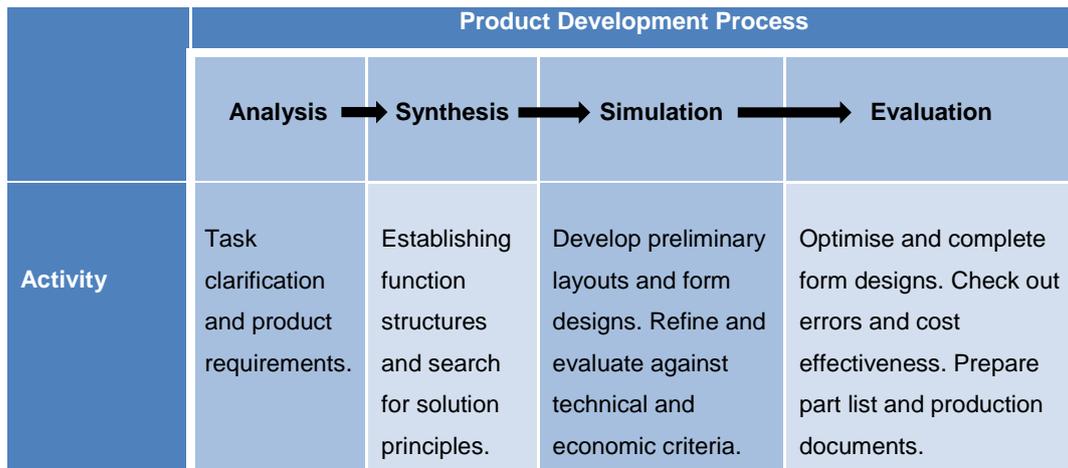
**In-house designers:** those employed by your company.

**External designers:** contract designer(s) brought in for specific jobs.

**Both:** in-house and external designers.

b) If NO, please could you explain why there are no designers to do design related work?

4. How important is **design at the following stages** of the product development process?



	Very Important	Important	Slightly Important	Neutral	Slightly un-important	Un-important	Not important
<b>Analysis</b>	<input type="checkbox"/>						
<b>Synthesis</b>	<input type="checkbox"/>						
<b>Simulation</b>	<input type="checkbox"/>						
<b>Evaluation</b>	<input type="checkbox"/>						

5. Does your company **document** the product development process?

YES

NO

Not sure

6. Please list different ways you use to **measure product's success**, (e.g. reviews, sales, profit etc.)

7. How important is **incorporating the user** into the product development process?

Very Important	Important	Slightly Important	Neutral	Slightly un-important	Un-important	Not important
<input type="checkbox"/>						

8. Do you think the user can **effectively share ideas** with the product development team?

Strongly agree	Agree	Slightly agree	Neutral	Slightly disagree	Disagree	Strongly disagree
<input type="checkbox"/>						

9. What is an **average time** spent on a typical project?

Less than 4 weeks	4 – 8 weeks	9 -12 weeks	13 – 16 weeks	More than 16 weeks
<input type="checkbox"/>				

10. On average, **how many projects** does your company run at the same time?

1	2	3	4	5	6 or more
<input type="checkbox"/>					

11. How do you know what product to develop? Please choose one of the following options.

**Product commission:** a client telling your company what they want.

**Product batch production:** company deciding which products to make.

**Both:** Product commission and batch production.

12. What is the *importance of design* in a product development process?

13. Do you get your *customers involved* in the product development process?

YES

NO

Not sure

14. Rate the *importance of the* following *people* to the product development process.

	Very Important	Important	Slightly important	Neutral	Slightly un-important	Un-important	Not important
Investors (owners)	<input type="checkbox"/>						
Suppliers	<input type="checkbox"/>						
Employees (designers)	<input type="checkbox"/>						
User	<input type="checkbox"/>						

15. During the product development process, rate the **importance of involving the user** at different design stages (**analysis, synthesis, simulation and evaluation**).

		Product Development Process			
		Analysis	Synthesis	Simulation	Evaluation
Activity		Analysis → Synthesis → Simulation → Evaluation			
		Task clarification and product requirements.	Establishing function structures and search for solution principles.	Develop preliminary layouts and form designs. Refine and evaluate against technical and economic criteria.	Optimise and complete form designs. Check out errors and cost effectiveness. Prepare part list and production documents.

	Very Important	Important	Slightly Important	Neutral	Slightly un-important	Un-important	Not important
Analysis	<input type="checkbox"/>						
Synthesis	<input type="checkbox"/>						
Simulation	<input type="checkbox"/>						
Evaluation	<input type="checkbox"/>						

16. The person purchasing a product is not always the user of the product. Are there efforts to go beyond the purchaser and **get in-touch** with the end-user?

YES

NO

a. Please provide a reason(s) for your answer.

17. How does your product development team know what the **customer wants** in a product?

(\* **Customer** is the person purchasing a product)

18. How does your product development team know what the **user wants** in a product?  
(\* **User** is a person that actually uses a product)
19. How is **ease of product use measured** during and after the product development process?
20. Does your company have **links with training** and/ or educational institutions?
- YES  NO
- a. Please provide a reason(s) for your answer
21. Does your company undertake **market research**? (i.e. attend trade shows, get feedback from customers/ clients, deploy sales people, exhibitions etc.)
- YES  NO  Not sure
22. Where do you see your company (**future plans**) in 5 years?
23. How do you plan to **improve the design** of your products over the next few years?

**Thank your cooperation!**

## 12.4 Interview Study Questionnaire

## 12.4.1 Interview Final Questionnaire

### **User-Centred Design (UCD) Interview** **Implementing optimised user-centred approach to design practice in** **Botswana: Challenges for the Industry and Education Institutions**

#### *Definitions*

- **User** is a person that actually uses a product.
- **User-centred design (UCD)** is the involvement of the user in a product development process.

The interviews target Graphic design and Furniture & interior companies identified from the surveys conducted earlier. The intended participants will be 18 - 67 years old (above Botswana's age of consent and below the retirement age), employed, mentally stable, and able-bodied people. The study's objectives are to;

- Determine the level of design awareness in Botswana's companies.
- Ascertain current understanding of user-centred design (UCD) in Botswana.
- Explore the training needs of companies in Botswana in relation to UCD.

Your participation is strictly voluntary and you are allowed to withdraw from the survey if uneasy at answering any of the questions. The Ethical Advisory Committee at Loughborough University has cleared this study and all data will be held in compliance with the Data Protection Act (1998). All information collected on participants in this study will be treated as confidential and will remain strictly anonymous. The results of the study will be shared with the participants, if they are interested. The University has a policy relating to Research Misconduct and Whistle Blowing which is available online at [http://www.lboro.ac.uk/admin/committees/ethical/Whistleblowing\(2\).htm](http://www.lboro.ac.uk/admin/committees/ethical/Whistleblowing(2).htm). Below are the researchers involved with this study;

PhD Researcher: Mr. Matthews Olyn (PhD Researcher), M.G.Olyn@lboro.ac.uk ; +44 1509 226971, Mobile: +44 7864154532

Supervisors: Dr. Richard Bibb, R.J.Bibb@lboro.ac.uk, +44 1509 228333  
George Torrens, G.E.Torrens@lboro.ac.uk, +44 1509222664

### Data Collection Techniques:

- Audio (Dicta-phone)
- Video (camera)
- Note taking

### Procedure

- *Red text represents follow-up questions.*
- *Both question and follow-up will be asked to all participants.*
- *The Basic Design Cycle: will be introduced to the respondent prior to starting the questionnaire. A separate copy will be printed and put in-front of the respondent.*

		Product Development Process			
		Analysis	Synthesis	Simulation	Evaluation
Activity	Task clarification and product requirements.	Establishing function structures and search for solution principles.	Develop preliminary layouts and form designs. Refine and evaluate against technical and economic criteria.	Optimise and complete form designs. Check out errors and cost effectiveness. Prepare part list and production documents.	

# Interview Questionnaire

**Objective 1: Determine the level of design awareness in Botswana's companies.**

1. Rank the following stakeholders in terms of their importance to product development. Rank the options 1, 2, 3 and 4 in order of importance with 1 being the most important stakeholder.

Stakeholder	Ranking
Investor	
Suppliers	
User	
Employees	

- a. Why the most important stakeholder?
  - b.
2. What is your definition of design, designer and designing?
  3. What is an added value of design? **How does design improve your product?**
  4. How do you measure the design effectiveness? **How do you know that a product is what the user wanted?**
  5. Which one of the following measures of product success is the most important? **[Happy client, product reviews and sales/ profit]. Rank the following measures of product success starting with the most important?** Rank the options 1, 2 and 3 in order of importance with 1 being the most important measure of success.

Measure of success	Ranking
Product reviews	
Sales/ profit	
Happy client	

- a. Why the most important measure of success?
6. How is your product development "process" documented? **What information do you document during the product development process?**

7. How many employees have been through a design school or equivalent? e.g. high school, college, university, etc. **The number of employees formally trained in the design field?**

**Objective 2: Ascertain current understanding of user-centred design (UCD) in Botswana.**

8. How can the user/ customer best share ideas? **Which mode of communication is most effective to sharing ideas between the user/ customer and product development team?**

Rank the options 1, 2 and 3 in order of importance; with 1 being the most important mode of communication.

Communication Mode	Ranking
Talking	
Drawings/images	
Written	

- a. **Why the most important mode of communication?**

9. At which stages of the product development cycle do you measure product usability?

Product development stages		Usability measurement
	<i>Simplified</i>	
Analysis	Start	
Synthesis	Middle	
Simulation		
Evaluation	End	

- a. **How do you measure the usability?**

10. What do you think are the implications of incorporating user on creativity and/ or innovation of NPD teams? **How do you think involving the user in product development team will impact the product produced?**

11. What is the best way to incorporating user's ideas into design decision making? **How do you incorporate user's ideas onto product development?**

12. When is it most crucial to involve the user in the product development process?

How are consultations with the customers conducted?

Rank the options 1, 2 and 3 in order of importance with 1 being the most important stage for user involvement.

Product development stages		Usability measurement
	<i>Simplified</i>	
Analysis	Start	
Synthesis	Middle	
Simulation		
Evaluation	End	

a. Why the most important product development stage?

**Objective 3: Explore the training needs of companies in Botswana in relation to UCD.**

13. How is your market research conducted? Can you briefly describe the methods you use to better understand the user of your product?

14. Besides, offering internships what type of a relationship would your company like to have with educational institutions? How do you think educational institutions can best contribute to your company's success or future?

15. Do you do any of the following activities UCD activities? Which of these activities do you do during the product development process?

ACTIVITIES	PRODUCT DEVELOPMENT PROCESS <i>(Simplified)</i>		
	START	MIDDLE	FINISH
Informal expert review.			
List tasks the users are to perform.			
Investigate characteristics of the intended users.			
Use of Storyboards, Mood boards and Scenarios			
The environment in which the users are to use the system (context).			
Confirmed by users or their representatives.			
Set quality in use objectives.			
Set measurable criteria for the resultant (usability).			
Use of mock-ups			
Simulated tasks, (sketches, 3D models, collect user-feedback).			
Specify system and use.			
Develop user training.			
Obtain design feedback (usability and design improvement).			
Assess whether objectives have been met.			
Field validation (evaluate in use).			
Long-term monitoring (support users).			

16. Are you willing to incorporate UCD activities to product development processes?  
Why?

17. Are you aware of the standards ISO 18529 (Human-centred design processes and practices) and ISO 13407 (User-centred design cycle)? Are you interested to working to these standards?

## 12.5 Case study Questionnaire

### 12.5.1 Information Extracted from ISO 13407 and ISO 9241-11 for questionnaire development.

#### Response Evaluation Guideline

<b>Planning the human-centered process</b>	
<b>Information Item (Question) and clause</b>	<b>EN ISO 13407: 1999 (guideline)</b>
List human-centered activities carried out during the study.	<ul style="list-style-type: none"> <li>a) Understanding and identifying the context of use,</li> <li>b) specifying user and organizational requirements,</li> <li>c) producing prototypes,</li> <li>d) Evaluating designs according to user criteria.</li> </ul>
What are the procedures followed for integrating human-centered activities with other development activities.	Design organizations should incorporate HCD into their existing internal procedures and development standards. I.e. organizational procedures for prototyping, testing, establishing appropriate user involvement.
The individuals and organization(s) responsible for HCD activities and the range of skills and viewpoints they provide.	Projects benefit from additional creativity and ideas from the interaction do members who, collectively have an extensive skill base.
Are there procedures for establishing feedback and communication on HCD activities as they affect other design activities and methods for recording these activities?	Some time is also required for effective communication among NPD team participants and for reconciling potential conflicts and trade-offs.
Do milestones during the design and development process have provisions for an iterative process?	Project planning should allow for iteration and for incorporating user feedback.
Did you have suitable timescales to allow feedback to be incorporated into the design schedule (including early stages).	Extra communication and discussion to identify and resolve problems early-on in the project can result in significant savings at later stages when changes are generally more costly.

<b>Specification of the context of use</b>	
<b>Information Item (Question) and clause</b>	<b>EN ISO 13407: 1999 (guideline) (EN ISO 9241-11:1998, page 8)</b>
How do you gather specifications on the range of intended users, tasks, equipment and environment? (7.2)	<p>Characteristics of the <b>users</b> can include knowledge, skill, experience, education, training, physical attributes, experience, habits, preferences and capabilities. If necessary, define characteristics of different types of users.</p> <p>The overall goals of use of the system. Characteristics of <b>tasks</b> that can influence usability should be described (frequency and duration). The description has to include the allocation of activities and operational steps between the human and technological resources.</p> <p>The <b>equipment</b> includes the hardware, software and materials to be used. Basic description, product id, functions</p> <p>The <b>environment</b> can include relevant standards, attributes of a wider technical environment (workplace, furniture), the ambient environment (temp., humidity), legislative environment and social and cultural environment.</p>
Which are the sources from which the context of use is derived? (7.2)	The characteristics of the intended users; The tasks the users are to perform, and The environment in which users are to use the system. If there are extensive results from user feedback, help desks and other data, these provide the basis for prioritizing user requirements for system modifications and changes.
Where is the evidence of conformation of context of use information?(7.2)	Use ISO 9241-11
Where is the evidence of the provision of context of use information to the NPD team? (7.2)	Use ISO 9241-11
Where is the evidence showing that the context of use has been used in the design process? (7.4.1)	Use ISO 9241-11

<b>Specification of the use and organizational requirements</b>	
<b>Information Item (Question) and clause</b>	<b>EN ISO 13407: 1999 (guideline)</b>
The range and relevance of users and other personnel in the design (7.3).	Required performance of the new system against operational and financial objectives; relevant statutory or legislative requirements, including safety and health; cooperating and communication between users and other relevant parties; the users' jobs (including the allocation of tasks, user's well-being, and motivation); Task performance; Work design and organization; management of change, including training and personnel to be involved; Feasibility of operation and maintenance; The human-computer interface and workstation design.
Statement of HCD goals (7.3)	Specifying the functional and other requirements for the product or system. For HCD, this activity should be extended to create an explicit statement of user and organizational requirements in relation to the context of use description.
Priorities for the different requirements (7.3)	User and organizational requirements should be derived and objectives set with appropriate trade-offs identified between the different requirements. This specification should define the "allocation of function" – the division of system tasks into those performed by humans and those performed by technology.
Criteria against which the design can be tested (7.3)	These requirements should be stated in terms that permit subsequent testing and should be confirmed or updated during the life of the project.
Evidence of confirmation of the above by users and their representatives (7.3)	
List of statutory or legislative requirements (7.3)	
Evidence that the requirements have been used in the design process (7.4.1)	

<b>Evaluation of designs against user requirements</b>	
<b>Information Item (Question) and clause</b>	<b>EN ISO 13407: 1999 (guideline)</b>
HCD goals to be evaluated.	Evaluation techniques vary in their degree of formality, rigor and user involvement, depending on the environment in which the evaluation is conducted. The choice is determined by financial and time constraints, the stage in the development life cycle and the nature of the system under development.
Evidence that an appropriate evaluation plan has been produced and followed.	What parts of the system are to be evaluated and how they are to be evaluated, for example, the use of test scenarios, mock-ups or prototypes. Feedback and use of results in other design activities. How evaluation is to be performed and the procedures for carrying out the tests. Resources required for evaluation and analysis of results and access to users (as necessary); scheduling of evaluation techniques and their relation to the project timeline.
Who is responsible for the evaluation.	
Evidence of the appropriateness of the test procedures.	An adequate number of users took part in the testing and these users were representative of those identified in the context of use; there was testing of major human-centered objectives; there were valid testing and data collection methods; there was appropriate treatment of test results; and the conditions of testing were appropriate.

<b>Evaluation of designs against user requirements: For user testing</b>	
<b>Information Item (Question) and clause</b>	<b>EN ISO 13407: 1999 (guideline)</b>
Definition of the context of use which was used as a basis for evaluation.	
Description of the user and organizational requirements.	
Description of the product tested and its status.	e.g. production prototype.
Description of the measurements undertaken, the users and the methods used.	
The methods and measures used and rationale for their use.	Depending on whether the purpose of the evaluation is to feedback to design, to test against specific standards or provide evidence of achieving human-centered goals (i.e. usability or user health and safety).
The results and relevant statistical analysis.	
Pass/fail decision in relation to the requirements.	

“Evaluation is an essential step in human-centred design and should take place at all stages in the system lifecycle”, ISO13407 (1999, p8).

## 12.5.2 Case Study Final Questionnaire

### User-Centred Design (UCD) Case Study

#### Implementing optimised user-centred approach to design practice in Botswana: Challenges for the Industry and Education Institutions

These case-studies will focus on reviewing a recently completed project in the four companies being investigated. Two companies from each of the two industries Furniture & Interior (FI) design and Graphic & Advertising (GA) design will be selected for the case studies. The intended participants will be 18 - 67 years old, employed, mentally stable, and able-bodied people. The study's objectives are to;

- Investigate the effectiveness of the product development process being followed within a company.
- Find out how the user is being incorporated/ involved in NPD.
- To what extent PDP is being documented within a company.

The participant's participation is strictly voluntary and you are allowed to withdraw from the study at any point during the data collection. The Ethical Advisory Committee at Loughborough University has cleared this study and all data will be held in compliance with the Data Protection Act (1998). All information collected on participants in this study will be treated as confidential and will remain strictly anonymous. The results of the study will be shared with the participants, if they are interested. The University has a policy relating to Research Misconduct and Whistle Blowing which is available online at [http://www.lboro.ac.uk/admin/committees/ethical/Whistleblowing\(2\).htm](http://www.lboro.ac.uk/admin/committees/ethical/Whistleblowing(2).htm). Below are the researchers involved with this study;

PhD Researcher: Mr. Matthews Olyn (PhD Researcher), M.G.Olyn@lboro.ac.uk ; +44 1509 226971, Mobile: +44 7864154532

Supervisors: Dr. Richard Bibb, R.J.Bibb@lboro.ac.uk, +44 1509 228333  
George Torrens, G.E.Torrens@lboro.ac.uk, +44 1509222664  
Loughborough Design School, Loughborough University,  
Loughborough, Leicestershire, LE11 3TU, UK

## Data Collection Techniques

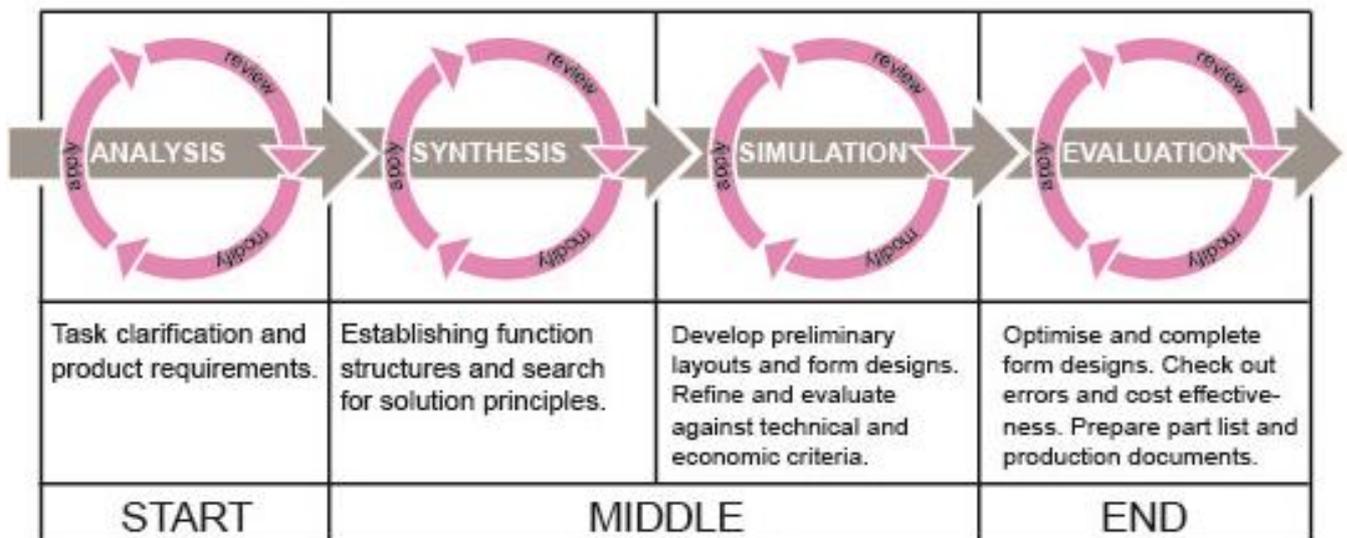
- Note taking.
- Audio (Dicta-phone)
- Images (camera)

## Procedure

- The researcher will review project documents provided by the company being investigated.
- The Basic Design Cycle: will be introduced to the respondent prior to starting the questionnaire.
- Semi-structured interview will be conducted to cover questions that were not answered by the documentation review.
- Information items (questions) that were not part of the project will be left blank.

## Product Development Process (PDP)

Derived from, The Basic Design Cycle.



Planning the human-centered process							
Information Item (Question) and clause	Documentation		When in the PDP?			EN ISO 13407: 1999 (guideline)	Project response and comments
	YES	NO	Start	Middle	End		
List human-centered activities carried out during the study. (6)						Understanding and identifying the context of use, specifying user and organizational requirements, producing prototypes, Evaluating designs according to user criteria.	
What are the procedures followed for integrating human-centered activities with other development activities. (6)						Design organizations should incorporate HCD into their existing internal procedures and development standards. I.e. organizational procedures for prototyping, testing, establishing appropriate user involvement. E.g. analysis, design and testing. The plan should be revised as requirements change and updated to reflect the status of activities.	
The individuals and organization(s) responsible for HCD activities and the range of skills and viewpoints they provide. (6)						Projects benefit from additional creativity and ideas from the interaction do members who collectively have an extensive skill base.	
Are there procedures for establishing feedback and communication on HCD activities as they affect other design activities and methods for recording these activities? (6)						Some time is also required for effective communication among design team participants and for reconciling potential conflicts and trade-offs.	
Do milestones during the design and development process have provisions for an iterative process? (6)						Project planning should allow for iteration and for incorporating user feedback.	
Did you have suitable timescales to allow feedback to be incorporated into the design schedule (including early stages). (6)						Extra communication and discussion to identify and resolve problems early-on in the project can result in significant savings at later stages when changes are generally more costly.	

Specification of the context of use [look at EN ISO 9241-11:1998]							
Information Item (Question) and clause	Documentation		When in the PDP?			EN ISO 13407: 1999 (guideline)	Project Response and comments
	YES	NO	Start	Middle	End		
How do you gather specifications on the range of intended users, tasks, equipment and environment? (7.2)						<p>Characteristics of the <b>users</b> can include knowledge, skill, experience, education, training, physical attributes, experience, habits, preferences and capabilities. If necessary, define characteristics of different types of users.</p> <p>The overall goals of use of the system. Characteristics of <b>tasks</b> that can influence usability should be described (frequency and duration). The description has to include the allocation of activities and operational steps between the human and technological resources.</p> <p>The <b>equipment</b> includes the hardware, software and materials to be used. Basic description, product id, functions</p> <p>The <b>environment</b> can include relevant standards, attributes of a wider technical environment (workplace, furniture), the ambient environment (temp., humidity), legislative environment and social and cultural environment.</p>	
What are the sources from which the context of use is derived? (7.2)						The characteristics of the intended users; The tasks the users are to perform; relevant characteristics of the equipment need to be described and The environment in which users are to use the system.	
Where is the evidence of conformation of context of use information?(7.2)						Use ISO 9241-11	
Where is the evidence of the provision of context of use information to the design team? (7.2)						Use ISO 9241-11	
Where is the evidence showing that the context of use has been used in the design process? (7.4.1)						Use ISO 9241-11	

Specification of the use and organizational requirements							
Information Item (Question) and clause	Documentation		When in the PDP?			EN ISO 13407: 1999 (guideline)	Project Response and comments
	YES	NO	Start	Middle	End		
What is the range and relevance of users and other personnel in the design? (7.3).						<p>Required performance of the new system against operational and financial objectives;</p> <p>Relevant statutory or legislative requirements, including safety and health;</p> <p>Cooperating and communication between users and other relevant parties;</p> <p>The users' jobs (including the allocation of tasks, user's well-being, and motivation);</p> <p>Task performance;</p> <p>Work design and organization;</p> <p>Management of change, including training and personnel to be involved;</p> <p>Feasibility of operation and maintenance;</p> <p>The human-computer interface and workstation design.</p>	
What is the STATEMENT for the HCD goals? (7.3)						Specifying the functional and other requirements for the product or system. For HCD, this activity should be extended to create an explicit statement of user and organizational requirements in relation to the context of use description.	
What were the PRIORITIES for the different requirements? (7.3)						User and organizational requirements should be derived and objectives set with appropriate trade-offs identified between the different requirements. This specification should define the "allocation of function" – the division of system tasks into those performed by humans and those performed by technology.	
What were the CRITERIA against which the design can be tested? (7.3)						These requirements should be stated in terms that permit subsequent testing and should be confirmed or updated during the life of the project.	
What is the EVIDENCE of confirmation of the above by users and their representatives? (7.3)							
List the statutory or legislative requirements? (7.3)							
What is the EVIDENCE that the requirements have been used in the design process? (7.4.1)							

Evaluation of designs against user requirements							
Information Item (Question) and clause	Documentation		When in the PDP?			EN ISO 13407: 1999 (guideline)	Project response and comments
	YES	NO	Start	Middle	End		
What are the HCD GOALS to be evaluated? (7.5.2).						The choice is determined by financial and time constraints, the stage in the development life cycle and the nature of the system under development. What parts of the system are to be evaluated and how they are to be evaluated, for example, the use of test scenarios, mock-ups or prototypes.	
What is the EVIDENCE that an appropriate evaluation plan has been produced and followed? (7.5.2).						Resources required for evaluation and analysis of results and access to users (as necessary); scheduling of evaluation techniques and their relation to the project timeline. Feedback and use of results in other design activities. (PDP)	
Who is RESPONSIBLE for the evaluation? (7.5.2)						How evaluation is to be performed and the procedures for carrying out the tests.	
What is the evidence of the APPROPRIATENESS of the test procedures (7.5.7.1)						An adequate number of users took part in the testing and these users were representative of those identified in the context of use; there was testing of major human-centered objectives; there were valid testing and data collection methods; there was appropriate treatment of test results; and the conditions of testing were appropriate.	
<b>For user testing:</b>							
What is the DEFINITION of the CONTEXT of use which was used as a basis for evaluation? (7.5.7.4).							
What is the DESCRIPTION of the user and organizational REQUIREMENTS? (7.5.7.4)							
What is the description of the product TESTED and its STATUS? (7.5.7.4)						e.g. production prototype, final model, mock-up..	
Describe the measurements undertaken, the users and the methods used? (7.5.74)							
What are METHODS and MEASURES used and rationale for their use? (7.5.7.1)						Depending on whether the purpose of the evaluation is to feedback to design, to test against specific standards or provide evidence of achieving human-centered goals (i.e. usability or user health and safety).	
What are the RESULTS and RELEVANT statistical ANALYSIS? (7.5.7.4)							
<b>Pass/fail</b> decision in relation to the requirements (7.5.7.4)							

## 12.6 Top 10 UCD practices

### 12.6.1 Number of coding references: Top ten UCD practices in AD case study

Figure 82 shows the top 10 performed activities, which received the most answers within each category. Nvivo was used to generate a list of the top 10 activities performed in this case study.

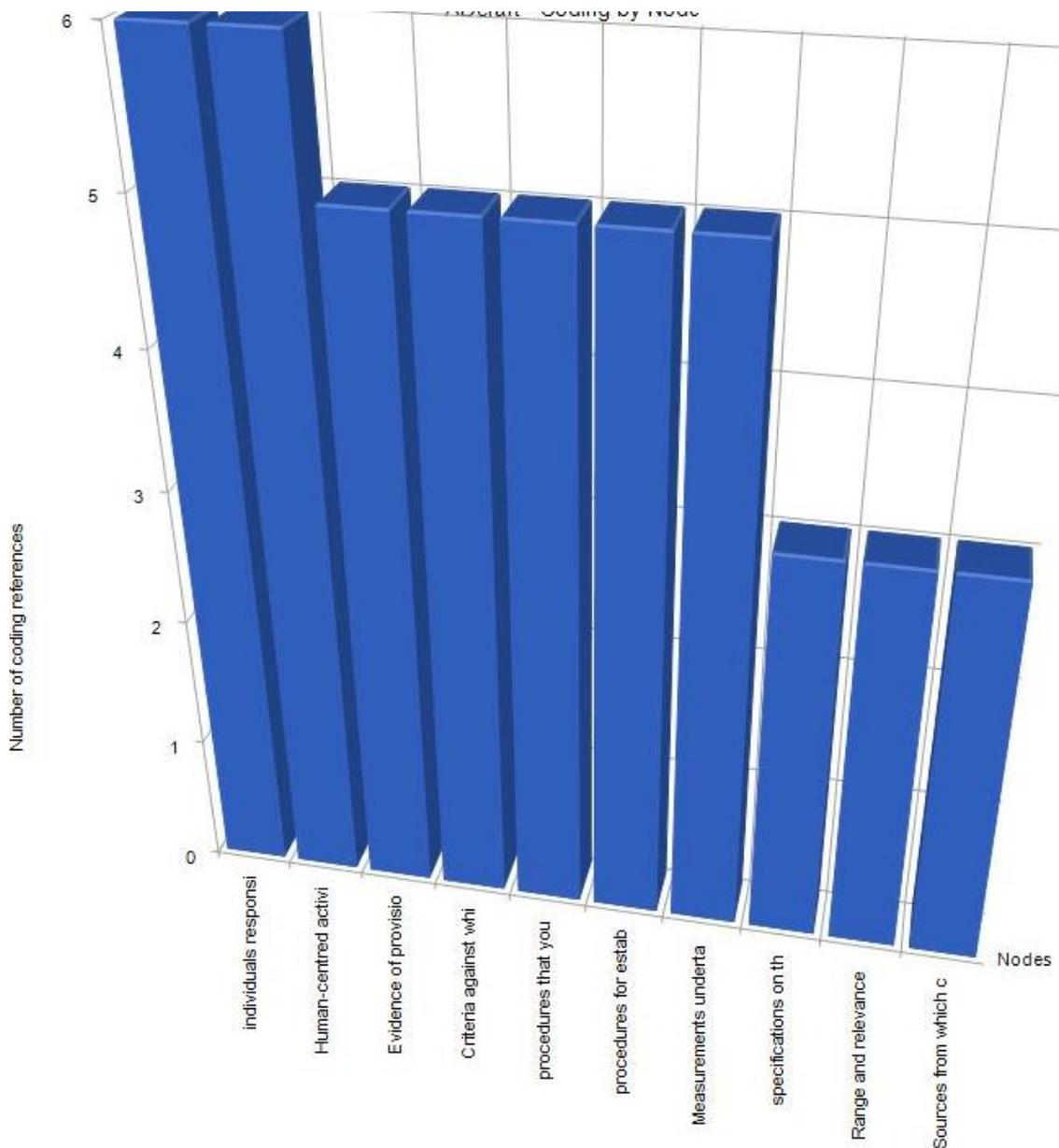


Figure 82: Top ten performed UCD practices in AD.

## 12.6.2 Number of coding references: Top ten UCD practices in VP case study

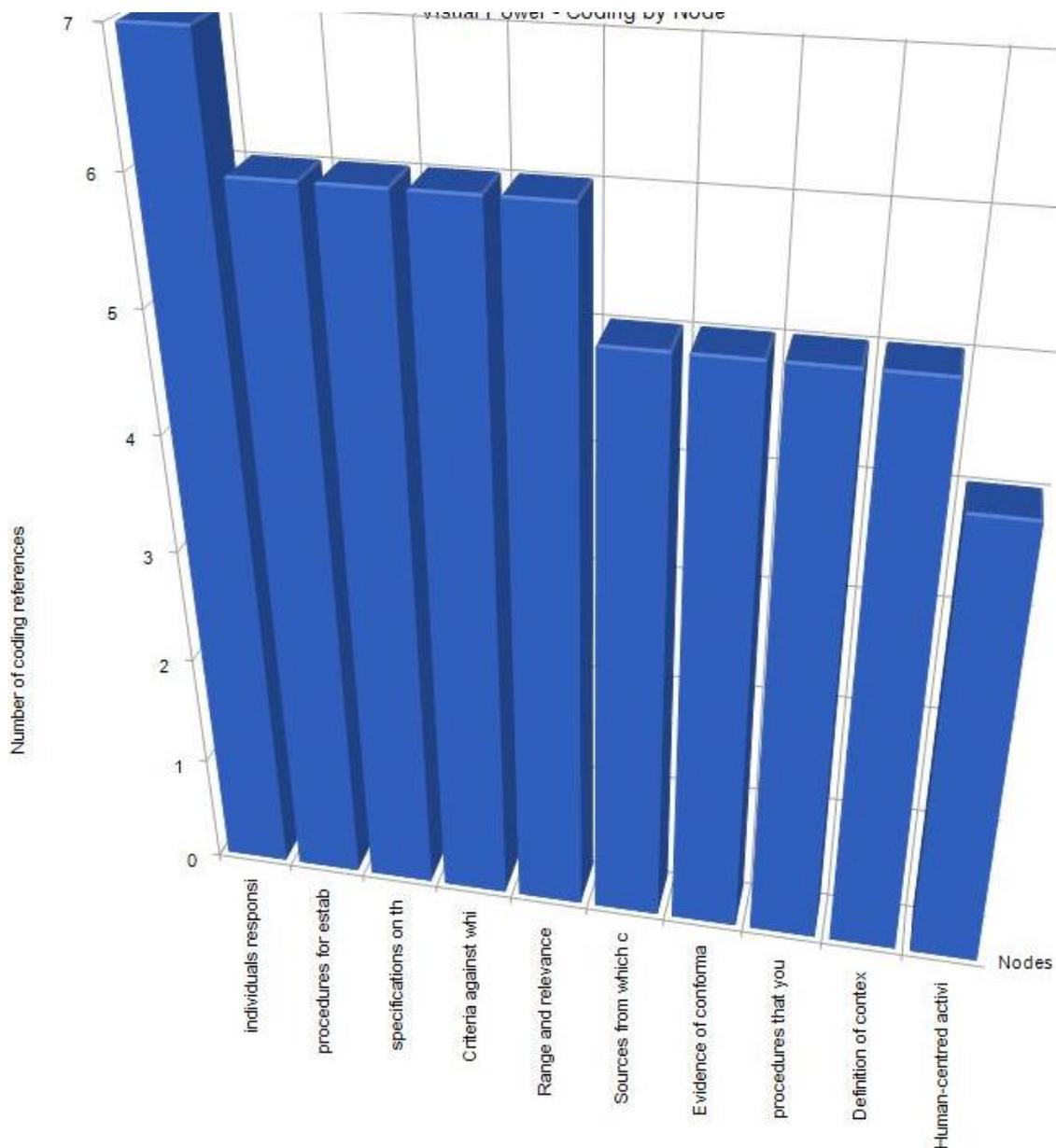


Figure 83: Top ten performed UCD practices in VP.

Figure 86, is an Nvivo generated graphic showing the top ten UCD practices performed in this case study. These are the questions that received the most responses in this case study. It is evident that the first three activities were similarly important, while the next seven UCD practices were relatively equally important.

### 12.6.3 Number of coding references: Top ten UCD practices in PJ case study

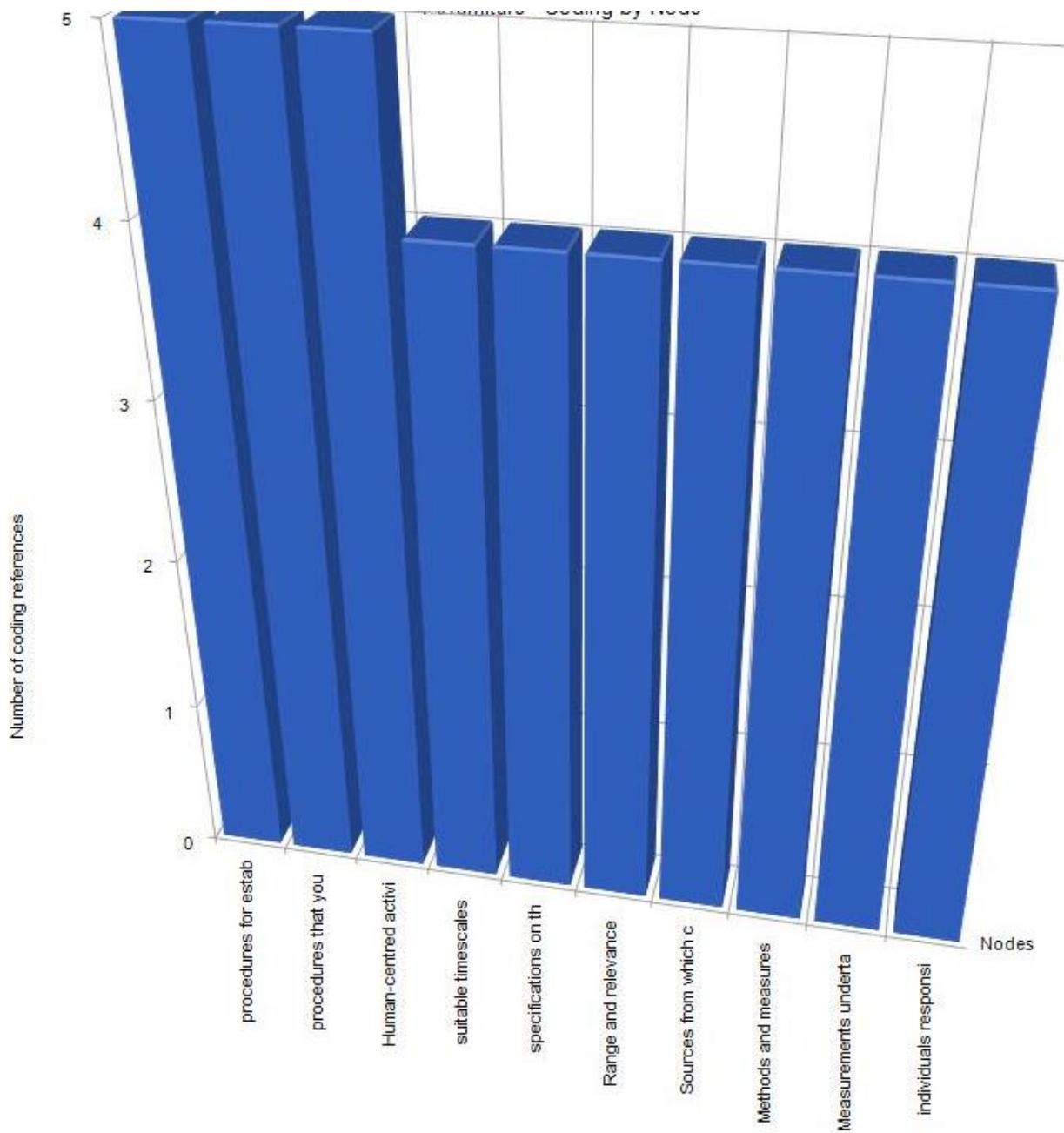


Figure 84: Top ten performed UCD practices in PJ.

### 12.6.4 Number of coding references: Top ten UCD practices in MJ case study

Figure 88 shows the top 10 performed UCD practices, which received the most answers within each category, generated through Nvivo.

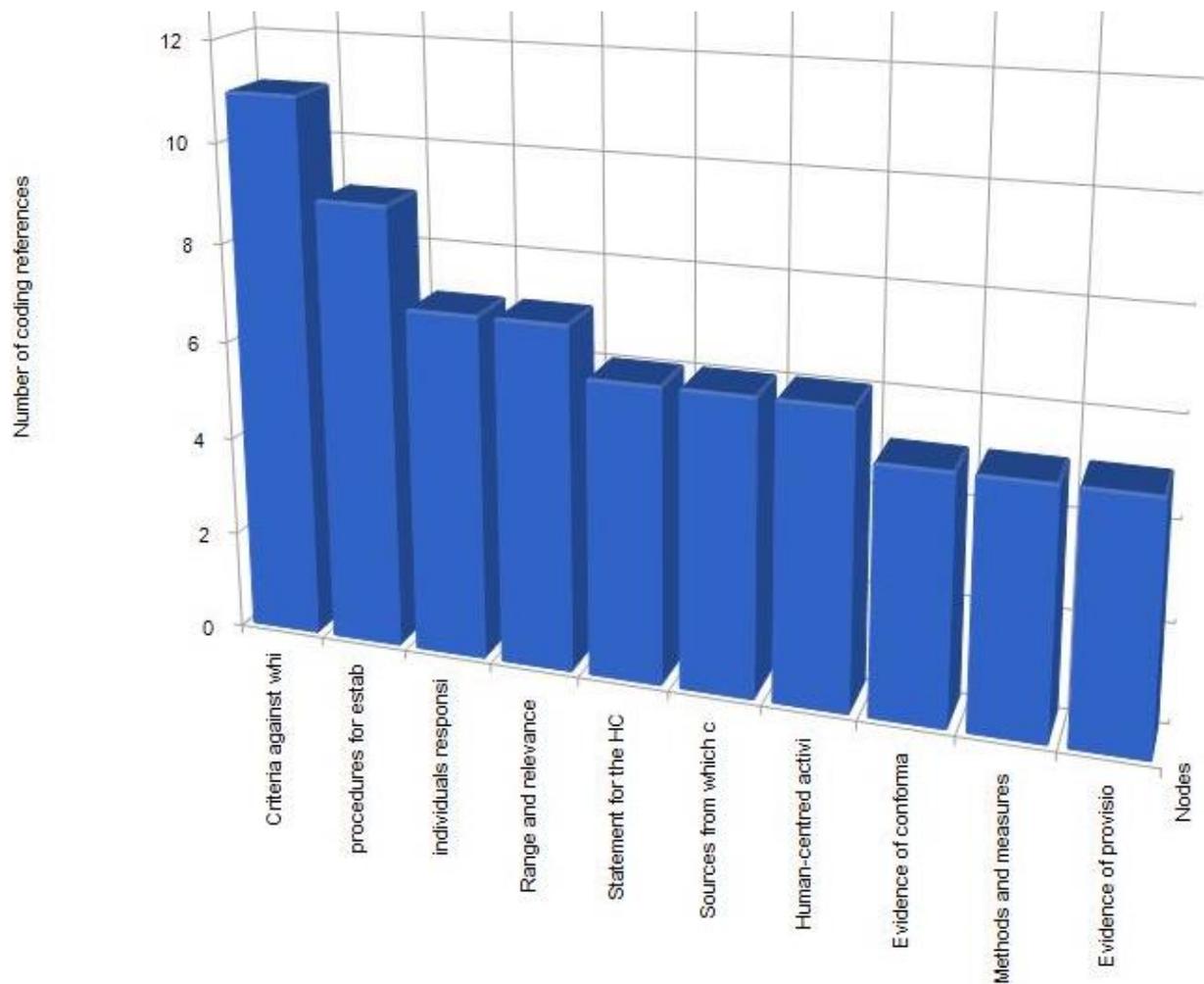


Figure 85: Top ten performed UCD practices in MJ.