CHAPTER 2: DESIGN PROCESS
2.1. Introduction:

“Design is a prediction concerned with how things ought to be. It is aimed at changing an existing situation into a preferred one.” (Popovic: 1999: 26)

“…design process / development process - the creative and problem-solving process by which a concept becomes a product ready for manufacture.” (Norris and Wilson, 1997, 30)

Having a methodology to work from assists the designer in developing products. This methodology in the industrial design field is known as design process. In my experience, industrial designers will evolve their own design processes that can assist in the development of products to fit the needs of their clients and the product users. These processes are likely to differ depending on the project requirements and the designers own expertise.

In Table 1, I summarise three design processes that I have identified. Within this table I look at the diverse processes and briefly compare the differentiation in these design processes.

<table>
<thead>
<tr>
<th>Process</th>
<th>Traditional Design Process</th>
<th>User-Centred Design Process</th>
<th>Community Centred Design Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Involvement</td>
<td>Users are included sporadically or not included at all</td>
<td>Fully integrated throughout process, users are vital to the process</td>
<td>Users are is the centre of process of design for new product to occur</td>
</tr>
<tr>
<td>Research</td>
<td>Market driven</td>
<td>User driven</td>
<td>Ethnographical type research</td>
</tr>
<tr>
<td>Product Solutions</td>
<td>Client / designer identifies problem Through market research, intuition, and basic user testing the solution is sought</td>
<td>Client/designer identifies problem Through observing the user and testing the users’ interaction with the product a solution is sought</td>
<td>User observation offers solutions for what type of product should be designed</td>
</tr>
<tr>
<td>End Result</td>
<td>Product</td>
<td>Product</td>
<td>New system or new product Not necessarily for commercial purposes</td>
</tr>
</tbody>
</table>

Table 2.1.: Comparison between the design processes
Most practicing designers have used the traditional design process\(^1\) as discussed in the first section of this chapter. For the most part this process would have been taught at the educational institution the designer attended or the designer would have learnt of these principles through publications they have read. The examples found in Lawson (1997) and Pugh (1991) give an indication of this early form of design process. The traditional design process has also formed the basis from which most new design processes have developed. Lessons learnt from using the traditional design process have helped to evolve areas of design thinking and the development of a variety of processes more appropriate to specialist product development needs. For most practising designers the use of the early form of traditional model design process is adequate for their own and their clients needs as this process is linear in nature and allows for simple sequential application to the product being designed. The shortcomings of using only the traditional design process may lie in the limited amount of attention paid to the products end user and this linear sequential nature of the process.

In the late 1960s and throughout the 1970s several conferences and several publications appeared globally in an attempt to try to get designers to move away from design for consumerism and begin to address real needs and real problems. “By the last years of that decade consumer awareness had given rise to what became known as, variously, the “responsible” design movement or the “socially useful product” debate” (Whiteley, 1993:94). The conferences and publications referred to by Whiteley (1993) include amongst others:

- “The Designer” (later to become the Chartered Society of Designers Journal) urged designers to be more “outward-looking and…ponder the relationship of design to society – its role and purpose” (Whiteley, 1993: 94)

\(^1\) In this chapter I use the term “traditional design process” loosely as an indication of the earliest writings on design processes.
• The French Group 1970 International Design Conference “lambasted designers for hollow concerns” and called for designers to become aware of the implications of design on the environment and people (Whiteley, 1993: 95)

• Victor Papanek’s (1985) Design for the Real World, first published in 1971, “became the bible of the responsible design movement” in which he indicated the greater need for awareness and design around poorer communities and ecological responsibility (Whiteley, 1993: 96)

• The UNIDO-ICSID conference at the National Institute of Design (NID) in 1979 that later led to the Ahmedabad Declaration gave a “plan of measures” included in which was the development of infrastructure to have “developing countries” help themselves through the setting up of industrial design training and competence. This would lead, according to the declaration, to designers who would show empathy and concern for the environment and people within the country that their design is intended for (Ahmedabad Declaration, 1979)

Whiteley (1993) discusses how these publications and conferences not only concerned themselves with the environment but also with design for poorer communities. Around this time there was a “spirit of dissatisfaction with the status quo in design” (Whiteley, 1993: 98). These conferences and Papaneks (1985) Design for the Real World can be traced as the beginning phase for three very specific directions in design process development: user centred, community centred and sustainable design. In this chapter I have included sections on user centred and community centred design. I have not included aspects of sustainable design as this area has, in my opinion, become an integral part of current design processes and design thinking.

2 “NID has been a pioneer in industrial design education after Bauhaus and Ulm in Germany and is known for its pursuit of design excellence to make Designed in India, Made for the World a reality.” (www.nid.edu, 2007)
In the user centered design process, discussed in the section 2 of this chapter, advanced user research and integrating these users into this design process is fundamental. Designers are able to learn directly from the user and gain a true understanding of how the product they are designing will need to work for the user. Issues such as ergonomics, user interface, and tactile response of the product are analysed by the designer not only to sell more products but also to give the end user greater benefits. This approach also helps to give the product an advantage over its competitors where the user may not have been considered as carefully. Much work has been done on design processes centred on the potential products users (Papanek, 1985; Morello, 1995; Green and Jordan, 1999; Index Magazine, 2007). Good examples are found in Green and Jordan’s (1999) Human Factors in Product Design, Morello’s (1995) “Discovering Design” Means [Re-] Discovering Users and Projects and on the Index Magazine website (www.indexaward.dk). These user centric approaches take the problem to be resolved or product area being designed around and then through testing and experimentation with the user result in solutions that fulfil these users’ needs.

The issue raised by designers in the 1960s and 1970s highlighted the need for designers to be more involved in design for society (Papanek, 1985; Whiteley, 1993). From this resulted, for some designers, a change in approach to design (Whiteley, 1993). Technology transfer, appropriate technology and socially responsible design approaches became an alternative to the traditional design process aimed at market-led consumerism (Whiteley, 1993). In 1999 I became involved in the first Interdesign on Water issues, held in South Africa, and have since been involved in the second South African Interdesign on Sustainable Rural Transportation in 2005 and a community project on issues related to rice production in India in 2006. From my experiences in the first Interdesign combined with my experience in commercial design
practice I have developed a community centred design process which I have tested on two occasions: the Interdesign 2005 and the rice project in 2006. The process developed for these community centred projects involves the designer to be intimately involved within the community and for the designer to develop an understanding of potential needs or better systems without a preconceived notion of what the solution should be. The process combines aspects of the traditional design process, user centred process, appropriate technology and socially responsible design. I elaborate on this process in the third section of this chapter.

In the concluding section of this chapter I suggest a design process that could be applied to the development of products for developing communities in South Africa. Through this process I hope to devise a system that could be used in the design of projects, such as safer paraffin stoves, within the South African context. This also becomes the underlying research methodology for the rest of this dissertation.

2.2. The Traditional Design Process

“During the first half of this century, the product development process was entrusted to technical specialists working in conjunction with humanist designers. The appearance of the marketing specialist during the second half of this century meant that designers could further abdicate their role of generalist in the product development process.” (Zaccai: 1995: 8)

According to Zaccai (1995), the first part of the 20th century was dominated by engineering-led design and the second half by marketing-led design. Both the engineering and marketing led design processes fall under the umbrella of what I define loosely as the traditional design process, from which other more recent design processes have evolved.

This first section of Chapter 2 discusses the evolution of the traditional process from a simple linear approach to design processes to a more complex system of constant re-evaluation of each phase during the design process.
2.2.1. The evolution of the design process

2.2.1.(i.) The Industrial Revolution and the emergence of industrial design

“The origins of industrial design can be traced back to the Industrial Revolution which began in Great Britain in the mid-18th century, and which heralded the era of mechanization. Prior to this, objects were craft produced, whereby both the conception and the manufacture of an object were the work of a single individual. With the development of new industrial manufacturing processes and the division of labour, design (conception and planning) was progressively separated from the act of making.” (Fiell and Fiell, 2006: 07)

The Industrial Revolution changed the manner in which products were made. The change was from labour intensive handmade low production runs to machine made mass manufacture, as new production processes were developed (Pevsner, 1981). The “continuing expansion of trade and commercial opportunities…” (Heskett, 1980: 11) at the end of the medieval phase in history, in cities in Western Europe, advanced the need for processes that would enable massive reproduction of craft products (Heskett, 1980). These commercial opportunities led manufacturers to realise that in order to fulfil these needs, manufacturing technology needed to be advanced (Heskett, 1980). During this period there was a great deal of invention and evolution of technologies, generating new possibilities in material conversion for manufacture (Pevsner, 1981: 44).

It was suggested that “…the Industrial Revolution initiated a shift from craft to mass production and with it a separation of the design process from the actual manufacture of an object” (Poister, 2006: 05). This separation of design from manufacture was as a result of the division of labour (Poister, 2006). This division of labour removed the designer from the making and liberated the designer to concentrate on the design of products for the mass manufacture processes emerging at the time. Fiell and Fiell (2006) call this division of labour the separating out of the function “…design (conception and planning)…” and manufacture
which have become the founding principles of how design has, over time, become more of an intellectual practice than a making practice (Fiell and Fiell, 2006).

“At this early stage, however, design had no intellectual, theoretical or philosophical foundation and was considered just one of the many interrelated aspects of mechanical production. Thus industrial goods of the years up to the 19th century were created by specialists from the technical, materials and production spheres rather than by an industrial designer. Towards the end of the 19th century, however, manufacturers began to realise that they could gain critical competitive advantage by improving the constructional integrity and aesthetic appearance of their products. As a consequence, they began to invite specialists from other spheres – most notably, architects – to contribute to the design process.” (Fiell and Fiell, 2006: 07)

The emergence of a specialist in the field evolved from that period into the modern industrial designer. This new field developed from the “… concept of industrial art which originated and prevailed in the countries of Western Europe during the post-Industrial Revolution period. New and rapidly developing industries… felt the need to apply artistic concepts to mass production and therefore, sought to effect a transition from individually-crafted, traditional objects to the new machine-made products. The term industrial art later on became ‘Design’ so as to encompass a wider field” (Balaram, 1998: 15). “Industrial design subsequently became a fully-fledged discipline in the early 20th century, when theory was integrated into industrial methods of production” (Fiell and Fiell, 2006: 07).

The notion of a design process began to evolve alongside this new specialist, although it was not until the 20th century that written versions these processes for began to appear.

2.2.1.(ii.)Engineering-led design (linear models):

Although I must assume that engineers and the industrial artists practicing before the 1960’s used a process to assist the design for mass manufacture in the period during the Industrial Revolution, it is difficult to find written evidence of this. The first writing about design processes appear in the late 20th Century and even these don’t indicate the origins of design
processes (Pugh, 1991; Wright, 1998; Lawson, 1997; Olewnik, 2002; von Stamm, 2003). Individuals involved in design may have adopted informal processes that made their system of working easier. Olewnik (2002) suggests that the Ford factory (established in June 1903) when setting up the assembly line, produced the first formal evidence of a design process (Olewnik, 2002: 2). Most of the design processes written up were for the architectural and engineering fields rather than for industrial designers. The processes were, however, universal in their systematic approach to developing a solution for the design issue at hand and were easily translatable to suit industrial designers.

Von Stamm (2003) sites NASA’s Phased Project Planning as the earliest design process for the development of large engineering projects: “One of the biggest influences on how companies approach product development in the West has been a concept developed by NASA in the 1960’s, introduced to make the management of large scale, complex defence projects easier. The first version, “Phased Project Planning”, as it was called, described a basically sequential approach consisting of four phases:

- Preliminary analysis (phase A)
- Definition (phase B)
- Design (phase C)
- Operation (phase D)

…checkpoint reviews were introduced to ensure that mistakes would not be carried forward into the next phase” (von Stamm, 2003: 39). This process was originally intended for large scale engineering type projects but could be adapted to suit all product development projects.

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3 “Ford’s introduction of the assembly line was the first step in a formal design process. Though it brought accuracy to manufacturing, the process failed to offer choice to the customer [1]. The evolution of mass production brought about efficiency in design while maintaining accuracy, however, consumer choice was still not an option.” (Olewnik, 2002: 2)

The system of phases and checks/reviews is still in use today in many of the engineering based design processes such as the Stage Gate Process (von Stamm, 2003).

The Royal Institute of British Architects (RIBA) set up a fundamental design process that allowed for payable and deliverable stages between the client and the architect in the design of a building (Lawson, 1997). “The most widely used model of building design is the RIBA Plan of Work for Design Team Operation. This sets out the details of work to be carried out by each profession during each stage of the process, but differs from most other models in that it does not show “links” of information between activities to indicate how particular tasks are related” (Austin, Baldwin, Li and Waskett, 1999: 281). In 1965 RIBA produced a handbook for Architects: The Architectural Practice and Management Handbook in which was carefully laid out this design process:

- “Phase 1 assimilation: The accumulation and ordering of general information and information specifically related to the problem in hand.
- Phase 2 general study: The investigation of the nature of the problem. The investigation of possible solutions or means of solution.
- Phase 3 development: The development and refinement of one or more of the tentative solutions isolated during Phase 2.
- Phase 4 communication: The communication of one or more solutions to people inside or outside the design team” (Lawson, 1997: 32).

These phases are not necessarily sequential, according to Lawson’s (1997) understanding of the handbook, and could have several phases revisited and re-addressed during the design process. However, Luck, Haenlin and Bright (2001) contradict Lawson by stating: “The sequential nature of the Plan of Work was criticised and a revised method …was developed to suit different …methods and recognise the iterative nature of stages of the construction
process” (Luck, Haenlin and Bright, 2001: 298). The RIBA Plan of Work was developed specifically for architects and was seen as a tool to assist the architect and client in setting in place phased stages for the payment of work to date (Lawson, 1997). It is for this reason that the process is linear; if the architect and client were to revisit previous stages then the original payment schedule would need to be revisited and revised.

Swann (2002) indicates that “in the 1960-70’s, there was considerable thinking and writing which had an enormous impact on the concept of the method and practice of design, particularly as related to industrial design areas. The theoretical work of designers coming from an engineering background promoted a ‘scientific method’ to be applied to design problem solving” (Swann, 2002: 50). Swann (2002) sites John Christopher Jones, Bruce Archer and Nigel Cross as having developed the “bibles” for industrial design process. These processes were based on the import of methodologies from engineering practice whereby they applied “…rational approaches to design that established a basis of research, analysis, synthesis, production and evaluation.” (Swann, 2002: 50) This fundamental system, according to Swann (2002), of “problem / research – analysis – synthesis – execution - production – evaluation” (Swann, 2002: 53) (with the addition of problem and execution) became the basis for design process education and practice in the 1960’s and 1970’s (Swann, 2002) and reflects the fundamentals of the NASA Phased Project Planning: Preliminary analysis - Definition - Design - Operation (von Stamm, 2003).

These earliest forms of design process (NASA, RIBA and the Jones, Archer, Cross system (Swann, 2002)) are the fundamental basis from which most design processes have evolved for the industrial design field. In fact these fundamentals may have changed name, but have not necessarily changed sequence.
2.2.1.(iii.) Marketing-led design (linear model):

Since the publication of the NASA Phased Project Planning (von Stamm, 2003) and Jones, Archer, Cross system (Swann, 2002) there has been an evolution in engineering and design processes. However, according to Luck, Haenlin and Bright (2001) the fundamental of the RIBA Plan of Work process has remained relatively unchanged in the architectural field and to some extent is still in use today (Austin, 2001; Luck, Haenlin and Bright, 2001). The processes that initially evolved from the NASA Phased Project Planning and the Jones, Archer, Cross systems were linear in nature and a good example of this early development can be seen in French’s 1971 process shown in Table 2 (Wright, 1998). The linear sequential process made the management of product development projects easier by being able to set deadlines to a set of deliverable at each stage similar to the intention of the RIBA Plan of Work process (Lawson, 1997). In the 1990’s there was a shift from the linear, sequential design processes to more integrated and dynamic systems; as shown by Pugh’s 1991 Total Design process in Table 3. These newer systems allowed for a flow of ideas and a re-examination of previous stage decisions which were more difficult to achieve in the sequential linear processes (von Stamm, 2003).
An evolution from the NASA Phased Project Planning and the Jones, Archer, Cross systems can be found in the French process from 1971 (Wright, 1998: 2). This was not a significant step forward, but was directed at industrial designers and engineers rather than architects or only engineers. More significantly it was intended for the development of products rather than buildings or massive engineering projects and as such has become the framework for most of the processes that followed (Wright, 1998). It also clearly reflects some of the fundamentals
from the NASA Phased Project Planning and the Jones, Archer, Cross systems i.e. “problem / research – analysis – synthesis – execution - production – evaluation” (Swann, 2002: 53)

The French 1971 (Wright, 1998) design process shows how these early design processes lacked an inclusion of the user in the development of the product. “Determination of customer requirements” as shown in the French 1971 (Wright, 1998) process is a broad term used in this processes context to describe marketing reports (often in-house) in organisations (Wright, 1998). These reports would give the designer a company understanding of their market principle from which to work from. This could be problematic if the company did not have a good market research system or if the designer was unable to interpret the report for product design requirements. Additionally, this report features in the first stage of the project only and is not specifically revisited to test solutions against at a later development stage.

The concern with linear type design processes such as French’s 1971 (Wright, 1998) process is that mistakes made early on in a project appear to be built upon or the project is stopped as the solution fails. “The sequential approach is described as “relay race” where the baton is passed from one department to the next, often requiring changes to accommodate requirements of a downstream department” (von Stamm, 2003: 40). The corrective measure would need to be revisited at certain stages, but as these have not been accommodated for by the designer or client in the original brief it is often difficult to do so without requiring a new start to the project (von Stamm, 2003).

2.2.1.(iv.) Marketing-led design (integrated model):

Possibly the largest difference between these newly emerging industrial design / engineering based design processes and the RIBA process is that “The RIBA Plan of Work … linked the
client brief to stages of the construction process” (Luck, Haenlin and Bright, 2001: 297) where the industrial design / engineering processes were completely integral to all aspects of the development of the product process and needed to be informed by every department within a company: from design to marketing to manufacture. (von Stamm, 2003). So the idea of moving from a strictly linear process to one in which stages in the design process were frequently revisited became the core for newer processes such as Pugh’s (1991) Total Design Process. Further development of design processes in later stages of the 1980s through the 1990s evolved into processes which carefully considered the non-systematic nature of design i.e. integrated models (von Stamm, 2003). von Stamm uses the analogy of sport to highlight the differences between earlier sequential / linear design processes and the newer integrated versions by indicating the contrast of “…the relay (sequential sequence)…” with the new approach as a “…‘rugby game’, in which the product is passed back and forth between the different departments, like the ball in rugby.” The “…advantages of the new approach include not only increased speed, but also greater consistency and integrity of the product, because of the early consideration of concerns and requirements from all departments involved in a product’s development process” (von Stamm, 2003: 41). These newer processes allowed for the reverting back to previous stages throughout the design process. It is noticeable that the process has gained complexity and each phase has become elaborate and more specific.
Table 2.3.: Total Design: Design Core (Pugh, 1991: 220)

According to Austin, Baldwin, Li and Waskett (1999) “Among the best known models is Pugh’s “total design” model, generically covering all design processes” (Austin, Baldwin, Li and Waskett, 1999: 281). The Total Design Process (Pugh, 1991) begins to unpack and
closely examine all the issues of each phase in the design process. These inputs add value at different times during the products development. Each phase has a return to the previous stage in the flow diagram, allowing mistakes made or incorrect decisions to be revisited during the process and corrected (Pugh, 1991).

“Total design is the systematic activity necessary from the identification of the market / user need, to the selling of the successful product to satisfy that need – an activity that encompasses product, process, people and organisation” (Pugh, 1991: 5). Although more inclusive of the user throughout the product development process than its predecessors, the Total Design (Pugh, 1991) process proposes investigating the user on a marketing level rather than as the core concern that later user centred processes promoted in the late 1980’s through to today (Luck, Haenlin and Bright, 2001; Ranjan, 2004; Black, 2005; Zaccai, 1995; Popovic, 1999). Voice of the Customer (Pugh, 1991) which appears several times during the Total Design process (Pugh, 1991) is, according to Wikipedia, “a market research technique that produces a detailed set of customer wants and needs, organized into a hierarchical structure, and then prioritized in terms of relative importance and satisfaction with current alternatives” (en.wikipedia.org). So, it is essentially a marketing tool that gives a set of marketing based variables instead of an in depth understanding of the user. Pugh states that “what might be termed the “front end” of design is still not handled at all well” (Pugh, 1991: 29). Pugh also describes the concept of understanding the user from the marketing perspective: “The starting point for any design should be the establishment of the market/user need situation in considerable depth. It is common practice to produce a ‘brief’, at this stage. This can vary from the simplest statement of requirement …to a comprehensive document that aptly describes the true user needs” (Pugh, 1991: 30). By this, the implication is that there was a need for a better research of the user, but because most companies involved in design during
this era were essentially marketing driven (Zacai, 1995) the user did not inform the process of development, nor did the user have much impact in later stages of the design process.

2.2.2. Evolving design processes

Von Stamm (2003) summarises the principle of the changing emphasis in design processes through the 20th century with the table summary of the generations of design processes:

<table>
<thead>
<tr>
<th>Generation</th>
<th>Type of Model</th>
<th>Characteristics of model</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>Technology push model</td>
<td>Simple linear sequential process; emphasis on R&amp;D, the market is a receptacle for the fruits of R&amp;D</td>
</tr>
<tr>
<td>Second</td>
<td>Need pull model</td>
<td>Simple linear sequential process; emphasis on marketing; the market is the source of ideas for directing R&amp;D; R&amp;D has a reactive role</td>
</tr>
<tr>
<td>Third</td>
<td>Coupling model</td>
<td>Sequential but with feedback loops; push or pull/pull combinations; R&amp;D and marketing more in balance; emphasis on integration at the R&amp;D/marketing interface</td>
</tr>
<tr>
<td>Fourth</td>
<td>Integrated model</td>
<td>Parallel development with integrated development teams; strong upstream supplier linkages; close coupling with leading-edge customers; emphasis on integration between R&amp;D and manufacturability/design for marketability; horizontal collaboration (joint ventures)</td>
</tr>
<tr>
<td>Fifth</td>
<td>Systems integrating and networking model</td>
<td>Fully integrated parallel development; use of expert systems and simulation modelling in R&amp;D; strong linkages with leading customers (customer focus at the forefront of strategy); strategic integration with primary suppliers including co-development of new products and linked CAD systems; horizontal linkages; joint ventures; collaborative research groupings; collaborative marketing arrangements etc.; emphasis on corporate flexibility and speed of development (time-based strategy); increased focus on quality and other non-price factors</td>
</tr>
</tbody>
</table>

Table 2.4.: “Five Generations of NPD Models (based on Rothwell 1992)” (von Stamm, 2003: 41)

In trying to place the design processes discussed in this section of Chapter 1 within the Five Generations table I would speculate (as I have no first hand information of the process) that the Ford Design Process (Olewnik, 2002) would appear to fit into the first generation of design processes because it is the earliest known process and one used for production line
work and so probably sequential and linear in design. The RIBA Plan of Work (Lawson, 1997), NASA Phased Project Planning (von Stamm, 2003) and the Jones, Archer, Cross (Swann, 2002) processes link well between the first and second generation design processes with a slight change in emphasis from offering a solution only to offering a solution which is devised from an understanding of market needs. The 1971 French process (Wright, 1998) would fit in the second generation with the beginning aspects of feedback loops in the third where R&D works more closely with marketing. The Pugh (1991) Total Design process has its footing in the third generation but has aspects which are moving into the fourth such as integrated development teams and a coupling to the customer, although still market driven.

The next section of this chapter deals with the latest evolution in design processes: that of user centred design which is the fifth generation model. However, in my opinion, all design processes have evolved from the earliest form and as such may in some way cross all generations at once. The traditional form of the design process and its evolved siblings are still useful for certain projects, but as the nature of design and the user evolves, so too should design processes.

Zaccai (1995) provides a summary of how industrial design evolved through the 20th Century:

“During the first half of this century, the product development process was entrusted to technical specialists working in conjunction with humanist designers. The appearance of the marketing specialist during the second half of this century meant that designers could further abdicate their role of generalist in the product development process. It was assumed that the historical division of labor could be reconciled with the disparate needs of the consumer so long as each specialist, or better yet each team of specialists, concentrated on one of the three distinct aspects of the collective consumer psyche... The marketing specialist would focus on divining the emotional expectations of the consumer. The technical specialists would focus on the rational requirements of the product’s physical performance. And the designer would focus on “aesthetics”, commonly understood as the sensory need for visual appeal and differentiation... There are several reasons why this is a highly efficient way of producing mediocre products.
Firstly, only the technical specialist, among the three specialists, has been able to develop the great depth required to solve complex technological problems.

Second, marketing has not been able to develop the expertise needed to understand even more complex emotional expectations of human beings.

Third, design, which has developed a superficial knowledge of ergonomics to complement its knowledge of the machine aesthetic, has not developed a deeper understanding of what might be called a human aesthetic, which encompasses the intellect, the soul, and all of the senses.” (Zaccai, 1995: 8)

The issue of how these principles of developing “mediocre products” (Zaccai, 1995) due to the insular domains of each section dealing with only a small aspect of the design process is a problem which only the most recent design processes start to address. Reich (1996) starts to address the requirement for a change from the traditional design process to a process which requires the inclusion of users:

“In the 'traditional' design situation, user needs are 'thrown over the wall' to the designers whose response - the design - is then 'thrown over the wall' to downstream experts (e.g., manufacturers, sellers) till it reaches the customer or the end-user. An assumption of traditional design is that active user involvement comes after the design process is over. From this point of view, a producer creates a product and the success or failure of the product in the market transfers to the design process. Users of products are assumed to be essentially consumers of products and have very little or no direct role in creating the products themselves or even communicating their own needs. Product realization is then used, or so it is thought, as a means to make explicit the needs that are often not articulated by the users themselves. In effect, in industrial societies, the manufacturers often articulate user needs without necessarily involving users or create needs users accept as their own. In traditional design, participation is often side-stepped by reducing the user to a databank. This is manifest in disciplines such as human factors or ergonomics that enable 'representing the user in the design process'. In this case, the best designers can achieve is by creating building blocks that allow users to adapt the product to their specific needs.” (Reich, 1996: 167)

The need for “a deeper understanding of... human aesthetic” (Zaccai, 1995) and how “…manufacturers often articulate user needs without necessarily involving users or create needs users accept as their own” (Reich, 1996) and Swann’s statement that “surely the days are gone when only the designer and client approve a design... The public is having an increasing say in validating the design...” (Swann, 2002) becomes the theme for section two of Chapter 1, user centred design.
2.3. User-Centred Design Process

“The concept of user-centered design has arguably given rise to one of the most fundamental changes in the field of design over the past few decades. Design has since shifted focus from giving form to objects and information to enabling user experiences, and from physical and cognitive human factors to the emotional, social, and cultural contexts in which products and communications take place.” (Boztepe, 2007: 57)

In this section of Chapter 1, I begin to discuss an evolution in design processes – that of user centred design. I start by giving a historical background that looks at some of the developments in the process and end with some basic guidelines to assist in applying of a user centred design process.

2.3.1. The evolving user centred design process:

“While individuals and groups refer to a user-centered approach in a variety of ways, there is largely a common definition to which all ascribe. In short, whether it is called empathic, human-centered or discovery research and design, the approach focuses on a careful study of people’s behaviors, attitudes and values as a way to gain an understanding of how to best shape successful design strategies and concepts. The approach relies upon an increasingly diverse mix of qualitative and quantitative research methods, analysis tools and concept-generation exercises.” (Rothstein and Tornello-Shirey, 2004)

Design writers of the 1980s through 1990s expressed concerns for the way in which designers were concentrating on a marketing approach to product design and paying little attention to user satisfaction with the products being produced (von Stamm, 2003; Wright, 1998; Zaccai, 1995; Popovic, 1999). According to Popovic (1999) products are usually designed through the client-designer relationship and exclude the user, their environment and context. So the product is “…designed ‘for users’ but not ‘with users’” (Popovic, 1999: 26).

Kahmann and Henze (in Green and Jordan, 1999) discussed the issue that “product developers are becoming increasingly aware that an understanding of the interaction between user, product and environment can play an important role in the development process. One way of acquiring this understanding is to involve users in the various phases of product development.
This is known as user-centred design.” (Kahmann and Henze, 1999: 113 in Green and Jordan, 1999).

Rothstein and Tornello-Shirey (2004) indicate that “during the past twenty years, user-centered research (UCR) has become an increasingly common and important part of contemporary product development” (Rothstein and Tornello-Shirey, 2004). Rothstein and Tornello-Shirey (2004) give a history to what we now call the user centred design process: “The origins of this approach to design and development actually stretch back to the beginning of industrial design in America. Starting in the 1940s and 1950s, Henry Dreyfuss, widely considered the father of industrial design in the United States, practiced a method of design that clearly focused on studying people’s behaviors and attitudes as a first step in designing successful products. During the next forty to fifty years, Dreyfuss’ example served as motivation for other highly successful and influential designers … to adopt a user-centered research and design approach” (Rothstein and Tornello-Shirey, 2004). However, as an accepted design process, user centred design only started being used in general practice amongst designers in the late 1980’s and into the 1990’s (Luck, Haenlin and Bright, 2001; Black, 2005; Zaccai, 1995; Popovic, 1999). “Since the 1980s, user-centred design has gained influence and most designers now claim to be user-centred or to carry out user research. This may simply mean testing design solutions in the latter stages of design projects but there is increasing understanding of the need for research in the early stages of a project in order to inspire design.” (Black, 2005: www.designcouncil.org).

Ranjan (2004) dates the user centered design processes as moving into mainstream design a little later “the consciousness of the user-centric methodologies …began to have a direct impact on our design processes into the late nineties and beyond.” (Ranjan; 2004: 3). The
discovery by designers that “information and expertise can reside in the most unexpected people, the users themselves” (Ranjan, 2004: 8) was a breakthrough that has had an impact on the changing ways in which products are being designed (Ranjan, 2004).

Luck, Haenlin and Bright (2001) give a summary for the necessity of this new approach to design: “User participation in the design and briefing process has been a concern for several years... It has received more critical attention since the 1980s when the lack of inclusion of the user perspective in the design process was considered an oversight. It was considered that the inclusion of the end user’s views in the design process and briefing process would result in greater user satisfaction” (Luck, Haenlin and Bright, 2001: 303).

2.3.2 The user centred design process:

“In the Danish context, the battle has always been between the two classic considerations of design: form and function, both of them very important aspects of the user experience... However, a third consideration has been lurking in the background for a long time: fit. The concept of fit has changing meanings in the world of design, sometimes referring to the designer’s sense of coherency in a design object, and thus presenting itself as a feel, rather than a concrete and measurable parameter. This notion of fit is the one relating to the designer in the ivory tower, cut off from the real world and the people in it. It is almost as ungraspable a quality as beauty. But things are changing. With the new design practices, fit has finally become a widespread tool for design... Gaining knowledge about users’ explicit and tacit needs can be achieved through a variety of operations, and success depends on how this knowledge is utilized and managed” (Dali and Jarler, 2007: 05).

The process of user centred design attempts to create products for use by including the user at every stage during the design process. This inclusiveness gives direct feedback throughout the user centred design process to assist the designer or design team in becoming sensitive to users and understanding issues that the design team may not have understood from personal use of the product (Luck, Haenlin and Bright, 2001; Ranjan, 2004; Black, 2005; Dali and Jarler, 2007).
As traditional design processes evolved, so the system shifted from linear and sequential to an integrated system that could move backwards and forwards between stages unlike the earliest forms of design processes (see 2.1. Traditional Design Process). The user centred design process relies on integration and continuous re-evaluation and interaction with the user (Dali and Jarler, 2007).

“The working method of designers is not a linear process. Rather, it is a process in which designers keep asking questions about what it is they are working with. As a consequence, the aim is not a foregone conclusion, and this creates dynamics and may lead to solutions that are very different from what was first anticipated. This “method” or way of thinking is almost in direct continuance of user-centered design, which is based on understanding the needs of consumers” (Dali and Jarler, 2007: 21).

Boztepe (2007) argues that the application of user centred design is universal and any product that interacts with a user should have users involved during the design process, however small the interaction is. This value needs not only be for the consumer, it can also be for clients benefit as well: “today, there is a growing recognition that providing superior value for users is instrumental for business success” (Boztepe, 2007: 57).

In the 2007 Index Magazine (established in 2002 in Copenhagen, Denmark), an online journal specifically aimed at user centred design (UCD), Dali and Jarler (2007) talk about how “Almost all designers will say that design has always been user-centered, and this is completely correct in the sense that design, unlike art, is considered a commercial activity aimed at customers. Trends in UCD are not about customer focus, then, but instead about how to uncover and understand the needs of customers.” (Interview with Jorgen Rosted: Dali and Jarler, 2007: 16)

User centred design, according to Dali and Jarler (2007), has at least three different historical roots: “Human factors studies, Ergonomics and Usability testing.” (Dali and Jarler, 2007: 6). These three aspects: human factors studies (including anthropology and ethnography),
ergonomics and usability testing are used where necessary in the user centred design process (Dali and Jarler, 2007: 6).

- On human factors studies, Dali and Jarler (2007) discuss the focus of this study as being an understanding of the “cognitive and perceptual elements of people” (Dali and Jarler, 2007: 6). This requires the use of multidisciplinary teams that include anthropologists, ethnographers, psychologists, designers and engineers (Dali and Jarler, 2007). “Human factors design is all about making things understandable and easy to use on a mental level.” (Dali and Jarler, 2007: 6)

- Dali and Jarler (2007) discuss their second historical root, ergonomics, which concerns itself with the study of the human body. “Ergonomic design adapts to people’s comfort and safety. Ergonomics makes design fit to the human scale and the human body… The functionalistic movement of design from the 1920s onward was especially interested in ergonomics. By reshaping everything from houses to kitchen utensils, they hoped to ensure a greater ease of use for the common man.” (Dali and Jarler, 2007: 6)

- The third historical root of user centred design, according to Dali and Jarler (2007), is usability testing. This discipline was originally developed for digital interface design, but is now being applied more broadly in other fields (Dali and Jarler, 2007: 7). “The overall impact of usability on User-centered Design & Innovation does not have so much to do with its means and methods as with its very persistent focus on the user and the user experience.” (Dali and Jarler, 2007: 7). This type of testing was originally conducted by ethnographers and anthropologists, but is becoming a mainstream tool by which designers are able to conduct basic testing relevant to product design (Dali and Jarler, 2007).
In 1997 den Buurman (Kahmann and Henze, 1999: 114 in Green and Jordan, 1999) gave form to a user centred design process through the simple but clever layout of the process and its integration with the user throughout the design of the product (see Table 5).

Table 2.5.: “The process of user-centred design (from Den Buurman 1997)” (Kahmann and Henze: 1999: 114 in Green and Jordan, 1999)
The Den Buurman 1997 (Kahmann and Henze in Green and Jordan, 1999) model has a familiar structure to traditional design processes such as the Total Design process (Pugh, 1991), with similar stage layout and deliverables at each phase of the process. However the key difference between this process and traditional processes is the continual use of users and continuous re-evaluation and revisiting of previous stages throughout the design. These revisits are informed by the users’ feedback during the design process (Kahmann and Henze, 1999 in Green and Jordan, 1999). In order to successfully integrate users in the process careful consideration needs to be given as where and when the designer should be testing the user. In the den Buurman’s 1997 model (Table 2.3.1.) (Kahmann and Henze, 1999 in Green and Jordan, 1999) testing happens between all stages.

“To most, UCR is presented as an essential component of how concepts are conceived, developed and tested in contemporary design. It is involved in all parts of the design process used to best address user needs and expectations. This entails using the research during early phases to identify new design opportunities as well as testing concepts during later development and post-production phases. As such, the UCR is defined as a tool for generating new opportunities as well as evaluating concepts in development” (Rothstein and Tornello-Shirey, 2004).

All user centred design incorporates user trialling or testing as the fundamental base from which a new product solution is derived. Not only are the ergonomic aspects of product design developed and refined throughout this process, but visual form giving or aesthetics, colour, materials and tactile aspects can be developed by the designer and then tested against the users as well. There is no assurance that the product will be accepted in the market, but there is a greater chance of success than if the product was designed excluding the users. A systematic approach of where to include the user and how to go about this inclusion will help to create an understanding of how effective this design process can be. Although this process is inclusive of users, the fundamental design process is followed and the framework in which the designer will work remains in place (Luck, Haenlin and Bright, 2001; Ranjan; 2004; Black, 2005; Dali and Jarler, 2007).
2.3.3 Guidelines for user testing:

“It might be thought that an ideal way of involving users in the design process is for the designers to be the users. When the designers are the users, they understand perfectly the needs of the users better than anyone else could. Since their ideas and values are the users' as well, designers are subject to no external influences and can proceed from their own, subjective ideas and values and can be as artistic as they are personally capable. The users do not need to communicate need to the designers because designers-as-users already know them. However, the perspectives of others can give insights that the designer-as-user does not have: users are not without bias or blindness on their own behalf...not only are designers ideally situated to understand the technical requirements of a design, they are also ideally situated to understand the needs of users; i.e., what the needs of users ought to be. The ideal of participatory design challenges the notion of an expert understanding of users of artefacts. As with a user, no expert is without bias or blindness; assuming otherwise has led to design failures.” (Reich, 1996: 169)

According to Popovik (1999) designers should begin to see the users as clients; this user as client approach should be taken as the leader for clients to produce user satisfaction. Obviously the context of this approach needs to be evaluated and applied where appropriate.

To understand user constraints, the designer “must have a body of knowledge about users and their behaviour which can be obtained from (a) research, (b) evaluation of same products / systems, (c) evaluation of related products/systems, and (d) evaluation of predicted products / systems.” (Popovic: 1999: 29)

Rothstein and Tornello-Shirey (2004) point out that the research methods used for user centred design are borrowed from the social science disciplines and are therefore well understood and defined. The “basic methods for studying people, such as observations and interviews, come from a large body of knowledge developed over many decades by qualitative researchers in a variety of fields” (Rothstein and Tornello-Shirey, 2004: 3). Rothstein and Tornello-Shirey (2004) discuss how designers and researchers have adopted and adapted many of the social sciences methodologies for use in design projects and that these methodologies are now being used in all phases of the design process. Examples sited by Rothstein and Tornello-Shirey (2004) include “cultural inventories and lifestyle audits”
which are “both new design research tools developed specifically to study social and cultural references in daily life.” (Rothstein and Tornello-Shirey, 2004: 4). Further to this, according to Rothstein and Tornello-Shirey (2004), participatory design, which is a methodology used to encourage users direct involvement in design thought, is cited as a good example of how research methods can be used to support design work during concept generation and development phases.

Swann (2002) warns us that “The users of design should be genuine ‘collaborators’, and not merely co-opted for token comments in an illusion of collaboration” (Swann, 2002: 57). However Swann (2002) is understanding of the predicament industrial designers find themselves in: “It could be argued that collaborative participation in the design process is difficult to attain because designers often are operating as sole practitioners for individual clients” (Swann, 2002: 57) however, according to Swann (2002), even though designers may work alone, they still work within the greater social system of society and this single aspect should not prevent these designers from working in collaboration with end-users.

Norris and Wilson (1997) suggest that comprehensive research and grounding needs to be completed before users are included. According to Norris and Wilson (1997) this is done to remove any dangers to the user before testing starts and can also be used as mechanism to develop and design the test procedures. Norris and Wilson (1997) developed a guide for designers when starting a project:

- “Review regulations and standards. If these exist for your product, then some potential hazards will already have been identified and minimum safety criteria set for them.
- Analyse accident statistics to see what types of accidents are occurring, who is being injured, where, when and how
• Produce a user specification based on your list of potential users

• Build up scenarios of how different people might use a product in different circumstances

• Observe and analyze how similar products are used

• Carry out design appraisal with people other than the design team who may have an idea about the way the product will be used and its potential hazards.” (Norris and Wilson; 1997, 11)

A key to user centred design is finding systems to test the user against the product throughout the design process. A set of potential avenues for testing users is summarised from Popovic (1999) and given below:

• Set up a checklist in order to define the operations of the product or system and give an indication of users needs.

• Focus users’ group should be set up to test the projected use of the product.

• Interviewing users is a good way of finding out context of use and user needs.

• Observation techniques, which are directly observing the product in use, should be predetermined to organise what needs to be observed. According to Popovic (1999): guidelines to be set up before the study, these include definitions of: “(a) aim of the observation study, (b) scenario in which the product will be used, (c) type of data to be collected, (d) presentation of data, (e) time available for observation, (f) recording tools and (g) constant evaluation of observational stages.” (Popovic: 1999: 32)

• Protocol analysis or “Talking Aloud” (Popovic: 1999: 32) is a system of having the user verbalise each aspect of the tasks being performed with the design team studying the user while they are performing these tasks.
• Task analysis, simply observing the user performing the task of operating the product, may give better insight as the user is not required to verbalise the product in use and therefore may act more unselfconsciously during the tests (Popovic: 1999: 32).

Popovic (1999) indicates that any number of these systems can be used on the same project. The determining factor is time and careful selection of the correct type of users (Popovic, 1999).

Luck, Haenlin and Bright (2001) look at user testing research conducted by Hasdogen\(^4\) (1996): “Hasdogen (1996) studied the models of users during the design process and gathered views of designers and ergonomists on the suitability of each approach. He observed three generic models: empirical, experimental and scenario-based, theoretical models.” (Luck, Haenlin and Bright, 2001: 305). In Hasdogen's 1996 observations, according to Luck, Haenlin and Bright (2001), the empirical models were based on data collection that was assumed to represent the user population, however the model was involved with the design process sporadically, the data collected was often of anthropometric nature and the validity of the data was questioned as the data did not reflect enough human diversity. The experimental model involved immediate feedback from users, and according to Hasdogen's 1996 observations (Luck, Haenlin and Bright, 2001), design practitioners found it an essential tool to assist in the design process. Scenario-based models, according to Hasdogen (1996) (Luck, Haenlin and Bright, 2001), are formed around story lines and scenarios of how the user would work and interact with the product.

"Participatory design integrates two radical propositions about design. The first is the moral proposition that the people whose activity and experience will ultimately be affected most by a design outcome ought to have as substantial a say in what that outcome is...the second is the pragmatic proposition that the people who will need to adopt, and perhaps to adapt to an artefact or other outcome of design, should be included in the design process, so that they can more offer expert perspectives and

preferences regarding the activity that the design will support, and most likely transform. The pragmatic proposition is that directly including the users’ input will increase the chances of a successful design outcome” (Carroll and Rosson, 2007: 243).

Van Veggel (2005) discusses the need for designers to include ethnographic research in the design process: “By studying people in their actual routine behaviors, performing these behaviors with the tools they routinely use in their usual physical and social environments, and possibly complemented by these users’ explanations and descriptions of these behaviors, ethnography produces an understanding that a designer can use to translate the users’ needs into product designs” (van Veggen, 2005: 5). He further explains that ethnographical research adds depth to the understanding of the user; additionally this process does not require an expensive laboratory setup as this is most likely field research at the source of the information: the users’ own environment (van Veggen, 2005).

This leads to an important factor in user centred design: that of selecting the user themselves. Norris and Wilson (1997) give suggestions on the best mechanisms to locate these users: “Identify all possible users: Think about everybody who might come into contact with your product. This means looking at: a) intended users – your target market; b) potential users – other people who might use the product; c) unintended users – people who are not expected to use the product but may come into contact with it anyway, such as children.” (Norris and Wilson; 1997, 10)

Any form of user centred design will rely on experience gained over time. “…the restrictions on the form of participation can be informed by a collective judgement that can benefit from experience with previous participatory projects. Therefore, recording previous participatory situations – especially, their rationale and outcomes – is a critical source for advancing the understanding and practice of participation.” (Reich, 1996: 166)
2.3.4. Conclusion to use centred design:

In this section on User Centred Design Processes a number key elements became obvious and could be applied to projects in future. I have listed those that struck me as most important. I use the texts and research review that informed this section of Chapter 2, as the foundation for these conclusions.

- Designers need to include the users of their products during all phases of the product development process.
- All products have users interact with them in one way or another; therefore all design should have user testing during the design process.
- The people upon whom the product will eventually be imposed should have a say in what that product outcome should be.
- Although designers may have a good understanding of how people interface with the product and may be able to use themselves to test the products against, it is necessary to see how the users will interpret this interface as well. Often projects are outside of the typical realm of the product designers own experience and so would necessitate specific user group testing.
- The historical roots of user centred design are to be found in social sciences and include human factors studies (anthropology and ethnography), ergonomics (anthropometrics and human interface) and usability testing (user trialling studies). The benefit of these links to social science are that there has already been much work done to develop systematic approaches to understanding people, their circumstances and their environments which could easily be adapted to suit product design research needs.
• User centred design shouldn’t be ‘window dressing’. It is important to the quality and acceptability of the end product that lessons learnt from the user testing should be applied in a reasonable and thoughtful manner to the end product.

• The designer needs to develop a good understanding of the users, the potential users and the unintentional users of their product. Through this the designers will have a broader scope or understanding as to the range of needs and requirements to assist in developing the final product.

• User research should take place in the environment of the user as far as possible, rather than in a laboratory, as this is a less intimidating way of working with the user. This will add further depth to the designers understanding of the people and their environment.

• The process of user involvement should be designed in a comprehensive manner before the users are involved. This is to make ensure the safety of the user is considered and also so that the designers know what they should be looking for in the outcomes from these interactions.

• As with all design processes, experience over time will help to make for a better understanding in future. Designers should record and critique the outcomes and evaluate acceptance or failure of the product in order to build a comprehensive database for future projects to work from.

2.4. Community Centre Design Process

“The majority of the world’s designers focus all their efforts on developing products and services exclusively for the richest 10% of the world’s customers. Nothing less than a revolution in design is needed to reach the other 90%.” (Polak, 2007)

2.4.1. Evolving community centred design processes:

Whiteley (1993) refers to a period at the end of the 1960s as the “spirit of ’68” (Whiteley, 1993, 94). “1968 kindled a spirit of questioning and reappraisal that infected the design
profession” (Whiteley, 1993, 94). At this time, Whiteley (1993) maintains that “designers needed to become more outward-looking and to ponder the relationship of design to society – its role and purpose.” (Whiteley, 1993, 94). By the end of the 1960s “consumer awareness had given rise to what became known as, variously, the ‘responsible’ design movement or the ‘socially useful product’ debate.” (Whiteley, 1993:94). Several conferences took place and several publications appeared at that time in an attempt to encourage designers to move away from design for consumerism and begin to address real needs and real problems (Whiteley, 1993). These conferences and publications referred to by Whiteley (1993) include amongst others:

- The Designer (later to become the Chartered Society of Designers journal) which urged designers to be more “outward-looking and...ponder the relationship of design to society – its role and purpose” (Whiteley, 1993: 94)

- The French Group 1970 International Design Conference “lambasted designers for hollow concerns” and called for designers to become aware of the implications of design on the environment and people (Whiteley, 1993: 95)

- Victor Papanek’s book: Design for the Real World, first published in 1971, “became the bible of the responsible design movement” in which he proposed the greater need for awareness and design around poorer communities and ecological responsibility (Whiteley, 1993: 96)

- The UNIDO-ICSID conference at the National Institute of Design (NID\(^5\)) in 1979 that later led to the Ahmedabad Declaration (1979) gave a “plan of measures” included in which was the development of infrastructure to have “developing countries” help themselves through the setting up of industrial design training and competence in their

\(^5\) “NID has been a pioneer in industrial design education after Bauhaus and Ulm in Germany and is known for its pursuit of design excellence to make Designed in India, Made for the World a reality.” (www.nid.edu, 2007)
own countries. This would lead, according to the declaration, to designers who would show empathy and concern for the environment and people within the country in which they work (Ahmedabad Declaration, 1979)

Whiteley (1993) deliberates how these publications and conferences not only concerned themselves with sustainable design (design for the environment) but more specifically with design for poorer communities and for need. Around this time there was a “spirit of dissatisfaction with the status quo in design” (Whiteley, 1993: 98).

Heskett (1980) reflects on the 1979 Gui Bonsiepe paper given at a Royal College of Art conference in London titled “Design for Need” (Heskett, 1980). Bonsiepe, according to Heskett (1980), argued that what was needed was “not design for dependent countries…but design in and by dependent countries, on the basis of social need” (Heskett, 1980: 206). Heskett (1980) names Victor Papanek, Buckminster Fuller and Eugene Schumacher as the pioneers of the movement for designers to redress the differences between what was being designed for the developed world and the needs of the developing world at the end of the 1960s into the 1970s (Heskett, 1980). Heskett (1980) discussed the efforts by industrialised countries to address social needs by developing new design principles and methods in the 1960s (Heskett, 1980). Heskett indicates the work of “Maldonado (Tomas) and a group of colleagues at Ulm” who proposed “a rational analytical sequence intended to identify the fundamental nature of any given design problem, enabling a solution to be devised to meet defined needs, rather than to provide aesthetic refinement or stylistic innovation” (Heskett, 1980: 206). According to Heskett (1980) these problem solving methodologies have translated into general design practice (Heskett, 1980).
Nieusma (2004) shows the historical development of socially responsible design from the concept of technology transfer, through the appropriate technology movement and onto socially responsible design. I explore these in more detail:

2.4.1.(i) Technology transfer:

The term technology transfer can be traced back to the 1960’s where advocates of this practice promoted the idea of directly transferring Western technology to developing countries (Nieusma, 2004). Through this system the “intellectual and financial resources already invested by the West” could be transferred to people in developing countries who “seemed to need technology the most.” (Nieusma, 2004: 13). Unfortunately, according to Nieusma (2004), the transfer of technology had a few setbacks including: the limited availability of resources in the developing country; and an incorrect interpretation of the problems encountered by the inhabitants. Additionally there appeared to be a lack of technical expertise within the developing countries in using and maintaining the solutions offered through this technology transfer process (Nieusma, 2004). “Technology scholars came to realize that differences between a technology’s developmental context and its use context were significant.” (Nieusma, 2004: 13).

Fry (2005) states that some designers of this period were attached to the concept of “mainstream developmentalism” which promoted the idea that “…‘underdeveloped countries’ imitate the industrialisation of ‘developed nations’, but in an accelerated form.” The alternative to this technology transfer was to introduce “less complex and capital intensive technologies that could be more easily integrated into local economies and culture.” (Fry, 2005). This option developed into the appropriate technology movement (Fry, 2005).
2.4.1.(ii) **Appropriate technology:**

According to Whiteley (1993), the appropriate technology movement started as the alternative technology movement and premised the notion “in which decentralized and ecologically sound energies and materials, and non-alienating social means of production, were developed.” (Whiteley, 1993: 96). Nieusma (2004) establishes that appropriate technology is the system in which local knowledge becomes the central tenet for the design of products and solutions that directly suit the local need (Nieusma, 2004). Paying better attention to the “use context” of the technology and listening to the people for whom the technology was intended became the guiding principles for appropriate technology thinking (Nieusma, 2004: 13). Appropriate technology promoters of the time argued that the context in which the technology was to be used should be directly relevant to the needs of the “poor people of the Third World and other marginalized social groups” (Nieusma, 2004: 13). According to Nieusma (2004) during the “1970s appropriate technology became a strong social movement in both developed and developing countries” (Nieusma, 2004: 14).

Appropriate Technologies, according to Whiteley (1993), are those technologies that are cost effective, use local materials where possible and appropriate, generate employment opportunities for locals, and the technology is such that maintenance and control can be done by the people for whom the technology is designed. In his view this technology and the application of this appropriateness need careful consideration in terms of culture, society, country and region (Whiteley: 1993). Further to this Whiteley (1993) says that key aspects of the appropriate technology movement are that the technology should use energy that is local, renewable or man powered and that all patent rights should be ceded to the locality of the technology or should be not put in place at all. Most importantly the technology should be able to evolve with the people who require it (Whiteley, 1993).
Fry (2005) believes that both the technology transfer and appropriate technology systems had faults “both approaches had their foundation in western technical rationalism, and both posited a faith in technology as a means to instrumentally or economically solve problems. Thus, both were blind to the problems created by the introduction of technologies such as: the displacement of local economies and the cultures they sustained; changing the symbolic status of craft skills and the people who possessed them. So, while the means adopted by the approaches differed, and they progressed at different speeds, the result sought (the induction of the local economy into global order of capital) turns out to be the same.” (Fry, 2005).

2.4.2. The variety of socially responsible design systems:

Nieusma (2004) indicates that “several related alternative design communities arose to take the place of the appropriate technology movement in Western design scholarship” (Nieusma, 2004: 14). He includes amongst these: universal design, participatory design, ecological design, feminist design, and socially responsible design which, according to him, have become important tools towards design for marginalised groups. I do not discuss ecological nor feminist design in this chapter, but I do feel strongly in favour of additional research in this area in the South African context specifically related to industrial design.

Before I move onto community centred design processes I would like to clarify the meaning of universal / inclusive design / design for all and human centred design.

2.4.2.(i) Inclusive Design / Universal Design / Design for All:

Inclusive Design is also known as Universal Design or Design for All (Coleman, 2006). Inclusive Design is “related to user-centred design, human-centred design, ergonomics, usability studies, design for disability, rehabilitation design, gerontechnology,
transgenerational design” (Coleman, 2006). Nieusma (2004) indicates that “effective accounting for difference” is central to the practice of universal design, the designer is required to design for “marginalized social groups” with a variety of different needs, and for the most part the needs are probably not ones the designer experience themselves (Nieusma, 2004:14). “Universal design theorists want designers to think systematically about ‘inclusion’ and to broaden their notion of who users are. In addition to the disabled, other groups typically marginalized by design include women, the aged, the infirm, and the young.” (Nieusma, 2004:15).

Coleman (2006) argues that inclusive design is neither a new form of design nor should it be regarded as a specialist area in design but rather should be seen as good business practice which “seeks to ensure that mainstream products, services and environments are accessible to the largest number of people” (Coleman; 2006). He elaborates on this point by discussing the shift in attitude by designers and manufacturers from making special solutions for disabled and older users and rather integrating their needs into universal solutions, in his opinion “this is important for social equality but is also a significant opportunity for business growth through new products and services.” (Coleman, 2006).

The term ‘design for all’ appears to be used as a name for inclusive or universal design practices in Scandinavian countries (Bendixen, 2003; Folkmann, 2003).

“Since ‘Design for All’ was introduced in Finland in the mid-sixties, interest in this philosophy and how to put it into practice has increased. The trend in Design for All has shifted from disabilities to abilities, to understanding all persons in a society as a resource. This will lead to innovative solutions and attitudes.” (Bendixen, 2003: 11)

According to Benedixen (2003) design for all was introduced to Finland in 1966 by Victor Papanek during his lecturing tour to that country. Papanek, according to Benedixen (2003), introduced the principles of “social aspects of design, urging considerations of its impact on
the surrounding society …lecturing about his ideas on design which was ecologically sound and aimed at benefiting the poor, the disabled and the elderly” (Bendixen, 2003: 11). Apparently the term “…‘Design for All’ was first used in the late seventies and early eighties” (Bendixen, 2003: 11).

Folkmann (2003) indicates that the Association of Danish Designers, have no specific policy on design for all, “but we base our work on the overall attitude that the important thing is to raise the quality of life – in society, in our surroundings, through products, services and communication – and that design can make a difference in terms of quality. Design for All is part of this endeavor, but not all of it.” (Folkmann, 2003: 6). Steinar Amland, in an interview with Folkmann (2003), said that he believes that design for all is integral to every type of design project. Amland (Folkmann, 2003) believes the principles of the design process “planning, preparing and guiding products, processes and systems to make them work in the best possible way for the largest possible number of people” remain the same for all projects (Folkmann, 2003: 6). Amland concludes his interview with Folkmann (2003) by summarising the sentiment towards the need for notions such as design for all: “In an ideal world, a concept like Design for All would actually be unnecessary. It reflects a basic interest in making products and information as accessible as possible to as many people as possible – and as such it should be a must to all designers.” (Folkmann, 2003: 6).

2.4.2.(ii) Human centred design

For Buchanan (2001) there has been a change in design themes from: “…‘form and function’ into the new theme of ‘form and content’…one of the distinguishing marks of new design thinking: not a rejection of function, but a recognition that unless designers grasp the significant content of the products they create, their work will come to little consequence or
may even lead to harm in our complex world.” (Buchanan, 2001: 35). Buchanan (2001) believes that the main theme of new design thinking is the central place of human beings in design work, he calls this “human-centered design” (Buchanan, 2001: 37). He differentiates this from user centred design in that human centred is not simply about usability: “It is true that usability plays an important role in human-centred design, but the principles that guide our work are not exhausted when we have finished our ergonomic, psychological, sociological and anthropological studies of what fits the human body and mind. Human-centered design is fundamentally an affirmation of human dignity. It is the ongoing search for what can be done to support and strengthen the dignity of human beings as they act out their lives in varied social, economic, political, and cultural circumstances.” (Buchanan, 2001: 37).

2.4.3. Socially responsible design:

“Theory about design for the market is extremely well developed. It cuts across many fields from design methods to management studies and the semiotics of marketing… Conversely, little thought has been given to the structures, methods, and objectives of social design. Concerning design for development, some ideas have been borrowed from the intermediate or alternative technology movement, which has promoted low-cost technological solutions for problems in developing countries, but regarding the broader understanding of how design for social need might be commissioned, supported, and implemented, little has been accomplished.” (Margolin and Margolin, 2002: 24)

Nieusma (2004) talks about how “Scholars who seek to counter consumerist design argue that existing market forces focus design resources to an indefensible extent on creating products aimed at satisfying the spurious desires of a narrow gap of people.” (Nieusma, 2004:21) He adds to this by saying that design that caters only to market-led consumerism adds to the quantity of products but leave “many basic human needs unaddressed.” (Nieusma, 2004:21)

Margolin (2007) states that the principles of socially responsible design find a history in the term “Design for Development” which was initiated at the Ahmedabad Declaration on
Industrial Design and Development (1979) in India. This initiative was started with the focus of promoting industrial design education in developing countries (Ahmedabad Declaration, 1979). Before this conference Margolin (2007) believes that design for development was generally related to Papanek’s (1985) ideals of what design should be doing for developing countries. Papanek’s (1985) ideals were for low technology products, essentially appropriate technology, that dealt with community survival rather than contributing to national development strategies (Margolin, 2007). The Ahmedabad Declaration (1979) recognised that design could make a valuable contribution to a nation’s economic development. The Declaration (1979) also upheld the need for interventions to include not only local skills, traditions and resources but should also include the developments available worldwide in science and technology (Margolin, 2007). This aspect, the inclusion of available science and technology advancements and the close relationship with industry, differentiates the Ahmedabad Declaration (1979) from Papanek’s (1985) “community-oriented” ideals for design for development (Margolin, 2007).

It is worthwhile having a look at some of Papanek’s (1985) principles before moving on to modern interpretations of socially responsible design.

In 1971 Papanek promoted a design principle of integrated design in his book Design for the Real World (Papanek, 1985), this principle could arguably be called the forerunner to subsequent socially responsible design approaches; “Integrated design…should be thought of as a series of functions occurring simultaneously rather than in a linear sequence” (Papanek, 1985: 295). He strongly promoted the understanding of the complexity of the design problem including its historical perspective, human and humane factors, the social perspective, social groups / classes / and societies (Papanek, 1985). He advised on the inclusion of “sociology, anthropology, psychology (perception, human engineering factors, ergonomics), and the
behavioural sciences” within design projects (Papanek 1985, 300). Papanek (1985) believed in the ideal that all designers need to work closely with fields outside of design and involve themselves in the “ecological, social, economic and political environment in which design takes place” (Papanek, 1985: 291) and that “all design must fill a human need” (Papanek, 1985: 295).

Papanek (1985) developed a work flow for his idea of integrated design:

1. “Assembling a design team representing all relevant disciplines, as well as members of the client group.
2. Establishment of a primary flow chart…
3. Research and fact-finding phase.
4. Completion of the first half of the flow chart…
5. Establishment of the second half of the flow chart…; what to do.
6. Individual, buddy-team, or team design, and development of ideas.
7. Checking these designs against the goals established in the flow chart, and correcting both designs and flow chart in light of these experiences.
8. Building of models, prototypes, test model, or working models.
9. Testing these by relevant user-group.
10. Test results are now fed into the flow chart.
11. Redesign, retesting, and completion of the design job, together with whatever written reports, graphic communication, statistical support data, or working drawings are necessary.
12. The flow chart is then preserved, to be used as a follow-up guide in checking actual in-use performance characteristics of the designed objects. After this the flow chart is filed; it is to be used as a guide for future design work.” (Papanek 1985, 312)
Papanek (1985) further elaborates on this design process by explaining that in practice the path will not necessarily be sequential as design doesn’t usually follow a linear pattern and that each stage during this integrated work flow may need to be revisited and reassessed.

Papanek (1985) developed six priorities which were based on his ideal for design for the future:

- “Design for the Third World” wherein he proposed the design of tools, lighting and appropriate products for the developing world.

- “Design for minorities” in which designers should design teaching and training devices for handicapped or disable people.

- “Design for medicine, surgery, dentistry, and hospital equipment” in which he proposed a redesign of equipment for the medical profession as in his opinion the tools for this profession were either “badly designed…or over designed.”

- “Design for experimental research” whereby he promoted design for the advancement of scientific research by making available equipment for research at a reasonable cost to researchers.

- “Systems design for sustaining human life under marginal conditions” meaning design for the development of shelter or housing in the event of major environmental catastrophe.

- “Design for breakthrough concepts” essentially design aimed at developing new products to benefit mankind instead of making minor adjustments to current products (Whiteley, 1993: 101)

Papanek (1985) proposed that much work needed to be done around design for need. For the most part designers are only working for a very small portion of the world who can afford superficial products that they don’t really require (Papanek, 1985). He suggested that
designers should follow a principle of “designing for many instead of designing for money” (Papanek, 1985, 69). The “fundamental tenet that ‘it is wrong to make money from the needs of others’…” underscores not only Papanek’s (1985) work but also possibly the sentiment of that period: late 1960s to early 1970s (Whiteley, 1993: 104).

Papanek (1985) suggest ways in which designers could be involved in design for developing countries:

1. The designer can sit in their office and design products using that countries materials and processes – to be sold in the designers home country

2. The designer participates by spending time in the poor country and develops products to be made there – but Papanek (1985) warns that their may be a problem in that the commitment is short-term and possibly not a meaningful engagement

3. The designer lives in the developing country and trains local designers to be involved in problem solving directly

4. The final (and in Papanek’s mind the ideal) is for a designer to move to the country and train designers to become design educators in order to transfer their knowledge to local designers – forming a cycle that will continually supply problem solving and development needs (Papanek, 1985: 85).

“The primary purpose of design for the market is creating products for sale. Conversely, the foremost intent of social design is the satisfaction of human needs” (Margolin and Margolin, 2002: 25). Margolin and Margolin (2002) propose that the market type design and social type design should not be seen as opposites, but instead as “two poles of a continuum” the difference being the priorities of who commissions the work, rather than the systems for manufacture, distribution and quality of design outcome. Margolin and Margolin (2002) indicate that although many products suit both social and market type consumers, specific
social design is needed for “people with low incomes or special needs due to age, health, or disability.” (Margolin and Margolin, 2002: 25)

Margolin and Margolin (2002) suggest that designers could become involved in social design practice through participating in the six-step problem-solving process used by social workers: the model of generalist practice. The model of generalist practice relies on strong collaboration between the social worker and the client, but could rely on equally strong collaboration between the designer, social worker and client (Margolin and Margolin, 2002). In table 6, I have devised an accessible format that illustrates the proposed Margolin and Margolins’ (2002) process of client, social worker and designer collaborative social design project.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Social Worker Intervention</th>
<th>Outcome</th>
<th>Design Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement</td>
<td>Problem identification /understanding</td>
<td>List of needs to be addressed</td>
<td>Identifies factors that contribute to the problem</td>
</tr>
<tr>
<td>Assessment</td>
<td>Holistic understanding of external influences on the problem</td>
<td>List of goals and objectives, timelines and work allocation for implementation of solutions</td>
<td>Develops intervention strategies related to the physical environment</td>
</tr>
<tr>
<td>Planning</td>
<td>Prioritise needs, determine hierarchy of needs; begin to brainstorm solutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implementation</td>
<td>Putting into action the goals and objectives agreed upon</td>
<td></td>
<td>Create needed product or work within the system to create one</td>
</tr>
<tr>
<td>Evaluation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Termination</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Table 2.6.: “Social Model” for design practice: collaboration between client, social worker and designer (Margolin and Margolin, 2002)

Margolin and Margolin (2002) suggest that the inclusion of a variety of other professionals such as psychologists, speech therapists, occupational therapists, and probation officers would help to form a team whose intervention and solutions would be comprehensive and holistic as
possible. The key and biggest differentiating factor between this social design process and Papanek’s (1985) process, according to Margolin and Margolin (2002), is that Papanek (1985) continued to want to create a separation between socially responsible designers and those working on commercial market-led design projects. Margolin and Margolin (2002) argue against this separation and promote the idea of including commercial aspects into social responsible design; thus allowing designers from all spheres of design practice to be involved, where possible, in design for social need (Margolin and Margolin, 2002).

2.4.4. National Institute of Design (NID) Craft Documentation Project:


“In the light of the dramatic acceleration with which change is taking place in India and the seriousness of the basic problems involved, we recommend that without delay there be sober investigation into those values and those qualities that Indians hold important to a good life, that there be a close scrutiny of those elements that go to make up a ‘Standard of Living’.

We recommend that those who make this investigation be prepared to follow it with a restudy of the problems of environment and shelter, to look upon the detailed problems of services and objects as though they were being attacked for the first time; to restate solutions to these problems in theory and in actual prototype; to explore the evolving symbols of India.

One suspects that much benefit would be gained from starting this search at the small village level. In order to insure the validity of such investigation and such a restatement, it will be necessary to bring together and bring to bear on the question – all the disciplines that have developed in our time – sociology, engineering, philosophy, architecture, economics, communications, physics, psychology, history, painting, anthropology … anything to restate the question of familiar problems in a fresh way. The task of translating the values inherent in these disciplines to appropriate concrete details will be difficult, painful and pricelessly rewarding. It cannot start too soon.

The growing speed of production and training cries out for some sober unit of informed concern sufficiently insulated to act as a steering device in terms of direction, quality and ultimate values.” (Balaran, 1998: 23)

Ghose (1998) cites the Eames India Report (1958) and the Ahmedabad Declaration (1979) on Industrial Design for Development as the foundation to promote the use of appropriate design

⁶ Eames C. and Eames R. 1958, THE INDIA REPORT, Ahmedabad, National Institute of design
in the developing world. The Ahmedabad Declaration (1979) “stated in clear terms the role of design in developing society. It called for (1) understanding the values of one’s society and then defining a quality of life within its parameters; (2) seeking local answers for local needs by using local materials and skills, while making use of advanced science and technology; and (3) creating new values, addressing priority needs, and preserving plural identities.” (Ghose; 1996, 190).

Ranjan (2001) reiterated this approach to design and elaborates on how NID is now integrating these values in their programmes. Through two specific interventions, the “Environmental Exposure” and the “Craft Documentation” projects, Ranjan (2001) believes students develop a real world sense for design and are sensitised to the “tools, skills and materials of design research and action” (Ranjan, 2001: 9). The underlying design process used at NID is shown in Table 7 (Ranjan, 2001). This design integration model, “Systems Design: The NID Model” (Ranjan, 2001), further illustrates the NID approach which includes four key elements of their design education: user and need research, scenario visualisation, concept development and business models (Ranjan, 2001). This model is used to underpin both the “Environmental Exposure” and the “Craft Documentation” projects (Ranjan, 2001).
Table 2.7.: “Systems Design: The NID Model” (Ranjan, 2001)

The “Environmental Exposure” project (Ranjan, 2001) takes foundation course design students to villages in the area surrounding NID (Ahmedabad). This type of project does not result in specific product outputs, but is used rather as a system of teaching students about the documentation of the relationship between the designer, the user and their environment (Ranjan, 2001). Through living and working in the villages the students are able to study, in depth, the way of life and work environments of the villagers (Ranjan, 2001). Ranjan (2001) ascribes this innovative teaching and learning system as having “brought home the realisation that design is centrally concerned with the user, the people and their needs, along with other insights into the nature of the design problem itself” (Ranjan, 2001: 8). He further states that “design problems and opportunities need an integrated framework for effective resolution” and that these “cannot be realised in a specialist mode within closed laboratories” (Ranjan,
2001: 9). For senior students the advancement on the “Environmental Exposure” project (Ranjan, 2001) is the “Craft Documentation Project” (Ranjan, 2006) which has them not only observing and researching, but also developing solutions.

“At the student level some of our courses have an inbuilt research content such as the Craft Documentation Project that takes students to field situations and provides them with exposure to rural crafts and work methods that are documented in great detail as part of the required study in textiles, and industrial design faculties.” (Ranjan, 2006:26)

The system of “Craft Documentation Projects” (Ranjan, 2006) implemented by NID sees the student living in a craft village for a period of time, during which the student observes the craftspeople at work, learning about the materials and processes available, the equipment used and the intricacies of the regional style and in this way the students “document the lifestyle and socio-economic conditions of people living in several regional belts” (Ghose; 1996, 196). By capturing this information in written, illustrated and photographic form the student is able to take away enough research and discussion material to work on projects for the village at NID (Ranjan, 2006). Through this research and the understanding of the craftspeople in these various regions, the institute is better able to advise and develop design for marketable products and introduce the craftspeople to “elements of modern design” (Ghose; 1996, 196). Once at NID, the student designers use the information gathered to develop designs that utilise the skills and styles of the craftspeople and source markets for the products developed in collaboration with the village crafters (Ghose, 1998). By allowing students access and interaction with these craftspeople the students learn how to become sensitive to other environments and develop empathy for the people for whom they are designing; this understanding has become an important part of the design education at NID (Ghose, 1998). Bhan (2006) discusses how “…the teaching in the schools here has instilled in a whole generation the notion that design has the power to change the quality of life for others” (Bhan, 2006). The institute has developed a library of this original research enabling access for future
NID design students but unfortunately this is not published widely and therefore unavailable to the world design community (Ranjan, 2001).

2.4.5. Community centred design process

The term community centred design is one which I have developed to differentiate it from social responsible design. Community centred design integrates a number of aspects of previous design paradigms including aspects of technology transfer, appropriate technology, and social responsible design. In the past 8 years I have been involved in both InterDesigns (see below) that have been hosted by the South African Bureau of Standards (SABS): Design Institute of South Africa. At the InterDesign: Water ’99, I was a South African group leader which was in essence an assistant-leader alongside the international group leader. In 2005, at the InterDesign: Sustainable Rural Transportation, I was made group leader for the Animal Drawn Carts section. In addition to the Interdesigns in 2006, two University of Johannesburg colleagues and I completed a community centered design project on Rice Production in Jahangirabad (near Lucknow) in India. All three of these experiences have added to my developing understanding of how to go about working on community centered design projects.

2.4.5.(i) Two Interdesigns:

Fourie and Kruger (2005) summarise the principle of an International Council for Societies of Industrial Design (ICSID) endorsed Interdesign: “an ICSID Interdesign is a forum in which mid-career designers from different countries and cultures work together with local experts for an extensive two-week period, exploring design issues of national, regional and global importance” (Fourie and Kruger, 2005: 8). They clarify this principle by including the ideas of “providing innovative and appropriate solutions through co-operative problem solving” with an emphasis on “understanding local cultures and actively engaging local communities
in helping to find meaningful, realistic answers” to the identified problem area (Fourie and Kruger, 2005: 8).

Since 1971, there have been 37 Interdesign projects worldwide, dealing with a wide variety of issues from Unemployment in Northern Ireland (1976), Design for Medical Purposes in Hungary (1979), Design for Elderly People in Finland (1989) to Design for the Wine Industry in Chile (2003) (Fourie and Kruger, 2005).

The Interdesign Planning Kit (2001) includes the following basic “work programme” for participants:

1. “Arrival and familiarization: explanation of methodology and process.
2. Intensive technical and background briefings.
3. Field trips and on site briefings and observation.
4. Group review of work, formulation of work program.
5. Allocation of tasks, preparation of completion schedule.
6. Interim presentations to other participants, experts, ICSID Coordinator and Organizing Committee.
7. One free day.
8. Working sessions towards design concepts and recommendations.
9. Final presentation of work.
10. Documentation of process and results.” (Interdesign Planning Kit, 2001)

This “work programme” relies on the management and design process of the group leader to steer the project through the two weeks. In 1999, I was in the fortunate position of working under Gianfranco Zaccai CEO of Design Continuum (Boston and Milan). Zaccai’s vast experience in his professional capacity and his experience as group leader in Interdesigns in Sweden and Columbia helped me to develop a good understanding of design processes for
such complex projects. By the time, in 2005, I was made group leader of the Animal Drawn Cart section of the Sustainable Rural Transport Interdesign, I had developed a reasonable process for my own group to follow. This process borrows heavily from Den Buurman’s 1997 process as described by Kahmann and Henze (1999) (in Green and Jordan, 1999) and appears in the section User Centred Design in this chapter.

![Diagram of design process](image)

Table 2.8.: An Interdesign design process developed by the author for the InterDesign 2005: Sustainable Rural Transport in the Northwest Province of South Africa
The design problem given to the participants was summarised by Fourie and Kruger (2005):

“Sustainable alternative modes of transport for rural areas are vitally important considering that more than 60% of rural households in South Africa claim that motorized transport is not available to them or too far away to access. Of the almost 16 million learners who travel to school every day, 76% (or 12 million) walk. About 550 000 children spend more than two hours a day walking to and from schools.” (Fourie and Kruger, 2005: 4).

The actual workings of the design process relied heavily on the research information gathered by the steering committee, group participants and the inclusion of such diverse experts as animal drawn cart specialists from the NSPCA; the legislative experts from the SABS and South African Department of Transport; designers and developers of carts from the Central University of Technology and commercial cart manufacturers from Johannesburg and Klerksdorp; as well as observation and information gathering from community members and the villages visited throughout the project. The group itself comprised of an engineer, an architect, professional and education industrial designers from the Netherlands, Canada, Kenya and South Africa, carters from the Kuruman area of the Northern Cape and students from the two Industrial Design Departments of the Cape Peninsula University of Technology and the University of Johannesburg. Having such a diverse group of people working together allows for multiple approaches to research and development which added enormous value to the solutions the group arrived at.

The first week of the process involved days of engagement and observation of the community with whom the designers were to design the cart, intensive investigation of all aspects of cart engineering and design, developing an understanding of harness and hitching principles and complete analysis of what would be required to fulfil the communities needs. In the second week of the project; having continually received feedback from the community, experts assigned to the group, and the carters from Kuruman; the group focussed on four specific
areas of design: harnessing and hitching, single axle donkey carts, double axle donkey carts and a sustainable system of integrating these solutions in the community. As there was little time to develop prototypes, no carts were manufactured and tested during this period, but a complete harness and hitching system was manufactured ready for testing by the end of the two weeks. At the end of the workshop three carts were selected for further development and the harnessing and hitching system was given to the NSPCA to test on carts in the Winterveldt region. Additionally a number of the solutions from another group; the Bicycles and Tricycles Group; were also selected for further development.

Fortunately at the end of this project the Design Institute of South Africa (SABS: DISA) and the South African Department of Transport decided to pursue the solutions through prototyping, testing and onto manufacture. The phases in my design process after ‘over-all form refinement’ have all taken place since the end of the Interdesign project in 2005. This is a step forward for the Interdesigns I have attended as at the end of the 1999 Interdesign on Water, design solutions developed during the two weeks were not completed to a manufacture ready stage nor tested in the community.

In 2005 students from the Department of Industrial Design of the University of Johannesburg completed pre-production engineering drawings for the three carts and a children’s BMX bicycle identified from the Interdesign steering committee. In April 2007, I along with two colleagues and a group of B-Tech: Industrial Design students tested the manufactured prototypes in the communities in the North West Province. The prototypes have since been refined and will be re-tested in November 2007 in the community and thereafter by the SABS before final engineering drawings are released for manufacture.
This project combined the principles suggested by Margolin and Margolin’s (2002) in encouraging market type design and social type design as the “two poles of a continuum” using commercial industrial design expertise alongside the need and knowledge of the community to develop an appropriate solution (Margolin and Margolin, 2002). All of the cart prototypes were developed to be able to be manufactured by both commercial companies and by village manufacturers through the inclusion of standard components and readily available materials and uncomplicated manufacturing techniques. The bicycles, however, will rely on large manufacture runs to reduce the final selling price. The project relied heavily on the inclusion of a variety of experts outside of the design field and had the designers working closely with the community for whom the design solutions are intended. These two principles reflect well on the learning from Papanek (1985) and Whiteley (1993) both of whom promoted the combination of these ideals in community centred design projects.

2.4.5.(ii) Rice Project, Jahangirabad, India

The design process required to develop products or solutions for developing communities is what we at the UJ Department of Industrial Design loosely term community centred design. The principles behind this process can be traced to a variety of research and participatory experiences that the members of the Department of Industrial Design and Faculty of Art, Design and Architecture at the University of Johannesburg have accumulated over the past 10 years. These experiences include involvement in the two ICSID supported SABS: Design Division sponsored InterDesigns and extensive experience in Indigenous Knowledge Systems (IKS) and Participatory Action Research (PAR). This experience has led to the understanding of a process that works well for community centred projects such as this rice project. The community centred design process allows the designers the opportunity to observe, research and communicate with the community in question on the procedures they follow to achieve
the desired goal, in this particular project - rice production. A dominant aspect of this process is the observational; this being an opportunity for the designers to simply learn the highly evolved systems and skills that individuals and communities have developed (over centuries) to make their working life easier or give better results to the end product. Once the design team has gained a level of understanding of all the issues related to the procedure the user will go through, the complex issue of trying to devise a suitable and sustainable solution begins.

Many of the problems uncovered during the project could not be addressed in the short time available for the project and the manpower on hand. This left the team with a list of other design problems in need of intervention and provides more opportunities for future workshops. The main issues identified through observation, research and the communication process were:

- The transportation of rice from the field to the cleaning area
- The planting of rice clumps
- The harvesting of rice
- The collection of the rice from the field

The design team decided to adopt the broad framework of design process from Den Buurman (Den Buurman, 1997 by Kahmann and Henze, 1999 in Green and Jordan, 1999). Of course not all aspects of the Den Buurman process were necessary, but the broad framework gives a good principle to follow.
Table 2.9.: “The process of user-centred design” (Den Buurman, 1997 by Kahmann and Henze, 1999: 114 in Green and Jordan, 1999).

The design team decided to try to reduce some of the drudgery in the current system of rice harvest by looking at solutions that would convert the current tool (a small sickle) and the
current poor ergonomic position of the user when cutting the paddy (squatting position) which caused serious back problems into a solution that would ergonomically be healthier for the users and accompanying this a tool that could harvest and place the rice in the correct manner for drying. This process required continual and sustained interaction with the community members involved. We required the product’s potential users to assist and give input in as many aspects of the product development process as possible.

The design team also carefully considered how, where and what could be manufactured close to the source of the problem. To this end the design team members sourced craftsmen and local manufacturers in Barabanki village which is located within 2km of Jahangirabad village and the campus of JMI who serviced the farms the project was testing on. Through the research a number of manufacturing opportunities presented themselves to the team. Barabanki as well as Jahangirabad villages have several crafters and manufacturers who could make products from wood and metal who are able to work these materials with an enormous range of processes that would usually only be found in bigger towns.

The design process broadly followed the steps outlined in the Den Buurman process with each phase being tested against the community around JMI campus. The design team were fortunate to have access to local farmers at a variety of levels from the subsistence farmers to farmers who employed a number of local labourers to work their crop for them. As concepts were developed, so community members were brought in and asked to give feedback. This process threw up a few issues related to the understanding of industrial design type concept drawings. The design team used the JMI students to translate when discussing the drawings with the farmers. The drawings that showed the product with a person using it were far more accessible than the product on its own. As the project progressed, the design team tried to
include the human figure in the sketches. Once the design team, in conjunction with the community members, narrowed the design concepts down to three or four solutions, it was decided to have these manufactured as working prototypes and then test these in the harvest process.

A craftsman located in Jahangirabad village manufactured the first solutions. The blades were manufactured from the leaf springs of a Bajaj taxi (three-wheeler) and the handle was made from locally used building material wood. The cost for six prototypes (three each of two different designs) was the equivalent to twice as many sickles (+/-Rupees 15 for sickle, +/- Rupees 30 for our design as prototypes). This made manufacturing the prototypes externally an easy and painless option. Another positive spin off would be that giving the designs over to the craftsman it was hoped that, if the designs worked, this craftsman could become the manufacturer of these products for the area.

The first set of prototypes were tested and filmed and we received favourable feedback from the users (translated to us by the JMI students). The positive feedback included an increased speed of harvest, users indicated that they would no longer suffer the back pain that plagued them in their normal posture for harvest work, and that the products would allow them more rest time due to the increased speed. The indication was for minor changes to the blade i.e. a serrated blade versus the smooth blade we had originally used and slight changes to the handle.

The second iteration of prototypes were made by the same craftsman with the changes as discussed, but the prototypes only arrived on the morning before we were to leave India. These prototypes were immediately taken to a different group of users, who were harvesting
at the time, by the students. The prototypes failed completely. The issues that appeared to be non-issues when the first round of testing was done now became the focus issues. Even the changes to the blade were met with disapproval. Of course this was frustrating and demoralising for the design team, but this indicates a breakdown in the process that requires some attention. The requirement for additional development and testing will be recalled when completing similar projects in future. It highlighted the complexity of the process of technology transfer and the delicate communication balance required when working with local communities. Unfortunately the design team needed more time to complete the project and continue sustained testing before a final or evolving design could be delivered to the users. This project needs to be taken up again and developed further.

2.4.6. Conclusions and observations of community centred design:
Having been involved in three community centred design projects and anticipating involvement in many more, I was pleasantly surprised to find Donaldson’s (2002) view on community centred design and design for development projects directly reflected my own thinking.

Donaldson (2002) gives five areas in which she believes such projects can show improvement:

1. The user needs to be central to the theme: “Engineers and designers are often taught during their formal education that the design process begins with a stated problem based on market need. They are also taught that the process is cyclic with multiple feedback loops based on user input” (Donaldson, 2002: 1), in her opinion this often leads to products, which although useful to the community, are often not appropriate or sustainable. Feedback from users is vital, in her opinion, especially when working in remote locations. Interaction with the users should take place “continuously
throughout the project, as well as after its completion” (Donaldson, 2002: 2). Comprehensive need and market research is needed for such projects and the design group needs to conduct field research and receive direct feedback from the product users (Donaldson, 2002).

2. “Great design is paramount” (Donaldson, 2002: 1): although the principles of community centred design are often not for the designers commercial gain, the design itself should still stand up to the rigours of analysis, if not then “technology that is unsuited to the user and / or environment, or that is simply poorly engineered can only be detrimental to users with no financial safety net to take risks” (Donaldson, 2002: 2). She summarises her thoughts on producing good design by stating: “High quality design includes all facets of design: functional, technical, ergonomic, sociological, etc. that must be recognized and suitably addressed” (Donaldson, 2002: 3). She also suggests, as Papanek (1985) does, that design for community should not limit access through the intervention of patents, but should be “open source” (Donaldson, 2002).

3. Community centred design should “think developmentally, act corporately” (Donaldson, 2002: 3): although the projects are aimed at developing communities, the approach should be market-driven, which means, the solutions should become sustainable (Donaldson, 2002). This reflects some of Margolin and Margolin’s (2002) thinking: the argument to promote the inclusion of commercial aspects into social responsible design; thus allowing designers from all spheres of design practice to be involved, where possible, in design for social need.

4. There should be more reporting on the outcomes of community centred projects, this should include both the successes and the failures (Donaldson, 2002). Most importantly is the “lesson learned” to allow future projects insight into how and why mistakes and success occurred (Donaldson, 2002). This, in Donaldson’s (2002) view,
should include the evaluation of aspects of feasibility, outcomes and the original goals set and “must be quantitative and measurable” and can be measured by the number of “jobs created, income generated, or return on investment” (Donaldson, 2002: 4).

5. Community centred design should encompass a wide variety of fields. Donaldson (2002) suggest the inclusion of engineering, business, economics, and sociology and through this she indicates that “different opinions, experiences, perspectives, and access to information encourages cross-pollination and even adds healthy tension which drives improved project and technology designs” (Donaldson, 2002: 6).

I add to her suggestions with a few of my own. These I have established from my experience in the two Interdesigns in South Africa and the rice project in India, and as I become more experienced at such projects will probably adjust and change them again in future.

• Research: comprehensive background research at the beginning of the project or even before the designers arrive at the community where the design project will take place is vital to the success of the project. Understanding the micro and macro view that influences the individual and community is integral to the solutions offered. Additionally, sensitising the design team to potential cultural issues should be included in this research; causing offence through ignorance of these issues can stall projects.

• Locate the design team in the village: as Papanek (1985) suggested it is better to be intimately involved in the community the design work is being completed in. To this end I suggest that living in the community, experiencing the problems of every day life will add value to the designers understanding and empathy of the people and problems they are experiencing.

• Observe, listen and develop an understanding: take time in the observation and discussion stages of the project, it is more important to learn as much as possible about the
community and the problems they experience than simply rushing into design solutions. From personal experience it never pays to rely on others for the research you need to complete. Direct observation and direct interaction allows the designer the opportunity to understand the issues first hand and this has a great influence when analysing potential solutions.

- The time required: two weeks is unfortunately just too short a period to fully comprehend the problems and offer solutions, no matter how committed the team. I would suggest a minimum of three weeks for the research and concept stages in future.

- How many designers does it take to change a light bulb? Keep the group sizes to manageable proportions, not only is it difficult for a co-ordinator to manage a large group, but it is also intimidating for the community when large groups of people descend on them. Also too few designers can influence the scale of the solution – I suggest a good middle ground is around 8 per group.

- Include a multidisciplinary team: include non designers in the team: social scientists with ethnography experience could add enormous value, add business people in for a check on fiscal reality, perhaps even marketers, alongside designers from varying backgrounds: industrial design, engineering, architecture and more. A diverse team allows for unusual approaches and solutions to the problems which industrial designers may not typically experience.

- Interpreters: use, where possible designers who have an understanding of the regional language and culture who are able to interpret the needs but within a cultural and regional sensitivity.

- Combine all design paradigms: be open to solutions that include technology transfer, appropriate technology, user centred design, socially responsible design and commercial design principles at once.
• Make no promises: include community members throughout the design process, but do not make promises that you may not be able to deliver on.

• Tackle manageable problems: it is probably better to try to resolve smaller problems, especially if the project proposes only short term commitment by the design team. If the intention is to be involved for longer periods, perhaps then a large, long term project could be dealt with.

• Finish working prototypes or write up solutions: with the support of local designers and manufacturers develop the project further, at least up to working and testing prototypes. It would be even better if solutions were ready for manufacture either in the village or commercially, and perhaps part of the solution should be making sure that this final stage is in place.

• Follow up: once prototypes have been manufactured, if possible, reformulate the team and test the solutions in the community once more before refining for final manufacture. Typical commercial design projects run for several months, why should corners be cut on community centred design projects.

• Be willing to make mistakes and try to learn and develop around these. As with all design projects, making mistakes is part of the learning and developing.

• Start to develop a database, possibly through questionnaires and surveys, on the community’s perceptions and understanding of the processes of design and potential impact on their environment. This could be useful for future projects.

The final words of this section I leave up to Donaldson (2002):

“For a product to be successful in a less industrialized economy, it must, at the very least, meet the same basic requirements for any product in any economy: the design must be of the highest quality and the design process must be driven by consumer needs.” (Donaldson, 2002: 7)
2.5. An Appropriate Design Process for the Development of Paraffin Stoves in South Africa

It appears that in the same way many South African industrial designers have involved themselves with the design of a new braai (barbeque), so internationally design academics have involved themselves with the development of new and improved design processes.

“Many designers are trying to make the design process more systematic, scientific, and predictable, as well as computer-compatible. Their attempts to rationalize design by developing rules, taxonomies, classifications, and procedural design systems are extreme examples of trying to provide design with a respectable scientific-sounding theoretical background or, at least, a theory-like structure that smacks of science. Their approach stands for reason, logic, and intellect but such a method leads to reductionism and frequently results in sterility and the sort of high-tech functionalism that disregards human psychic needs at the expense of clarity.” (Papanek; 1996, 56)

And within the same paper Papanek (1996) describes his own design process. Lawson (1997) states that design process maps “seem to have been derived more by thinking about design than by experimentally observing it, and characteristically they are logical and systematic” (Lawson, 1997: 39) the danger of this is that “writers on design methodology do not necessarily always make the best designers” (Lawson, 1997: 39). The “best designers are more likely to spend their time designing than writing about methodology” (Lawson, 1997: 39). As I write this section I hope to tread carefully and to not become another of Lawson’s (1997) theorists nor an introspective designer as Papanek (1996) suggests.

The reason I have developed a design process that I believe will be functional for the project of developing a paraffin stove in South Africa is because the systems that I have used in my professional practice are too market driven. Furthermore, the system I have used in socially responsible design projects are for projects that run for shorter time periods and are specific for community development. The process I propose in this study tries to combine many of the processes described in this chapter. With this process I hope to show a system that will allows designers to gain a better understanding of the problems related to paraffin stoves and the
circumstances and context of the stove user. I do not for a minute believe that this process is
the answer to all processes as I personally am still evolving it. However, this process may be
useful as a framework to start similar projects.

As with many of the processes I use the basic principle of design processes which Swann
(2002) ascribes to John Christopher Jones, Bruce Archer and Nigel Cross as having
developed. The process of “research, analysis, synthesis, production and evaluation” (Swann,
2002: 50) and Swann’s (2002) refinement of this in “problem / research – analysis – synthesis
– execution - production – evaluation” (Swann, 2002: 53) is fundamental to my process.
Margolin and Margolin’s (2002) suggestions that socially responsible design should combine
both market driven and socially responsible design paradigms in one process is in my opinion
the correct approach for future mass manufacture products for low income communities and
underscores some of my own thinking on this matter (Margolin and Margolin, 2002). I add
aspects learnt from the research I have completed on the traditional design process, user
centred design process and community centred design process as well as the processes I have
used for commercial design projects and the community centred design processes I have used
at the Interdesign and rice projects (described in 2.4.5.(i) and 2.4.5.(ii)).
Table 2.10.: My own commercial design process (informed by John Christopher Jones, Bruce Archer and Nigel Cross (Swann, 2002); Pugh, 1991; Lawson, 1997; Wright, 1998; von Stamm, 2003)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANALYSIS</td>
<td>List of requirements, ergonomic considerations, background research, and marketing research</td>
</tr>
<tr>
<td>CONCEPTUAL DESIGN</td>
<td>Design concepts, sketches, sizing mock-ups/rough prototypes, interpreting working mechanisms</td>
</tr>
<tr>
<td>CONCEPT PROGRESSION</td>
<td>Progression designs, renderings (cad/hand drawn), visual appraisal models, ergonomic testing, market testing, design refinement</td>
</tr>
<tr>
<td>DETAIL DESIGN</td>
<td>Finished designs, working prototypes, final market testing, engineering drawings / 3D CAD models</td>
</tr>
<tr>
<td>PRODUCTION PLANNING</td>
<td>Tooling design supervision, production supervision, and quality inspection</td>
</tr>
</tbody>
</table>

2.5.1. An appropriate Design Process:

The framework I propose for an appropriate design process is used as the structure for the research in this dissertation. This process is described in Table 2.13. In the process I propose that a lot more time is spent on the research and analysis phase of the project. At the same time fundamentals of continuous user testing, context analysis and environmental factors are included. Each stage of this process informs the next; also each stage can be revisited throughout the process, encouraging an integrated approach and continual re-evaluation.
Table 2.11.: an appropriate design process for paraffin stove design in South Africa

In the proposed process:

- Column 1 indicates the theme of the stage.
• Column 2 indicates the actions required.

• Column 3 indicates the criteria against which the actions could and possibly should be measured or that will inform the actions in column 2.

2.6. Conclusion:

The use of design processes cannot be controlled by the originator of the process. Designers will evolve systems for their own specific requirements and ways of working. The development of any process for design requires its continual re-evaluation and further development by the individual designer rather than the process originator. Furthermore, the context and application of industrial design continues to evolve. The processes which were used in the earlier parts of the previous century were acceptable for the time. Consumers received products that were informed by marketing, the manufacturer and the designers own perception of use. In today’s consumer culture this approach is no longer always acceptable. Designers are expected to be informed by and include the eventual user of the product in all aspects of the product development process. It cannot be anticipated what the next level of design process will be required to include, but this will probably look quite different from those processes that seem ideal today.

The process I have described as being appropriate for the development of a new paraffin stove in South Africa (2.5.) is very specific to the problem of paraffin stoves development. This process informs the remaining sections of this research. As with all design processes this system will be advanced and developed for further design work required on the paraffin stove I intend to continue with through to manufacture.