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**INNOVATIVE ECODESIGN**

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AN EXPLORATORY AND DESCRIPTIVE STUDY OF INDUSTRIAL DESIGN  
PRACTICE

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**Innovative Ecodesign**

An exploratory and descriptive study of Industrial Design practice

Supervisor: T Bhamra

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# Introduction **ABSTRACT**

This research provides a study of practices of Innovative Ecodesign. The literature has extensively highlighted the need for more radical innovations and more innovative approaches to ecodesign, to fall in line with sustainability targets. However, both theory and practice (and the resultant tools and methods) describe and present a more incremental approach, as prevalent and most suitable. Using a single case study methodology within the Industrial Design department of a major Electrical and Electronics manufacturer, this exploratory and descriptive study contributes to the theoretical framework and practical understanding of more innovative practices of ecodesign. Earlier work suggested that integrating ecodesign at the early stages of product development was critical to its environmental effectiveness and ability to innovate. This study therefore aimed to investigate Innovative Ecodesign by considering two key factors:

- Its integration into the early stages of the product design and development process
- Industrial Design practices of ecodesign.

The research concluded on Industrial Design practice as well as on the characteristics of Innovative Ecodesign.

Industrial designers conduct ecodesign in their own unique way, not fully represented in existing theory or accounted for in existing methods. They require specific types of information usually general and visually presented as well as substantiated with case studies and examples. The potential to innovate is seen as the greatest motivator for designers to conduct ecodesign, while their design processes use environmental priorities and 'the product' in an ambiguous way. Designer's key role and most significant contribution is in creative and strategic thinking (new ideas), and the proposal of new concepts which have a strong emphasis on increasing the desirability of these 'eco-products' or new behaviours. This demand-side orientation in the design considerations is particularly unique to Industrial Design.

The practices of Innovative Ecodesign undertaken here can be characterised as follows. It is an exploratory form of designing with an emphasis on openness and design freedom. Such design activities are perhaps best not immediately answerable to product development or aimed directly at the launch of new products. Among its aims are in embodying and expressing ecodesign principles and communicating these to others. Such design activities are strategic in their nature and requiring greater levels of participation across the production and consumption chain in future. They are systems based and holistic and prioritise environmental issues within the design brief. An important early aspect is the identification of either/or core business and consumer needs, which broadens the design considerations.

The study relates these findings back to existing ecodesign theory, and concludes that both ecodesign (its theory, descriptions, definitions and practice) and design itself (its profile, uses and practice) need to change and mature.

# Introduction

## AUTHOR PROFILE

Chris Sherwin was born and brought up in Stoke, but managed to get away safely. It was not until he began an MA in Furniture and Technology that his 'closet' green tendencies (always there but 'til then suppressed) finally surfaced or at least could be articulated. It was here that he developed an interest for this most complex but stimulating of subjects. A throw-away comment about the world not needing an more meaningless rubbish, an increasing realisation of his limits as designer as well as some frustrations as to the current shallow state of design led him away from design elsewhere. This coupled with the beginning of an interest and aptitude in research, led him to develop these interests in ecodesign matters as a full time occupation. Thus beginning a long, confusing and arduous journey from there to here.

What followed were 3 years of insecurity teaching and researching ecodesign and sustainability related matters at various institutes and with research bodies. In 1997 he took the brave leap of taking a Ph.D. post at Cranfield University to undertake full time research, gain some 'real-world' industrial experiences and leave his social life behind.

This lead to the standard roller-coaster ride of Ph.D. experience, but along the way, he has managed, to do interesting, enjoyable as well as making a (hopefully) significant and valid research contribution. Throughout this time, he also lectured and taught extensively, most notably at Goldsmith College on the Ecodesign programme, normally learning as much from students as they do from him. Such experiences have helped clarify his thoughts that the sustainability problem is very much a design problem and his status as a designer with environmental sympathies, rather than a environmentalist trying to do design.

At the time of submission he has taken a job with Philips Environmental Services, where he will (perhaps naively) try and make a difference. Whilst there, he hopes to balance his dual interest of doing what is 'right' with what is 'interesting' – priorities interchangeable on different days or depending to whom he is talking. He leaves Cranfield University with some fondness for the place.



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# Chapter 1

## INTRODUCTION

*This introductory chapter aims to set out the framework and scope, and the aims and objectives of this thesis. It begins with the background to the research with a brief introduction to some core themes and concepts. The chapter will then describe the scope, aims and objectives of the thesis while the final section will highlight the thesis structure by briefly summarising the contents and aims of each chapter*

### **1.1 Background to Research**

This thesis and the research on which it is based, explores practices of environmentally driven design or 'ecodesign' as it is currently termed. As a novel concept as yet in its infancy, it is little practised or understood. The work focuses on the design dimensions of ecodesign, from the perspective of the designer - what it means to embrace and conduct this novel concept in design. Ecodesign fits into and is informed by various external and related field of knowledge such as: sustainability and sustainable development; corporate environmental responsibility and management; clean production and technologies and design methodology which will be unfolded further in later chapters. This chapter however introduces the research. It begins with a brief summary of the fields affecting ecodesign, and presents the background to the research as well as stating some early and primary motivations. It will continue by presenting the research aims and objective, and end with the thesis structure.

#### Research Tradition

The subject matter and aims of this research mean it is in the 'design research' and to some extent the 'design management' tradition. Its aims are to explore and expand the theoretical field of design (in this case ecodesign) and shed light on practices of *designing*. Having an empirical basis within a single case also means the research is to some extent design management research, as many findings will relate as much to the management and organisation of design as they will to its practices and processes.

#### **1.1.1 Introduction to the Research**

This introductory section is split into four parts describing the theoretical framework and knowledge and subject domains of the research, as: Introduction to Sustainability and Sustainable Development; the Business of Sustainability; Introduction to Design; and Introducing Ecodesign.

##### **1.1.1.2 Sustainability and Sustainable Development**

Fuelled by new ideologies, scientific advances and evidence of increasing environmental pressure on resources and the earth's ability to deal with the by-products of industrial development, the previous 30-40 years has seen a significant rise



in environmental concern. This has resulted in such concepts as environmental protection, resource conservation and sustainable development emerge, gain widespread acceptance and begin to permeate mainstream business and societal consciousness.

There is increasing evidence that current human patterns of production and consumption, as well as being unfair (such as the increasing gaps in wealth and poverty), are now clearly environmentally unsustainable in the long term. Further and more recent development no longer associate this deteriorating environmental quality solely to technological developments and scales of production that do not respect nature's processes or its limits (supply-side issues alone). They now also implicate systems of 'consumption' such as the environmental impacts resulting from 'over' and 'under-consumption' by the world's richest and poorest people. The problems are clearly structural (raising questions of our current models of development) and of a magnitude that threatens notions of economic growth and human well-being (particularly the assumption that the former automatically equates to the latter). Though opinions differ as to the nature of the interventions necessary, and though the intricacies and details are by no means clear, to move towards or achieve (this somewhat mythical state of) sustainability, what we do now have is acceptance of the need for change.

The magnitude and challenges to the UK are well illustrated by targets set by Friends of the Earth (McLaren et al., 1998) for reductions in consumption based on per capita levels of resource use in 1990. Their study sets UK resource reduction targets for 2010 and 2050 for various resources in line with accepted international requirements (see figure 1.1):

	<i>Target reduction 2010</i>	<i>Target reduction 2050</i>
<b>Energy</b>	30%	88%
<b>Land</b>	7%	27%
<b>Timber</b>	65%	73%
<b>Water</b>	15%	15%
<b>Aluminium</b>	22%	88%
<b>Steel</b>	21%	83%

Figure 1.1: UK reduction targets for various resources by 2010 and 2050 (McLaren et al., 1998, cited in, Fletcher, 1999)

The study is careful to point out that environmental resources, and the concurrent environmental problems associated with their misuse are locally and regionally based. Thus resource reduction targets will be very much based on local and regional variations, such as resource availability, and the political, economic and socio-cultural context, hence sustainable developments should be specific and 'local'. So UK target for water reduction will be dramatically different from, for example Malta, reflecting the availability of water within the local context. What the study does highlight is the challenging nature of the targets, ranging from 15-88%, and also the need for radical improvements implicating every facet of economy and society. This requires dramatic improvements in resource productivity and by definition radical innovations.

### **1.1.1.3 The Business of sustainability**

There is an argument that the nature and magnitude of the sustainability challenge will be resolved at a governmental level. Due to the endemically unsustainable nature of



the economic and political systems in which production and consumption operate, the most effective interventions are policy development and new treaties and trade agreements. This argument states the systems as inherently flawed in, for instance the perceived wisdom's on which economic growth are based, make no acknowledgements for limited resources at one end of industrial production, or of the earth's ability to deal waste and pollution at the other (Cooper, 1994; Ekins and Max-Neef, 1992)

Rather than simply 'top-down' political and economic interventions bringing trade and markets into line with sustainability, all actors within our current means of production and consumption (or 'stakeholders' as they are termed) are challenged to embrace, develop and implement sustainability principles and practices. Among the most frequently implicated is business and industry. In the past, companies have been widely condemned for harmful and damaging practice. Recently, a more thorough acknowledgement of the true complexity and interconnectedness of the issues, as well as a maturing of the environmental movement itself (Mackenzie, 1997), now ironically champion business and industry as among our greatest environmental hope. As arguably the most powerful force in the development of both societal and technological innovations we currently have, business will be a (or perhaps even *the*) major driving force for more sustainable means of producing and consuming. The Chairman of Du Pont, as cited in Beard (1999) states this well: "*Environmentalists can agitate, governments can legislate, but industry can innovate*". (unpaginated)

Though these are challenging questions threatening our very notions of business and affecting all a companies operation, primarily these are questions of product development as impacts are most often associated with the development and design of the products a company produces (van Weenan, 1995). As questions of product development, they are perhaps more than anything else questions of 'design'. Previously these environmental questions may have been resolved by designing the processes to 'clean up' after the problems were created, or else designing new ways for the product to be 'produced' in a less harmful manner. Now the questions are of what product to make in the first place. Not only is this a question of design, but it is a question for designers. Such questions will not be resolved at production (how you make it) or engineering (how it work) stages of product development, but in the 'design and conception' of the product itself (what it is).

#### **1.1.1.4 Design and Product Development**

Understood as a process (designing), a profession (designer) and an outcome (design), the term 'design' is resigned to confusion, misunderstanding and misuse (Dilnot, 1998). It is most often associated with the conception, planning or detailing of products for manufacture, Frequently these associations emphasise manufacturability, and making products easier or more profitable to make. The latter half of the century has seen concepts of design move more towards the demand-side and concepts of usability, desirability, visual appeal and fun, etc and especially associated with making products easier to sell (du Gay et al, 1997). This latter role is especially the case with Industrial Design, whose title highlights its roots in the design of goods for mass production, but is now most closely related to consumer and usability related design matters within product design and development. Myerson (1995) maps the most



significant roles throughout the 20<sup>th</sup> Century, highlighting its many contexts and often contradictory nature of design:

*"Design for Business; Design for the Real World; Design for Profit; Design for Society. Here are four phrases that describe the changing role of the designer in the post-war years – and chart the often schizophrenic positions that the international design professions occupies as it weaves between being the obedient servant of the client, commerce and consumerism on one hand, and the ethical champion of broader social and cultural concerns on the other" (unpaginated)*

Such understandings of the nature and purpose of design will significantly shape ones approach and uses. By definition this will also significantly influence (and perhaps limit) its application to environmental matters. Thus the term 'design' will inform notions of 'ecodesign'.

#### **1.1.1.5 Introducing Ecodesign.**

*"In many ways, the environmental crisis is a design crisis. It is the consequence of how things are made, buildings are constructed, and landscapes are used" (Van der Ryn and Cowen, 1996, p-9).* There is now a small, but well-established critique of the design sustainability relationship, with various authors implicating design as central to our currently unsustainable developmental paths (Papanek, 1995, Whiteley, 1993, Madge, 1993). As with the evolution of notions of sustainable business, design is similarly stated as both part of the problem and ironically part of the solution. As will be explained in following chapters, literature suggests a variety of contexts, roles, strategies and approaches for a more environmentally responsible design. All point towards some or even a major role for design within a transition to a more sustainable future.

At a more practical and operational level, designers (and industrial designers specifically) have a potentially major part to play in the development and design of more sustainable products, which is not fully utilised at present. Being located at the 'early stages' of product development, designers have a significant influence over the design, and in some cases the very 'nature' of the product itself. In turn, this has a potentially major influence on the resultant environmental impacts of the product and the ability to innovate. Though opinions differ on the scale, there is clearly some role for design within the transition to more sustainable systems of production and consumption. It is these kinds of design questions, located within the product development and company context that are the domains of this enquiry.

## **1.2 Research Motivation**

Several factors and observations motivate this research. The first and most prevalent relates to a prior knowledge of the epistemology of ecodesign, bought to the study, but further expanded and confirmed through the literature review. This centred on the several identified questions as to the nature of current ecodesign theory and practice.

The research was initially motivated by one overriding contradiction, which, at the time the researcher was perhaps not able to fully articulate, but with hindsight is clearer. Within much ecodesign theory and practice the researcher was left with the overriding question: 'where is design?', in that much existing ecodesign theory and practice was not seen as being *about or for* designers. It was seen as almost exclusively a management or environmental sciences based subject, either: to manage and integrate



ecodesign into either a department or design process; or alternatively assess the environmental impacts of resulting designs. These two, though related are not design practice itself. Two key theoretical contradictions emerged from this:

- Theory and practice tended to focus on the material, technological and engineering dimensions of ecodesign and are dominated by this 'instrumental' view of design.
- Current ecodesign themes seriously limits its ability to develop, whilst also limiting its potential environmental contribution.

Along with these more personal observations, initial discussions and previous research at Cranfield and elsewhere also helped this defining process:

- The first of these was the DEEDS project (DEsign for Environment Decisions Support) conducted at Cranfield University previously (Simon et al., 1998, McAlloone, 1998). This surveyed US and European companies in the Electrical and Electronic sector to define the ways in which companies integrate ecodesign into product development. A key finding and recommendation from the need to integrate ecodesign at the 'early stages' of product development and that these early stages offered the greatest opportunity for environmental improvement and innovation.
- Also among the only comprehensive enquiries of the Industrial Design – ecodesign relationship was that of Bakker (1995), which highlighted most current practice as more 'incremental' in nature not able to deliver the environmental improvements necessary, and called for more 'radical' practices of ecodesign along with the resultant tools and methods.

Though the two studies appear separate, they interconnect in that the 'early stages' are recognised as critical to the level and effectiveness of innovation. In many ways therefore the 'early stages' are the key to more innovative ecodesign.

### **1.2.1 Limitations of current literature and existing theory**

Further literature helped confirm these theoretical limitations as well as shape the enquiry, the research aims and objectives. Existing work to date, tends to:

- Have little or no reference to Industrial Design. The Industrial Design – ecodesign relationship is little studied or understood and theory is descriptively inadequate.
- Research, tools and methods have tended to focus more on incremental, product redesign, rather than new product concepts or more radical forms of innovation necessary for sustainability.
- Many models, definitions and description have no empirical basis.
- Existing work is largely conducted at later (detail) design stages of the product design and development process, rather than the early stages of greatest importance. There are major questions as the transferability of such tools and methods to the early (concept) stages, where little work is currently conducted.
- Current practice has a strong technological (supply side) design emphasis, failing to acknowledge a 'socio-cultural' role for design in moving society and consumers

towards more sustainable patterns of consumption and lifestyles (societal orientation).

This research aims to in part fill some of these knowledge gaps. Conducting research around these core themes will call on research, literature and knowledge domains from the following subject areas: design and industrial design, product development; ecodesign and sustainability, and innovation.

### **1.3 Research Aims and Objectives**

This section describes the aims and objectives of the research:

#### **1.3.1 Aims**

The research aims to contribute to ecodesign epistemology and build knowledge of ecodesign theory and practice. It is an empirical enquiry into the early stage integration of ecodesign into product design and development; and the characteristics of Industrial Design practices of ecodesign. As such it contributes to two research domains: The theory – practice and Industrial Design – ecodesign relationship. The specific research aims are:

- To explore and describe the integration of ecodesign at the early stages of the design and product development process

#### **1.3.2 Objectives**

The following research objective characterise this research:

- To critically review ecodesign literature and summarize into "state of the art" theory.
- To identify the nature of early stage ecodesign integration.
- To describe the characteristics of Industrial Design based ecodesign.
- To explain how industrial designers conduct innovative ecodesign by building a descriptive model.

#### **1.3.3 Research Questions**

- How does an early stage (industrial) design department integrate ecodesign?
- How do industrial designers conduct ecodesign?
- What are the characteristics and practice of more innovative (or early stage) ecodesign?

#### **1.3.4 Research deliverables**

The key research deliverables are:

- A list of the nature and characteristics of early stage ecodesign as conducted by Industrial Design.
- A descriptive model of Innovative Ecodesign to aid its uses and integration within product development and its practice by industrial designers.

This thesis explores environmental issues in design. It is aimed as a comprehensive study of ecodesign in action i.e. *of ecodesigning*. Its particular focus is on Industrial



Design and the ways industrial designers conduct ecodesign as well as its integration into the early stages of product development. This thesis aims to contribute to and expand the existing knowledge base, by extending into novel design areas (Industrial Design) and to other stages of the design and product development process (the early or concept stages). It is based on in-depth 'field' research conducted on a single case over a two-year period. This empirical context allowed the research to build a rich and deep picture of the practices and processes of ecodesign at the 'early stages' in question.

#### The selection of the single case

Dealing broadly with 'practices' of ecodesign, raises the question of their selection. The research is based on a single case, whereas practices are normally selected as examples of 'best' or 'unique' practice. The idea of success or 'best' practice is difficult to assess here as it the selection will fundamentally be about a method of defining success. This usually refers to either critical acclaim or the magnitude of environmental improvement achieved in ecodesign, none of which were applicable at the commencement of this research. At this stage there were no designs to assess the success of. The case was therefore selected because of its novelty and simply as a case of practice (which has later emerged as both novel and successful). The research has since had some critical acclaim and exposure over the subsequent time period, many of which are highlighted in the list of publications. These factors, as well as the department's own assessment of the projects successes were seen as justification enough for the selection of this single case.

#### **1.4.1 Research Novelty**

The research demonstrates novelty in a variety of ways and for various reasons:

- It explores ecodesign within new and novel stages of product development, previously ignored – the early or concept stages.
- Theory is built from empirical evidence from a single case study, thus grounding it in reality. Much existing ecodesign theory is based on theoretical propositions developed from literature, history or criticism.
- It moves practices and concepts of ecodesign into a new design discipline - Industrial Design. There has been little work or theory relating to this form of design.

#### **1.4.2 Contribution to knowledge**

This research aims to make three overall contributions:

- Contribution to the epistemology of ecodesign – based on empirical research at the early (concept) stages of ecodesign and from an Industrial Design perspective.
- Knowledge of ecodesign practice – a study of ecodesign in action, of the ecodesign processes as conducted by industrial designers, seen to advance understanding in both ecodesign and Industrial Design innovation.
- Industry experiences of early stage ecodesign integration, seen to advance understanding of the management of ecodesign.



### **1.4.3 Innovative Ecodesign, not Ecodesign innovation**

Though dealing broadly with ecodesign innovation conducted by industrial designers, within the thesis the author makes a clear literary distinction. Throughout, concepts of ecodesign innovation are referred to as 'Innovative Ecodesign' which is a conscious choice. Though dealing with ecodesign innovation of a more radical nature at the studies completion none of the outcomes resulted in 'innovations' – in the sense of a product launched to market. This does not invalidate the work, but means the focus was much more on the creative and innovative practice of designing and the design process, than on the development and launch of products. For this reason, the term 'Innovative Ecodesign' rather than ecodesign innovation was deemed more appropriate and descriptive for this enquiry.

### **1.4.4 Epistemological Limitations**

Whilst highlighting the aims, objectives and usefulness of the research it is also important to highlight its limitations. These can be described and acknowledged as follows.

- This research places a strong emphasis on environmental issues within design drawing conclusions and theoretical generalisations about environmentally orientated product design and development (ecodesign). Much of this used environmental priorities as the 'innovation levers' or primary drivers within the projects. All design activities cannot be ecodesign projects (of this kind) as they will pursue other priorities. For the purposes of this research, the importance of environmentally issues is overstated.
- Similarly, the research looks at Innovative Ecodesign, usually characterised by the generation of new product concepts and designs. Most forms of design and product development do not and cannot result in new products or concepts often only resulting existing product redesign. Again the prevalence of the new and innovative is overemphasised for the sake of research and requirements of sustainability.
- A final limitation of the research occurs within its overall aims in describing novel design concepts and practices. There are some questions of the usefulness of descriptive design research within the context of environmental sustainability. Walker (1998) states this aim as self-defeating, as design responses will be specific to time and place, and thus not generalisable or wholly conclusive. Thus there are likely to be little or no universal theories or generic approaches to ecodesign. Whilst acknowledging this, the author feels that the relatively immature 'state of the art' ecodesign requires some description and definition, providing the aims are in highlighting *an* (rather than *the* definitive) approach to ecodesign.

### **1.4.5 Research Ontology**

The ontological stance of this thesis is that sustainability will revolutionise many if not all facets of business and society, but also that business will be a key player within the transition towards more sustainable patterns of production and consumption. In many ways sustainability is a critique of our models of development, and there is strong argument for radical redesign of the systems themselves. These researches chooses to operate largely within the current socio-economic systems, but acknowledges they

may be fundamentally flawed and require revision in the long term. Its central stance is that the transition towards sustainability in large part requires a revolution of and by industry and the ingenuity, creativity, the socio-political power and economic clout of contemporary business and industry. As Hawken (1993) puts it:

*"Ironically, business contains our blessing. It must, because no other institution in the modern world is powerful enough to foster the necessary changes..."*

*....Business is the problem and it must be part of the solution. It's power is more crucial than ever if we are to organise and efficiently meet the world's needs" (p-17)*

Similarly design will be located within a company and formal product development process, rather than explored in new and novel contexts.

## **1.5 The Thesis Structure**

The thesis is divided into three main sections: a literature review; pilot study; and main study. Throughout the thesis, the nature and aims of the research shifts from exploratory up to and within the pilot study, moving to become descriptive throughout the main study. The final conclusions and research deliverables presented at the main study completion are descriptive and to some extent explanatory.

### **1.5.1 Literature review**

The literature review consists of two chapters. The first being a review of the ecodesign and related subject matter while the second introduces and reviews literature on the single case in question:

Research Question(s) for Literature Review:

- What is state of the art ecodesign theory and practice?

### **1.6.2 Pilot Study**

An initial pilot study was conducted with the company and department in question. This was undertaken as a 'live' design project in which designers worked on an Innovative Ecodesign project to concept stages. This allowed a methodology to be developed and tested as well as to build a relationship with the case in question.

Research Question(s) for Pilot Study:

- How do industrial designers conduct ecodesign?
- How does an Industrial Design Department integrate ecodesign at the early stages?

### **1.6.3 Main study**

The Main Study comprises the major work within this research and its main contribution. It takes some key findings from the pilot project forward to the main study for the purposes of validation, confirmation and expansion. The data within the main study comes from a variety of sources and projects ensuring triangulation in collection and analysis and is presented in relation to the key research themes. It is then related back to the literature with the aims of building theory.

Research Question(s) within the Main Study

- How do Industrial Designers conduct ecodesign?
- What are the nature and characteristics of more Innovative Ecodesign?



#### 1.6.4 Chapters of the Thesis

These three parts are divided into eight chapters:

*Chapter 1* introduces the research giving a brief summary to the subject in question, while also describing the background and motivation for this research. This chapter will then present the scope of the research as well as the research aims and objectives. It also describes the thesis structure.

*Chapter 2 – the Literature Review* presents the literature on ecodesign with the aim of building 'state of the art' theory for both its theoretical framework and ecodesign practice. To do this it looks outside the field of ecodesign, to design and sustainability, though always from a design perspective.

In *Chapter 3*, the single case on which this research is based will be presented. The chapter will begin by introducing the company and its history, then to its corporate environmental policy, its view and approach on environmental management and current practices of ecodesign. It closes by presenting the product development process and the Industrial Design department in which the study was chiefly located.

Within *Chapter 4 - Research Methodology*, the research strategy, design and methods are presented. The chapter also presents the data collection and analysis techniques adopted within this enquiry.

The pilot project is introduced in *Chapter 5*. This 'live' design, conducted with Electrolux Industrial Design provided some early research findings, as well as a methodological framework and context on which to base the main study. The pilot study also resulted in a change and revision to the research design and questions, which are presented here.

*Chapter 6 – the Main Study* presents the research findings, via the two core research question revised after the pilot. This chapter closes by presenting two conceptual and descriptive models for the research findings in this enquiry.

Discussions and theory building are undertaken in *Chapter 7*. This relates the key research findings and the models back to literature with the aim of building new theory and contributing to knowledge.

*Chapter 8* presents the research conclusions, whilst also making suggestions for further work and research.

# Chapter 2 LITERATURE REVIEW

*This chapter reviews ecodesign literature. It begins by fitting ecodesign into broader framework of sustainable development, from a business and societal perspective. It then gives a comprehensive description of the ecodesign literature, but particularly the last few years. The chapter then presents a number of key ecodesign themes moving next to ecodesign practice. The chapter closes by introducing a number of related topics and by summarising the chapters finding as 'state of the art theory.*

## **2.1 Background and history of ecodesign**

This section introduces the concept and practice of ecodesign, and various developments that have shaped it. In doing so it draws on various related sources, such as: the historical development of the modern environmental movement; sustainability and sustainable development; as well as environmental management; and environmental philosophy.

## **2.2 Sustainability and Sustainable Development**

There is increasing and widespread recognition that our current forms of development and patterns of production and consumption are placing unprecedented and unsustainable pressure on the earth resources and ability to deal with wastes and pollution. (Wackernagel and Rees; 1996, McLaren et al.; 1998, Meadows et al, 1992). Such concerns over the last 30-40 years, have led to the emergence of notions of sustainability, and the widespread recognition that humanity should embark on a path of more environmentally sustainable development.

This is made more transparent with recent developments such as 'ecological footprinting' (Wackernagel and Rees, 1996). 'Ecological Footprint Analysis' is an environmental accounting tools helping give an indication of the resources required – consumption and waste assimilation - to facilitate any form of human development. A simple mental model is to imagine a glass terrarium or a dome over a human development (such as a city) to visualise the idea of ecological footprinting. How large would this hemisphere have to be to provide all the resources, materials and energy and assimilate all the wastes and pollution's required to sustain this development? This can be calculated as an area of productive land which is the 'ecological footprint' of the settlement, and thus the area of space needed it also helps visualise the concept.

Wackernagel and Rees (1996) apply these techniques to various countries providing a per capita ecological footprint. These figures are especially informative when compared



to the average footprint each person 'could have' if resources were distributed evenly across the planet (known as the 'fair earth-share') as presented in figures 2.1 and 2.2.

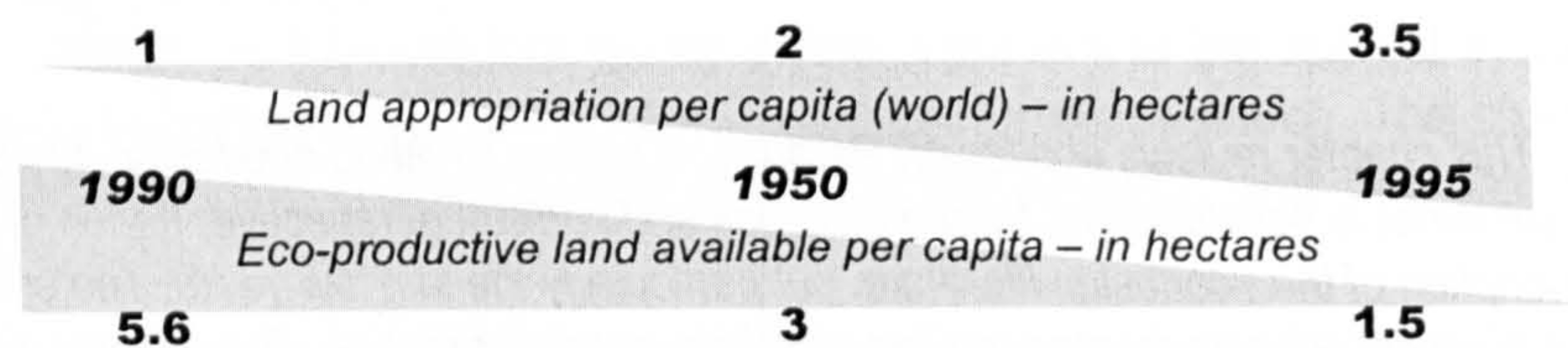


Figure 2.1: Per capita Ecological Footprints in 20<sup>th</sup> Century

Country	Approximate Ecological Footprint
<i>Per capita average</i>	<i>Fair Earth Share – 1.5 hectares (1995)</i>
India	0.38
Britain, Germany & most of Europe	Between 3-4 (average)
The Netherlands	3.32
Canada	4.27
United States	5.3

Figure 2.2: Individual nations average per capita ecological Footprint

Figure 2.1 illustrates clearly that per capita global resource consumption has increased steadily throughout this century (for 1900-95) from 1 to 3.5 hectares. Proportionally, and at the same time the amount of 'eco-productive land' (each persons 'fair earth share') diminished from 5.6 to 1.5 hectares per capita. And worryingly, these figures are diverging.

Ecological Footprints give a visible expression of unsustainable resource consumption and the resultant environmental impacts of lifestyles. As a comparative tool it illustrates the global inequities in material consumption, and the poverty and wealth gaps created by unfair distributions of resource use. Figure 2.2 present our 'fair-earth share' as 1.5 hectares (in 1995) and also illustrates that the world poorest are not consuming enough to meet their basic needs (do not consume their fair earth-share, with India's average being 0.38 hectares). In contrast the earth's richest (especially North America, at 5.3 hectares) are consuming a far greater 'earth-share'. This however is not simply a question of ethics, as the authors estimate current patterns of development are running down stocks (capital depletion) of global resources at around 30% per annum. In simplistic terms we are depleting our resource capital rather than living off the income, which is clearly unsustainable in the long-term. Wackernagel and Rees (1996) go on to propose that, were everyone to have the lifestyle of the average American we would need three 'Phantom (extra) Planets' to provide this. Ecological footprints give a quantitative, visible but perhaps more importantly symbolic illustration of humankind's absolute reliance on nature.

There are strong arguments that our currently unsustainable patterns of development are evolutionary cycles in the 'natural' development of human societies. Ponting (1991) historically links the collapse of great civilisations to their destruction of the resource bases on which they relied. Others point out the inherently unsustainable nature of our philosophical schools of thought (such as modern economic notions of well-being and progress, or the world religions) as not respecting 'nature' or acknowledging mankind's



reliance and independence on the planets continuity (Fry, 1999; Dobson, 1991). In short, our models of development, or the very 'idea' of development is in question. Sustainability is an all-encompassing concept embracing political, socio-cultural, economic, technological and philosophical domains (Clayton and Radcliffe, 1996). Though dealing less the specifics and details of developmental implementation, sustainable development offers a vision of possible pathways and directions for humanity to follow.

### 2.2.1 The History of Sustainability

Notions of sustainability affect and implicate all facets of society and economy. Though acknowledging the inherent dangers, this study chooses to describe it from a 'top-down' international, political and governmental perspective. The purpose of this is to be illustrative, rather than definitive. Perhaps the most significant of these was the World Commission for Environment and Development (WCED) report 'Our Common Future', later labelled the Brundtland Report (1987). This cited the most commonly accepted description of sustainability as:

*"... development that meets the needs of the present without jeopardising the ability of future generations to meet their needs."*

The Brundtland report helped broaden the focus of the discourse. It strongly connected poverty with environmental degradation, stating this was both a cause and effect of increasing wealth and resource disparities between the North and South. It implicated both 'under' and 'over-consumption' as key environmental factors in the current levels of environmental degradation. Essentially the successes of the Brundtland report were in galvanising National and International governing bodies into acknowledging the true nature of sustainability. It highlighted the complexity and interconnectedness of both causes and effects of environmental problems, and the differing scales of action required. It helped define and map sustainability.

Five years on came the second key international event, the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992 and later dubbed the 'Earth Summit' (UNEP, 1992b; UNEP, 1992a). In many ways and from an international and governmental perspective, the Earth Summit was a defining moment in the history of environmentalism and sustainability. Its proposals and achievements are too comprehensive to list here, but among its greatest achievements was in stating the need for both a 'top-down' and 'bottom-up' approach to the implementation of sustainable development. In short sustainability would *not* be achieved at governmental or corporate levels, through international treaties or new economic and political measures alone. It also required, more 'grass-roots', individual and societal intervention to ensure its success. Leading directly from this, was the call for all 'stakeholders' (actors within society, industry and economy) to implement sustainability at all levels of society. In this sense, there would be no 'grand narrative' or universal 'answers' to sustainability, as solutions and initiative would very much grow from context and place and be specific to individual, community and societal needs.

This shifting focus is well illustrated in Principles 7 and 8 of the Rio Declaration on Environment and Development (UNEP, 1992a, p.11-13) and Chapter 4 of Agenda 21 on 'Changing Consumption Patterns' (UNEP, 1992b, p.56-61) both outcomes of the Earth Summit. These promoted the need for developed countries to tackle there own



unsustainable patterns of development, while also encouraging new patterns of production and consumption. Suddenly sustainable development is firmly placed into the homes and lifestyles (the agenda and consciousness) of western consumers and more closely associated with 'demand-side' as well as 'supply-side' factors traditionally implicated. These and a number of subsequent documents (EC, 1993; UK Department for the Environment, 1998), plus Local Agenda 21 initiative occurring within every locality, highlight the need for changes to production and consumption patterns as well as presenting some progress.

#### 2.1.1.1 The Nature and Scale of innovations required for Sustainability

In many ways this begins to challenging western notion of wealth and wealth creation, of well being, happiness and how our needs are satisfied. With this, come a whole series of issues dealing with the demand-side – our lives, our aspirations and our needs. Clearly production and consumption related innovations would consider entirely new consumption patterns, such as the purchase and consumption of services (Giarini, 1992; Stahel, 1999), or notions of caring and sharing (Manzini, 1997), as well as actually reducing consumption (Durning, 1992). At its most challenging, this even suggests a sufficiency revolution, acknowledging nonmaterial wealth and immaterial values and means of satisfying needs, as well as limiting demand and individual consumption (Cooper, 1998; Durning, 1992; Jackson, 1996; Pantzar et al., 1995; Heiskanen and Pantzar, 1997; Cooper, 1997).

Along with the shift from supply-side to demand-side, recent developments have also given some scale to abstract notions of sustainability helping quantify it. Among the most useful of these is the Factor X concept, which at its most basic helps to give a 'factor' of environmental improvement required or achieved for sustainability. Thus a product or process improvement would be given a factor, say factor 2, indicating an overall improvement level of 50%. Factor calculations have been conducted to help quantify the overall environmental impact of human activity and our demands on environmental resources. Factors quoted here describe the magnitude of improvements necessary in per capita resource consumption to satisfy estimated sustainability targets. Two of the most widely used factors are described below.

- Ehrlich and Ehrlich (1990) use a simple equation based on estimated population growth and increases in consumption levels to propose reductions in environmental impacts. These estimate technological improvements as having to improve by Factor 20 or by 95% (one twentieth) of current levels to be deemed sustainable.
- By ignoring current inequities in wealth and distribution of resources, a less unsettling (and more widely used) calculation comes from Von Weiszacker et al (1997). They propose Factor Four, which "*means that resource productivity can - and should - grow fourfold. The amount of wealth extracted from one unit of natural resources can quadruple. Thus we can live twice as well - yet use half as much*" (p.xviii). This suggests a 75% improvement in resource productivity is required for sustainability

From these two description we can see clearly that to fall in line with sustainability goals (between 75 and 90% reduction in resource use per product or per capita),



ecodesign innovation needs to be both radical (beyond the redesign of what exists), whilst also being consumption and lifestyle orientated (social innovations):

*"Faced with the evidence of the interconnectedness of the environmental, economic and socio-cultural crises, it becomes increasingly clear that the scenario of the 'redesign of what exists' is not sufficient for the discovery of true solutions... The idea most modestly, is to propose solutions which contain some spark of innovation, meaning a new way of behaving or of viewing the world"*  
(Manzini, 1994, p-38)

### 2.1.2 The Business of Sustainability

All stakeholders are challenged to contribute to sustainability but much attention is focussed on business and industry. The role of business within sustainable development is the subject of debate with varying opinions often polarized. On the one hand, various authors propose sustainability as the next great business challenge (Schmidheiny et al, 1992) and that sustainability will only be achieved with the ingenuity, creativity and economic potential of companies (Elkington and Burke, 1987; Hawken, 1993). In contrast is the view that the environmental crisis is the result of the implicit unsustainability of current corporate, economic and technological practice ((Ed) Ekins and Max-Neef, 1992; Schumacher, 1973). This stance argues that a complete revolution in our means of organising the production and consumption of goods and services are necessary, promoting decentralisation, the use and application of appropriate technology, local materials and skills; whilst acknowledging environmental limits (Porritt, 1984; Illich, 1990; Fromm, 1995).

Ottman (1998), Beard and Hartmann (1999) and Fussler (and James, 1996), all promote new sustainable business opportunities for companies as well as impact reduction of existing products traditionally expected. From this view the environmental debate is the next economic revolution to tap latent markets and create new ones. From this argument, as the largest and most powerful entities we currently have, sustainability can only be a business revolution and will be fundamentally driven by industry (Hawken, 1993). Business views of and response to environmental pressures has, like the sustainability debate, matured over the years. The transitions are described in a number of ways, often ranging from reactive, to compliant, to proactive (Smith, 1998; Dewberry, 1996; Beard and Hartmann, 1999). Several authors (van Weenan, 1995; James, 1997; Kazazian, 1998) also describe an evolutionary response to environmental initiatives as moving up the product development process. This includes the move from: end-of pipe 'filters', tackling waste or pollution after it is created; to process related environmental impacts, usually focussing attention on how things are 'produced'; to the more mature state of environmental design initiatives focusing on the product, or 'what' is produced. Jackson (1996) has termed this a shift from environmental 'cure' to environmental 'prevention', while van Hemel (1998) describes the transition as: cleaning technologies - to cleaner technologies - to clean products.

This historic transition, as well as the call for all stakeholder involvement in sustainability significantly implicates design and designers as those involved in how products are designed and produced. More importantly however, being at the 'early stages' of product development, towards which these environmental interjections are diverging, designers have a potentially great contribution to make as will be described later.



### 2.1.3 Shades of Green

The scale and nature of environmental change or strategies to adopt are the subject of varying opinion. These opinions in turn will be shaped by amongst other things: ideas about nature; our relationship to other living things; and our place on the planet, are described as 'shades of green' (Porritt, 1984). In simplistic terms, like many other politically sensitive and emotive subjects, Environmentalism is a broad church, with differing quarters adopting differing ideological and philosophical stances on key economic, political, technological and social issues. The table below helps illustrate some of these, with Turner (1998) describing these views as ranging from 'very weak sustainability' to 'very strong sustainability'.

Very weak sustainability	Weak sustainability	Strong sustainability	Very strong sustainability
Efficiency criterion	Efficiency and equity criteria		Bio-ethical criteria and constraints
Neo-classical economics paradigm	Systems perspective: ecosystem 'health' and 'integrity'		Non-anthropocentric intrinsic value
Rational individual as consumer	Intergenerational equity duty		Non-anthropocentric intrinsic value
Utilitarian individualism and preference values	Anthropocentric intrinsic value		Transformative value in nature
Market-based valuation	Non-Anthropocentric instrumental value		
Anthropocentric instrumental value	Aggregate private values; social value of ecosystems		
Total economic concept value concept (private values)	Primary and secondary values in nature		
Infinite capital substitution possibilities and technical progress	'Critical' natural capital constraints		

Figure 2.3: Spectrum of overlapping sustainability positions (Turner, 1998)

Rather than being objective or having consensus, sustainability is value-laden. These 'shades of green' are important to acknowledge, as ones ideological standpoint on 'the environment' is likely to determine ideas about ecodesign strategies are most appropriate (Whiteley, 1993).

## 2.2 Introduction to ecodesign

This section introduces and summarises the literature on ecodesign. To begin it introduces the background and historical development of ecodesign.

### 2.2.1 Background to Ecodesign

The development of the concept and practice of ecodesign is the response from the design community to increasing environmental pressures, limits and awareness. Among the first and most vocal critiques of our modern and unsustainable forms of development, and especially the instrumental role of design within this were Vance Packard (1960) and Victor Papanek (1985). These critiques came out of the 1960's, widely recognised as the birth of modern environmentalism. There are a number of theories as to the exact causes of this growing concern for the environment and the resultant ecodesign movement, Madge (1993) however suggests:

*"(t)he ecological design movement which emerged in the 1970's can be said to consist of several interconnected strands: voices of dissent from within the design profession – most notably Victor Papanek and Gui Bonsiepe; the Appropriate Technology movement associated with E.F. Schumacher and the Intermediate Technology Development Group (ITDG); and Alternative of Radical Technology which developed out of the counter-culture movement of the 1960's" (p.153)*



Among the most vocal critic, Papanek (1985) accused designers of gross malpractice that was not only environmentally unsustainable, but socially unjust and did not focus on the world's 'real' needs. He placed the blame squarely at the feet of the Industrial Design profession, describing them as among the most harmful and manipulative professions known to man (second only perhaps to advertisers). Ironically these critiques also promoted 'design' as a central and fundamental part of sustainable development (Papanek, 1995; Papanek, 1993). What is part of the problem will ironically be part of the solution.

### **2.2.1.1 The second wave of Environmentalism**

The above has been suggested as the first wave of 'environmentalism' and broadly reflect the attitudes, views and environmental strategies of the time. However, several authors (James, 1997; SustainAbility, 1995; Madge, 1997) refer to the cyclical nature of the environmental movement and a second wave emerged from the late 1980's and early 1990's. This coincided with the Green Consumer revolution (Elkington and Hailes, 1987; Elkington and Hailes, 1998) seeing design as instrumental in the development and launch of eco-products, enhancing consumer acceptance of them, helping portray a more caring environmental profile for companies and applying and interpreting various new and clean technologies (Ryan, 1992). Two important publications articulating this were Green Design by Paul Burrall (1991) and Dorothy Mackenzie's Green Design; Design for the Environment (1997b). Both these texts listed extensive and compelling examples of designers and companies that had successfully (and profitably) conducted product and process redesign whilst considering environmental factors and reducing impacts. These texts and indeed this whole discourse has been described the 'normalisation' of ecodesign (Manzini, 1993a; Manzini, 1994) and presents the acceptable face of the sustainability and design related debate in which design, environmental issues and economic priorities were seen to be compatible. Here companies and designers 'seamlessly' consider and integrate environmental activities into their everyday design practice and were very much the new 'business' of ecodesign.

In contrast (and concurrently) to the development of this acceptable façade of ecodesign, a parallel debate began to broaden the remit of design within a maturing field of sustainability. Most notable was work from Manzini (1990) and Ryan (1993), while in the UK organisations such as the Ecological Design Association (EDA) with its resultant publication Ecodesign, as well as the Centre for Sustainable Design were born. Europe saw the setting up of the O2 global ecodesign network based in the Netherlands (O2, 1993) with similar aims and priorities. These debates were more holistic and radical in their viewpoints but had learnt lessons and avoided pitfalls such as language, tone and acceptability of the early pioneers. They were however not afraid to ask the more searching question of design and sustainability as Madge (1993) again illustrates this, in stating:

*"Although the recent spate of publications on 'green design' tend to view the greening of design as a relatively straightforward of applying environmental principles to the practice of designing products for industry, 'sustainable development' poses fundamental and uncomfortable challenges to the design status quo as it does to other professions and disciplines." (p.149)*

This broadening of perspectives saw these discourses turn to more contextual matters of the systems of production and consumption in which design operates (Margolin, 1996; Manzini, 1995b; Walker, 1995; Hirst, 1996). In 'Design for Society' (a post-script to Papanek's Design for Real World) Whiteley (1993) argues for a form of design that disconnects itself from what he describes as 'consumerist values'. He suggests that design needs to remove itself from its current role within the consumer society, which he likens to that of 'clowns, prostitutes or stylists', and face up to its moral values and responsibility. Others also highlight these contradictions of sustainable design within inherently unsustainable systems. Walker (2000; 1998; 1995) tackles the redesign of these flawed systems themselves, promoting design within more local and human-scale systems of production, attuned to resource and energy availability and indigenous skills and knowledge. Others began to relate design to cultural transitions and values as indicated in section 2.1.1.1. Increasingly design was promoted as able to embody new value and behavioural systems, more sympathetic to sustainability [Ryan, 1996; Manzini, 1993; Dewberry, 1996]. Mackenzie (1997b) for instance, states, "*designers also influence environment impact indirectly, through their role as setters of styles and tastes.*" (p.11)

The sustainability discourse will have varying impacts on design theory and practice, with views depending on one's 'shade of green' and on opinions as to the significance, nature and role of design. Many (Madge, 1997, Fry, 1999, Fry, 1994, Dewberry, 1996) suggest that ultimately, sustainability is a way to reinvent design itself, redefining its role, approach and ultimately its purpose:

*"The primary question for the design profession thus becomes not what new products to make, but how to reinvent design culture so that worthwhile projects are more clearly identified and likely to be realised."* (Margolin, 1998a, p.90)

Ecodesign has clearly mirrored the development of modern environmentalism in its scope and maturity. It now emerges as diverse and varied, and is connected to business concepts, such as environmental management on the one hand, and more critical discourses, such as alternative economic and the development debate which radically critique society and economy. This will affect how it is understood and conducted and is a manifestation of the differing 'shades of green' presented in section 2.1.3.

## **2.3 Defining Ecodesign**

The following section describes 'state-of-the-art' ecodesign. There are a variety of different ways to understand and conduct ecodesign. These require different approaches whilst achieving differing scales of environmental improvement. Ecodesign will be presented here in three ways:

- Ecodesign definitions and descriptions
- Ecodesign models
- Ecodesign principles and strategies

This literature review attempts to be representative, though not comprehensive. Where definitions, models, etc, represent a similar viewpoint, a qualitative selection will be made on which to present. Though a distinction is made between definitions, descriptions, models, principles and strategies the literature will show that there is



much overlap. Often models of ecodesign are descriptive, while also containing principles and strategies and three areas were selected to illustrate the following :

- What ecodesign is? (Definitions, descriptions, + some models)
- What ecodesign does? (Models, + some principles and strategies)
- How to do ecodesign? (Principles and strategies, + some models)

### **2.3.1 Definitions & Descriptions of Ecodesign**

The last two decades has seen a proliferation of terminology relating to the incorporation of environmental factors into design. This has included: ecodesign (Eco2-irn, 1994); environmentally conscious design (McAloone, 1998); Design for the Environment (Allenby and Fullerton, 1991-92; van Hemel, 1998); Life Cycle Design (Keoleian and Menerey, 1994); EcoRedesign (Ryan, 1992); green and sustainable design (Dewberry and Goggin, 1996). Keoleian and Menerey (1994) point out that these differing terminology's may be explained by the traditions out of which they developed. Design for the Environment developed out of the DfX concept – and is a logic extension of its practice. Life cycle design in contrast developed more from the environmental sciences and from environmental management terminology having a scientific orientation (Keoleian and Menerey, 1994). Each of these, though similar, may have specific nuances, practices or represents varying degrees of environmental integration or innovation. In the literature, the term ecodesign has both specific and generic usage. It is this generic use – as an umbrella term for many kinds of environmentally conscious design approach to which this thesis refers.

The earliest attempts to describe and define ecodesign tended to focus on its integration into existing design practice and in balancing it with other design considerations such as cost, quality, etc. It was also extensively promoted as a means of enhancing design and company profitability, public perception, and reducing costs. Keoleian and Menerey (1994) reflect this, in describing Life Cycle Design as a:

*"systems-orientated approach for designing more ecologically and economically sustainable product systems which integrates environmental requirements into the earliest stages of design. In life cycle design, environmental, performance, cost, cultural, and legal requirements are balanced." (p.650)*

While Allenby and Fullerton (1991-92), state that Design for the Environment:

*"...designates a practice by which environmental considerations are integrated into product and process engineering design procedures... DFE practices are meant to develop environmentally compatible products ad processes while maintaining product price/performance and quality standards." (p.55)*

#### **2.3.1.1 The Polarities of Ecodesign**

Over the past decade ecodesign theory has developed considerably in terms of both these operational distinctions of ecodesign and also through a broadening and widening of its agenda and focus. In recent years a number of authors have discussed and this as a series of polarities, or distinctly different pathways. These polarities tend to be introduced in an 'either/or' fashion and usually describe exclusive, but often-evolutionary approaches, consisting of two or sometimes three distinctions. Though not representing complete they do represent a useful picture of ecodesign. The following section aims to review various key authors suggested definitions and descriptions often

presented as polarities. This helps define 'what ecodesign is' and ranges from a more economy or 'socio-cultural' perspectives, to those specific to design.

### 2.3.1.2 Broader Contexts and Frameworks

Margolin (1996) describes two economic frameworks in which design might fit and operate as models of Global Expansion or Global Equilibrium:

- In the model of Global Expansion: the world consists of markets rather than nations, societies, or cultures. Products function in these markets as tokens of economic exchange. They attract capital, which is either recycled back into more production or becomes part of the accumulation of private or corporate wealth.
- With Global Equilibrium: the world is a system of ecological checks and balances, which consists of finite resources. If the elements of this system are damaged or thrown off balance or if essential resources are depleted, the system will suffer severe damage and possibly collapse.

The equilibrium model is more conducive to sustainability, but it requires a reigning in of consumption, posing a direct challenge to the expansion model.

A similar broad view on sustainability comes from Van der Ryn and Cowen (1996) and describes two approaches, which though have the same aims, have fundamentally differing epistemological and operating principles. These they describe as 'technological' and 'ecological' sustainability, noting "*while both are coherent responses to the environmental crisis, they are far apart in their specifics*" (p.5) and are summarised as:

- Technological sustainability - *'Every problem has either a technological answer or a market solution. There are no dilemma's to be avoided, no domains where angels fear to tread. It is about expert interventions in which the planets medical systems are carefully stabilized through high-profile international agreements and sophisticated management techniques.* (p.5)
- Ecological sustainability - *'is the task of finding alternatives to the practices that got us into trouble in the first place; it is necessary to rethink agriculture, shelter, energy use, urban design, transportation, economics, community patterns, resource use, forestry, the importance of wilderness, and our central values'.* (p.5)

Similar distinctions under the banner of 'efficiency' and 'sufficiency' are suggested by others (Stahel, 1999; Durning, 1992; McLaren et al., 1998), whilst more socially, ideologically and philosophically orientated (but relate) terminology comes from Pepper, in describing ideological polarities as 'ecocentric' and 'technocentric' (Pepper, 1996).

### 2.3.1.3 Environmental Management and Ecodesign

Hirschorn et al (1993) and Jackson (1996) contrast differing responses to environmental management and corporate strategy. They propose two distinct approaches, the 'curative' and 'preventative' strategies. The 'curative' strategies (waste management or pollution control) are compliance led and tackle environmental factors after they have been produced. The 'preventative' strategy in contrast aims to design out the problems before they happen, effectively reducing the creation of pollution at



source. This is an intrinsic part of the developmental process itself being holistic and integrated. Drawing extensively on this work, Fletcher (1999) constructs a convincing argument for the preventative environmental strategy is in fact a design strategy. Further, she points out that most existing methodologies and indeed work in the field uses the 'curative' approach of attempting to design within the current and flawed system.

#### 2.3.1.4 Design approaches and focus

A similar and useful set of ecodesign polarities is that of van den Hoed, in comparing 'ecodesign' to 'Sustainable Innovation' (van den Hoed, 1996). By comparing various authors (many of them described here), he defines two distinct but different approaches to ecodesign.

Characteristics of ecodesign	Characteristics of Sustainable Innovation
Focuses on integrating all aspects throughout the lifecycle	Function/need as the starting point not optimisation
Focuses on the redesign/optimisation of current products	Use of innovation process not product design process
Is a design activity, environmental aspects are integrated in the design phase	System level as opposed to the product level

Figure 2.4: Characteristics of ecodesign vs Sustainable Innovation (van den Hoed, 1996)

There are clear distinctions, whereas one focuses on product optimisation the other looks to new ideas and concepts' using results, functions and needs as the starting point. Ecodesign uses the lifecycle principle whereas Sustainable Innovation looks beyond the product to the system, and incorporating ethical, social and economic as well as environmental factors.

Several Ph.D. literature reviews make similar polarities to those described here. Bakker (1995) describes two ecodesign distinctions with the first (ecoredesign) dealing with a straightforward process of incorporating environmental principles into the design process, using the life cycle principle and being largely technologically focused. The second approach (beyond ecoredesign) aims to development attractive new products, services and scenarios that enhance sustainable lifestyles. Van Hemel (1998) makes a similar distinction describing the two extremes as the 'evolutionary' and the 'revolutionary' approach. The evolutionary approach integrates ecodesign into existing design practice – the key words are product modification and pragmatism. The revolutionary approach requires breakthrough innovation, new and more radical thinking, ideas and products to fall in line with sustainability targets. The key words are innovation and idealism.

Descriptions of similar contradictory views come from Ryan – drawing a distinction between “*ecoRedesign - the redesign of our existing world*”, and “*ecodesign - the design of something new, something truly sustainable*”. (Ryan, 1992; Ryan, 1996). Similarly, Charter (1998a, 1999) describes the differences between existing product redesign, and new product concepts or development as, 'Ecodesign vs Eco-Innovation'. Züst and Luttrupp (1998) make distinctions not in originality of product concepts, rather in their effectiveness as 'eco-efficient' and 'eco-effective' products. These differences are that: “*effectiveness is the measure to achieve the goal. Efficiency describes the use of means to achieve these goals... 'Do the right thing' related to effectiveness and 'do the thing right' to efficiency*”. In making the same distinction



between efficiency and effectiveness, Beard and Hartman (1997) suggest we are "spending the right amount of time creating the wrong products!"

Other environmentally related design terms come from Dewberry and Goggin (1996). They propose 3 ecodesign approaches as Green Design, Ecodesign and Sustainable Design:

- *Green Design*: has a single-issue focus, perhaps incorporating the use of some new material, such as recycled or recyclable plastic, or consider energy consumption.
- *Ecodesign*: adopts the life cycle approach, exploring and tackling all or the greatest impacts across the products life cycle.
- *Sustainable design*: would take a more broad and holistic approach, including: questioning/addressing needs; concern for ethics and equity, services and leasing; dematerialization, empowerment, caring and sharing; as well as incorporating ecodesign best practice.

There are clearly a variety of definitions and ways to understand ecodesign. Definitions do not merely describe differing types of ecodesign but different approaches, which allude to differing knowledge and operating domains of ecodesign. For instance, both van Weenan (1995) and Charter and Chick (1997), in describing Sustainable Product Development and Design draw heavily on ideas about incorporating ethical and equity issue (such as wealth disparities and developing world factors) into design and development. Beard (1997) and Simon (1994) however discuss sustainable design as relating almost entirely to environmental resource usage in mimicking natural or ecological principles. In stating that "(a) sustainable product must generate capital for future generation to offset its use of non-renewable resources" they promote design as developing entirely benign or even 'restorative' products. This relates more to the use of ecological and biological design principles, different from that of van Weenan (1995) and Charter (1997) who refer to a design context. In summary some description illustrate very differing approaches to ecodesign (evolutionary/revolutionary, radical/incremental, green/eco/sustainable design), while the latter describes shifting paradigms and domains (ecological, cultural, technological).

### **2.3.1.5 Characteristics of each approach**

Literature from a variety of authors states distinct difference in ecodesign approaches. Characteristics of these approaches can be broadly described as follows, and for the purposes of this study will be termed 'innovative' and 'incremental' approaches to ecodesign innovation:

- *Incremental (improvement, evolutionary) approach*: where environmental issues are incorporated into design in an evolutionary approach. It uses existing products, business models or forms of development as their starting point. It is viewed as a technical or technological problems, but will lead to sustainable developments in the long term. This tends to deal with the following factors: optimisation, efficiency, technology, new materials, and existing product redesign. It has a single product or environmental focus.
- *Innovative (radical, revolutionary) approach*: where environmental considerations are used as the driver for new and more radical concept development. This uses a

more revolutionary approach arguing that existing products and patterns of production and consumption can and would never lead to sustainability. It is viewed as a marriage of technology, culture and nature (though many authors select two of the three). It tends to deal with the following factors: effectiveness, innovation and creativity, mimics natural principles and ecological models, engages cultural and lifestyle factors and it extends beyond single or traditional product and company boundaries and is multi-disciplinary.

## **2.3.2 Ecodesign Models**

This section reviews models of ecodesign. Models are often understood as simplistic way of representing or understanding the world. They usually have the purposes of being descriptive or prescriptive. Models have potential to summarise complex information in a manageable and understandable form, and also are a visual and visible means of summarising and presenting data (of particular importance to designers and this thesis). Models of ecodesign may represent a range of its characteristics, domains and practices.

### **2.3.2.1 Hierarchy of Waste Management**

An early model of environmental design strategies relates to waste management, here developed by the New Economics Foundation (Cooper, 1994). Its primary emphasis is on waste reduction and management, only one in a broad range of environmental factors to be tackled in design. It promotes the 'reduction' of waste as the primary goal, followed by the 'reuse' of product, components and materials. Third on the hierarchy is 'recycling' some way below its traditional priority status in design. In many ways, this emphasis on waste mirrors the focus of the environmental movement at the time, largely on the affects of environmental problems at the 'end of pipe'. This model, and the waste management hierarchy indirectly led to the earliest and perhaps most simple ecodesign strategies – Reduce, Reuse, Recycle (often with Replace added at the start).





Figure 2.5: Hierarchy of Waste Management (Cooper, 1994)

### 2.3.2.2 Charters' four-step model of Ecodesign Innovation

Charter and Chick (1997) propose a 4-step model of ecodesign innovation, describing both company and design strategies. They discuss the model as a series of design stages or approaches for companies and designers to move through. They also notes most companies at the 'Re-pair stages, dealing with end-of-pipe' solutions, and the 'Re-fine' stage through the concept of eco-efficiency. It promotes the move to 'Re-design' and 'Re-think' stages to achieve the goal of sustainability. As Charter and Chick summarise:

*"To move beyond 'Re-design' to 'Re-think' will require significant leaps in thinking, driven by the emphasis on creative problem-solving and opportunity-seeking. An essential element of this process will be the development of a more systematic infrastructure to enable the cyclical flow of resources and energy within the product systems, as outlined in the emerging concept of 'industrial ecology'." (p. 3)*

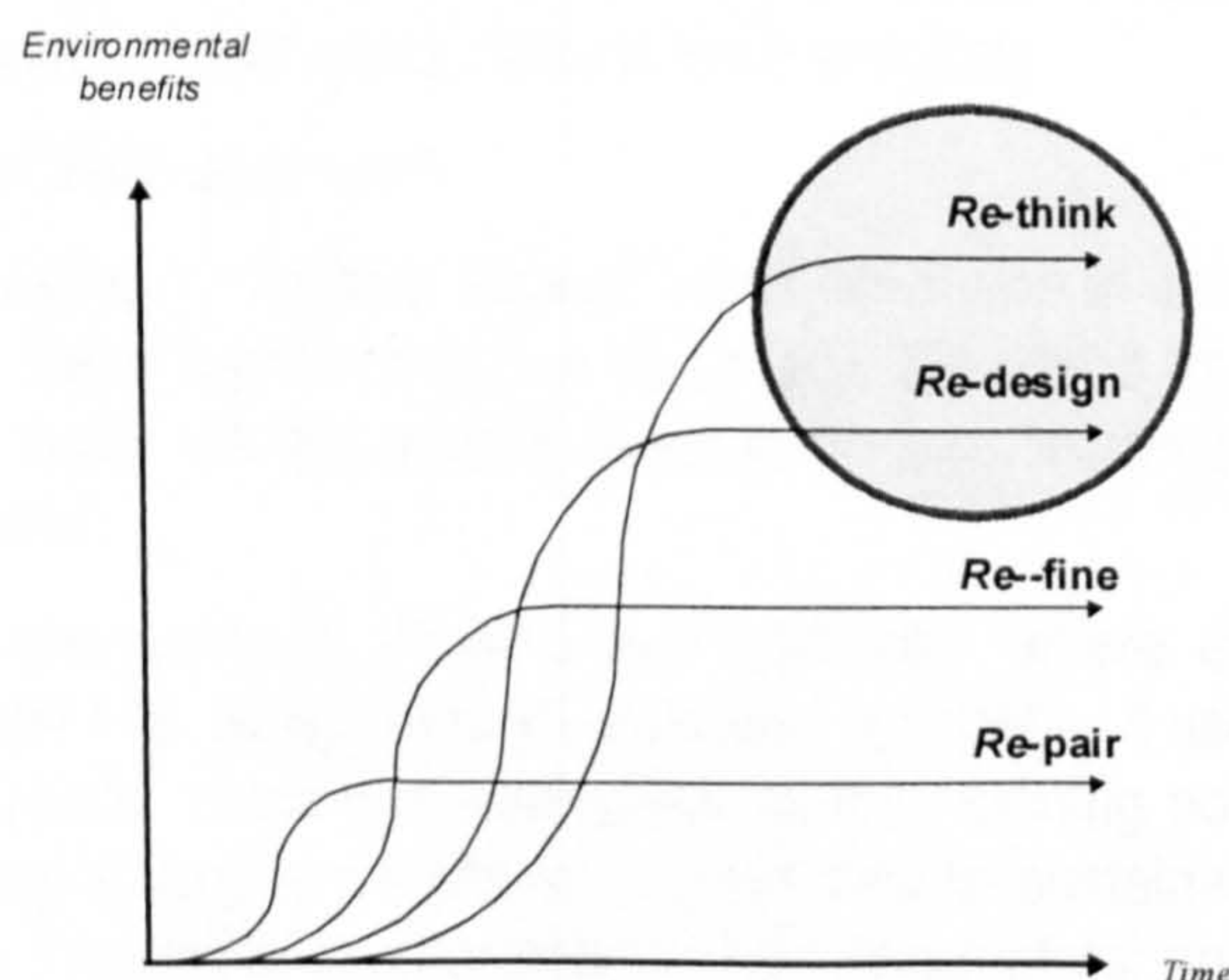


Figure 2.6: 4-step model of Ecodesign Innovation (Charter and Chick, 1997)



### 2.3.2.3 Brezets' model of Ecodesign Innovation

Brezet (1997) proposes a similar four-step model of ecodesign innovation this time consisting of differing design criteria and considerations. The four steps are described as:

- *Product improvement*: The improvement of existing products with regards to pollution prevention and environmental care. Products are made compliant.
- *Product redesign*: The product concept stays the same, but parts of the product are developed further or replaced by others. Typical aims being increased reuse of spare parts and raw materials, or minimising the energy use at several stages in the product life cycle.
- *Function Innovation*: involves changing the way the function is fulfilled. Examples include: a move from paper-based information exchange to e-mail; or private cars to 'call-a-car' systems.
- *System innovation*: New products and services arise requiring changes in the related infrastructure and organisations. A changeover in agriculture to industry-based food production, or changes in organisation, transportation and labour based on information technology.

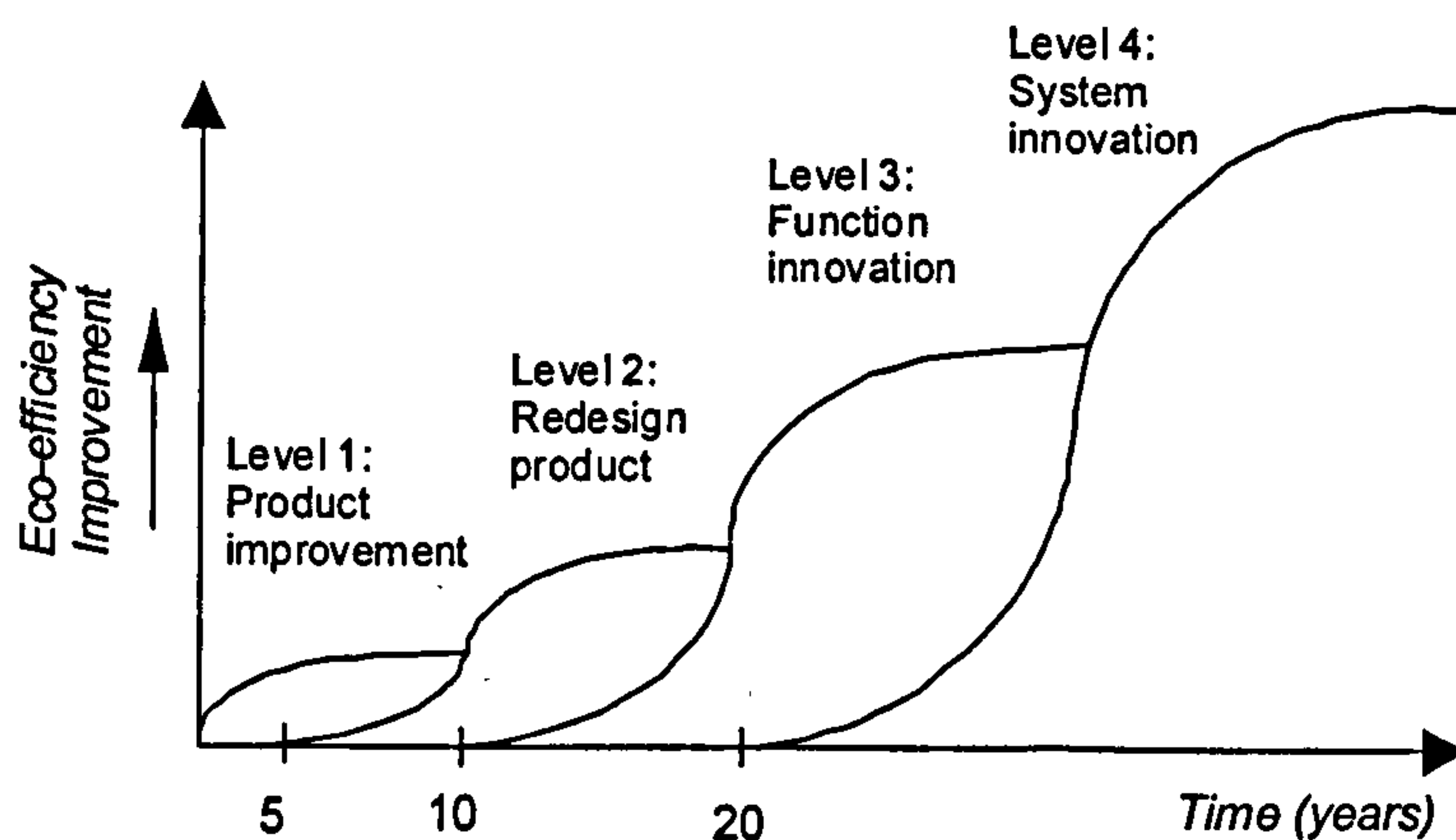


Figure 2.7: 4-stage model of Ecodesign Innovation (Brezet, 1997).

To move from level 1 to level 4, increasing amounts of time and complexity are required, leading to higher eco-efficiency improvements. This model indicates that these more complex ecodesign innovations will (or can) only be achieved over a significant time period, say 10-20 years. Others have reinterpreted and transformed this model in similar ways: such as Stevels (1997) by adding further factors, such as contexts and stakeholder involvement; and Ottman (1999a) with three stages.

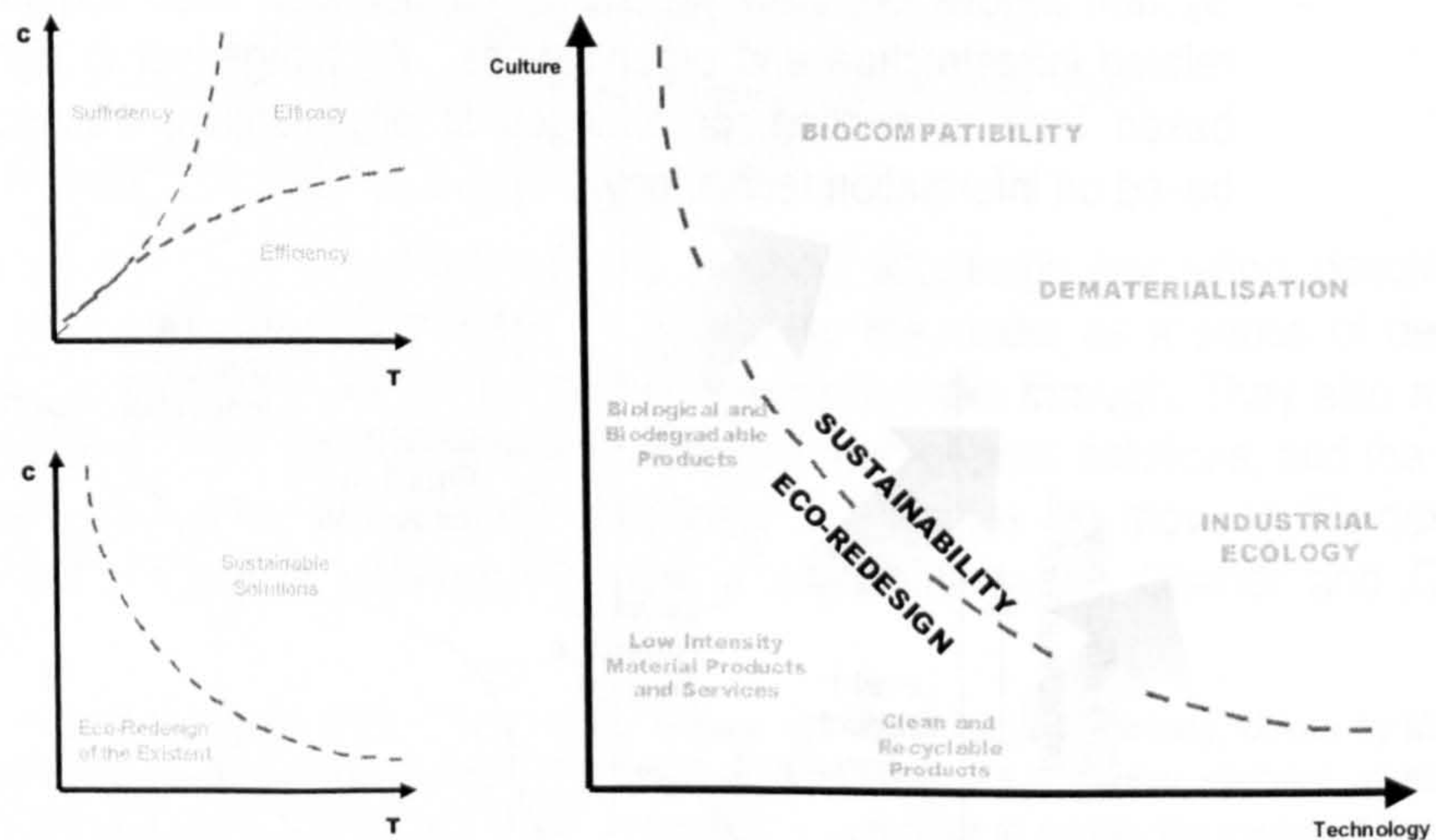
### 2.3.2.4 Domus Academy model

The Domus map of sustainability paths (figure 2.8) operates on two axis, X-Y described as 'technology' and 'culture' (Domus, 1997). The area most closely linked to culture refers to 'sufficiency' strategies, and questions of 'what' is being produced. The domain closest to the technology axis is 'efficiency' strategies, discusses 'how' to better produce existing products and services. Between these two domains is a third sector, 'efficacy', which presents a balance between these technological and cultural



innovations. The models also maps scales of innovation. Closest to the axes are described as those strategies which 'Eco-redesign the Extant', are more incremental and do not fundamentally change products or systems. Further from the axes beyond the concave arc are 'Sustainable Solutions', which are more radical and discontinuous in their nature and more likely to achieve the improvements required for sustainability. Sustainable solutions can be achieved in three ways:

- *Paths of efficiency*: by moving from clean production, clean and recycled products, to industrial ecology concepts – a set of artificially created production of supply systems
- *Paths of sufficiency*: moving from biodegradable products through to biocompatibility, which are compatible with natural cycles in terms of quality and quantity (respecting environmental limits)
- *Paths of efficacy*: which start with today's services and move towards



'dematerialization' thus radically reducing material intensity. These may rely more heavily on knowledge and information.

Figure 2.8: Map of Sustainability paths (Domus, 1997)

### 2.3.2.5 Bras' Model

The model proposed by Bras (1997), fits ecodesign (design for the environment) into company and the techno-economic context (figure 2.9). Important to note is that ecodesign fits into expanding frameworks of stakeholders, environmental consideration and complexity. He proposes a model described on X-Y axes with each strategy placed against a particular time frame on one axis, represented as life cycle time spans (Y-axis). In this sense strategies are very much reliant on economic and functional life cycles for the replacement of particular products or even human lifetimes. The Y-axis frames ecodesign against an ever-widening context of design activities, from individual product, to various products, then from a single to various manufacturers, finally to society.



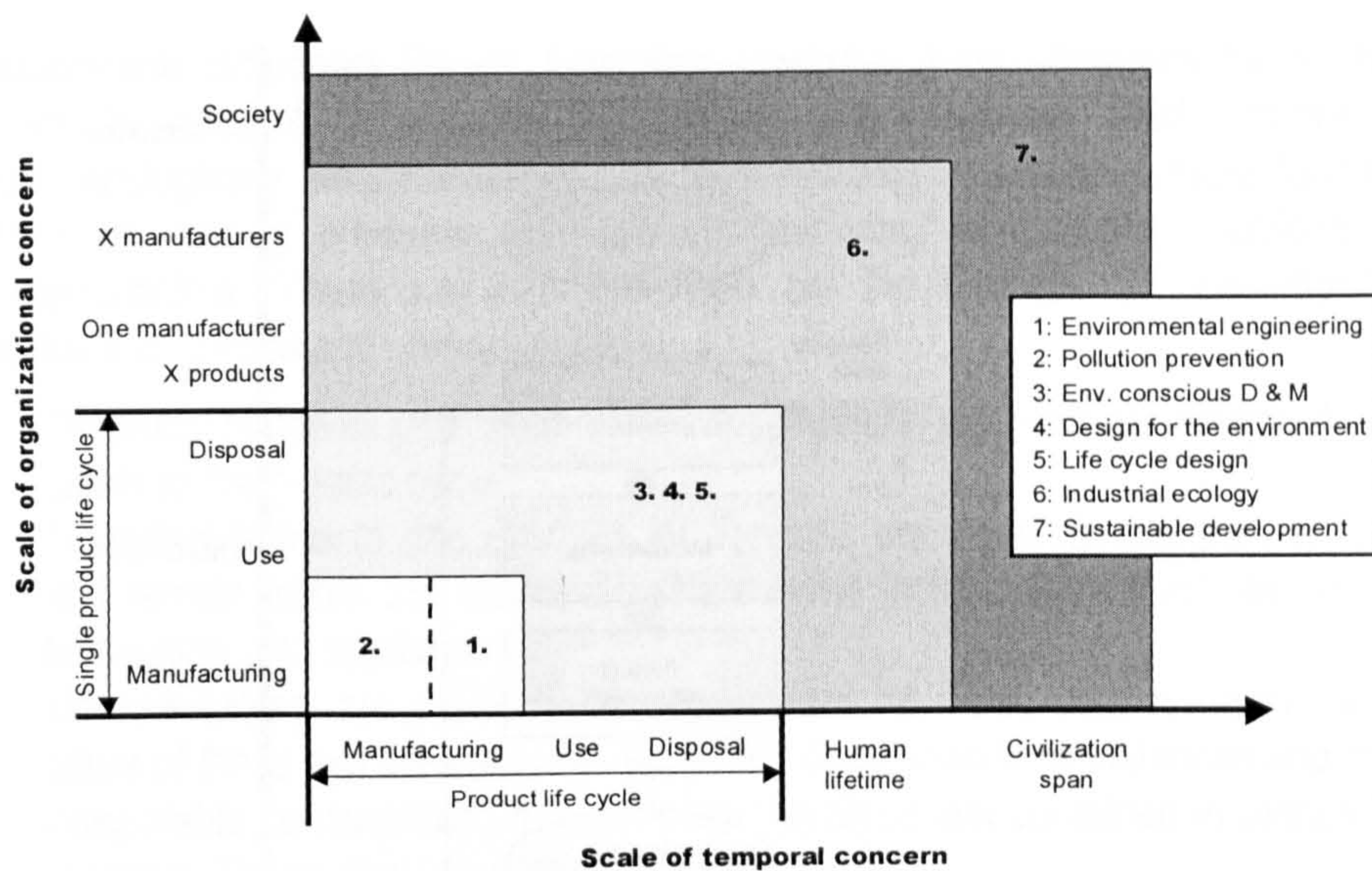


Figure 2.9: Environmental and temporal scale of environmental impact reduction approaches (Bras, 1997)

Others, in their similar models broaden the design focus of ecodesign out to 'Industrial Ecology' - groups of manufacturers - (Van Dijk, 1995) or the sustainable society (Dewberry and Goggin, 1995; Dewberry and Goggin, 1996).

### 2.3.2.7 Model of the Preventative Strategy

Jackson (1996) relates ecodesign interventions more closely to the timing of measures in product development. This model (figure 2.10) relates to the 'preventative' environmental management strategy described in section 2.1.1.3. This model and ecodesign strategy sees the economy as a 'provider of service', rather than a producer of products. It illustrates that these very early stages, as the conception and design of 'service provision' are where the greatest environmental benefits are gained and preventive strategies are adopted. Therefore *"(t)o apply the preventive strategy effectively, therefore, we must first look within the system and then be prepared to redesign - and where necessary reconceive it altogether"* (p.61).

This model illustrates a number of key principles highlighted earlier and by others. The first is in the shifting emphasis of ecodesign and environmental strategies up the product development (or service provisions) process towards the very early stages – in this case design and conceptualisation. It is here that the greatest environmental impacts, and greatest influence over 'what', and 'how' to design are afforded. Decisions here have enormous impacts on the resultant life cycle stages of material extraction, processing, manufacturing, etc when developing products.



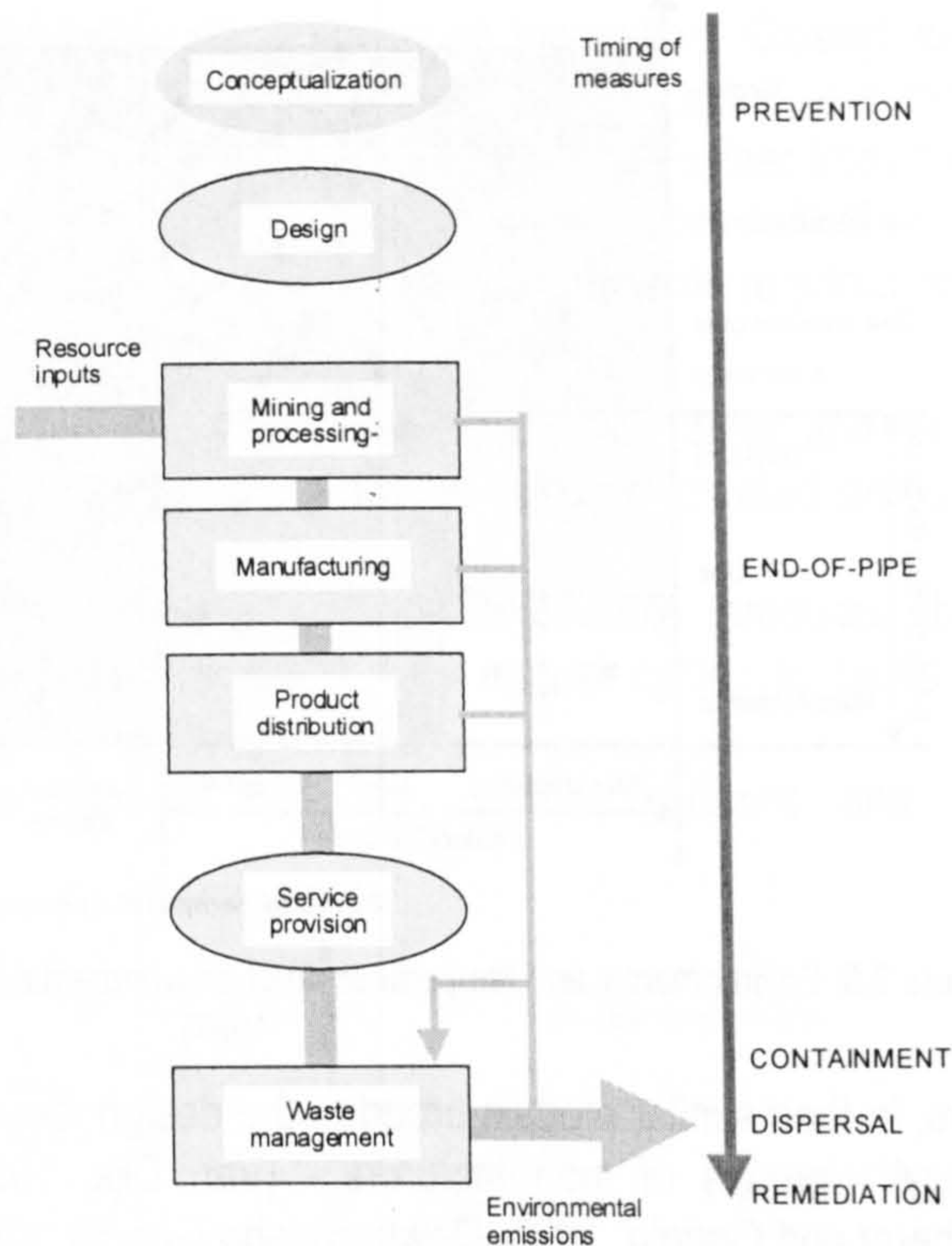


Figure 2.10: Structure of the service system and timing of environmental management strategies (Jackson, 1996)

### 2.3.2.8 Summary of Ecodesign models

A number of critical factors emerge from reviewing models of ecodesign. These can be described as:

- *Broadening contexts of ecodesign:* single product, multiple products, single or multiple company or the societal context.
- *Different approaches:* redesign/rethink, redesign of the existing or sustainable solutions.
- *Differing focuses for ecodesign:* either functional or systems innovation, or paths of sufficiency, efficiency and efficacy.
- *Differing stages of the design and developmental process:* earlier or later, conceptualisation and design of service provisions.

### 2.3.3 **Ecodesign Principles and Strategies**

This section focuses on ecodesign principles and strategies. For practical purposes those selected are more often typologies or summaries, rather than individual ones. Like the differences between definitions, descriptions and models, there is much overlap between principles and strategies and other related terms. Principles and strategies tend to deal more with the operational dimensions of ecodesign, helping indicating 'how to conduct ecodesign' aiming to empower designers. In most cases strategies and principles here represent both the 'incremental' and the 'radical' approaches and are transferable across many of the ecodesign domains and design stages described earlier.

#### 2.3.3.1 McDonough and Braungart



McDonough Braungart Design Chemistry describe three strategies for sustainable design (Bujanowsky et al., 1998; McDonough and Braungart; 1998, Charter, 1997). Such ecologically sensitive design (as they describe it) consider three fundamental principles, seeing products as: technical nutrients; as biological nutrients or as unmarketable's. These are also described as: the products of consumption, the products of service and unmarketable's

- *Technical Nutrients (the products of consumption)*: are products designed to return safely to the organic cycle.
- *Biological Nutrients (the Products of Service)*: are products designed to return to and remain within the technical cycles; these include items such as computers, televisions, and appliances.
- *Unmarketables*: are products that should not be made because they can't feed either of these two metabolisms. They include radioactive substances and currently inseparable contaminated materials like the chromium contained in tanned leather of shoes. These should be phased out completely.

### 2.3.3.2 Manzini's principles and strategies

Manzini has developed some of the most advanced thinking the practice and theory of ecodesign often dealing with the more radical approach and especially relevant to this enquiry. These have included for instance concepts, of 'forecasting' and 'backcasting' - either projecting forward from where we are today, or working back from a desirable and sustainable situation in the future (Manzini, 1995a). A similar and related concept is the 'leapfrog' strategy (Manzini, 1997), in which more radical innovations are sought that 'leap over' current and incremental innovations. Elsewhere, Manzini (1993a) illustrates three strategies for the more radical approach, by highlighting three principles:

- *From consumption to care*: developing products which require care and with which user can establish an emotional relationship
- *From consumption (of products) to utilisation (of services)*: looks at the concept of utilisation, going beyond the notion of possession and personal consumption
- *From consumption to non-consumption*: in which the reduction of needs can be experienced as an increase in social quality.

Earlier work by Manzini was more tactical and product oriented. One such example comes from 'The Garden of Objects', an exhibition for the Milan Triennial, aiming to exhibit products embodying the qualities of environmental sustainability (Manzini, 1992). The exhibition split into two sub groups titled 'Material' and 'Experiential' qualities.

- *Material Qualities*: are technical and manufacturing strategies that fit in with the need to reduce environmental impact (minimal matter, Eternal matter, medium matter, service products, clean production, making and unmaking)
- *Experiential Qualities*: are words and projects for an 'ecology of the senses', and relate to more immaterial, semantic, aesthetic, and semiotic design approaches.

The former is perhaps the most obvious manifestation of ecodesign, though the latter 'Experiential' approach is one not widely referred to before or since in ecodesign literature. It implies that designers have influence over both the materials and



immaterial qualities of the manmade world and that both have the potential to contribute to sustainability.

### 2.3.3.3 LiDS Wheel

Van Hemel (1998) with Brezet (Brezet and Van Hemel, 1997) propose a series of Ecodesign strategies and principles described within the LiDS wheel (Life cycle Design Strategies). Using descriptions constructed from leading thinkers, they construct a visual summary and tool "(t)he aim of the DFE strategy developed... is to provide an exhaustive overview of the options for improving the environmental profile of a product throughout the different stage of its life cycle..."(Van Hemel, 1998, p.31). As an integrated tool, the LIDS wheel aims to represent strategies for both the incremental and the radical approaches to ecodesign, and to redesign of existing products or for new and innovative concepts. These are illustrated in figure: 2.11

<b>Ecodesign principles</b>	<b>Ecodesign strategies</b>
1. Selection of low impact materials	Clean materials Renewable content materials Recycled materials
2. Reduction of materials usage	Reduction in weight Reduction in volume
3. Optimisation of production techniques	Clean production techniques Fewer production steps Low/clean energy consumption Less production waste Few/clean production consumables
4. Optimisation of distribution system	Less/clean/reusable packaging Energy efficient transport mode Energy efficient logistics
5. Reduction of impact during use	Low energy consumption Clean energy source Few consumables needed Clean consumables No waste of energy/consumables
6. Optimisation of initial lifetime	High reliability and durability Easy maintenance and repair Modular/adaptable product structure Classic design Strong product/user relation
7. Optimisation of end-of-life	Reuse of product Re-manufacture/refurbishment Recycling of materials Safe incineration (with energy recovery) Safe disposal of product remains
8. @ New concept development	Shift to service provision Shared product use Integration of functions Functional optimisation

Figure 2.11: Van Hemel's Ecodesign principles and strategies (van Hemel, 1998)

The principles and strategies are presented in the form of a directional wheel numbered from 1 to 8. Importantly van Hemel points out that the ecodesign strategy wheel is hierarchical and relate to the various stages of the product development process. Thus as one moves through strategies 1 to 8 one moves from the late to the very early stages of the product development. Strategy 8 (@New concept Development) represents the very earliest (what she terms product planning or strategic) stages, where the need is defined and there are higher degrees of freedom. Strategy 1



(Selection of low impact materials) deals more with later (detail design) stages of product development.

*"This development, from product system level, via establishment of the functional structure at product structure level, through to the search for design options for product details at product component level, is reflected in the DFE strategy wheel." (van Hemel, 1998, p.42)*

As such, the LiDS Wheel is a comprehensive summary of ecodesign strategies at every stage of product design and development and represents all types of ecodesign.

#### 2.3.3.4 Ecodesign typologies

Both Ryan (1992) and Roy (1994) propose typologies of ecodesign products. Ryan (1992) describes these as 'ameliorative and corrective' ecodesign:

- Corrective products – are aimed at improving environmental conditions, or at least reducing any contribution to environmental degradation.
- Ameliorative products – will be necessary if we are to survive the continuing environmental deterioration which will occur for some time, no matter what scale or rate of corrective programs are introduced.

Roy's (1994) ecodesign typology emphasises ecodesign approaches in relation to product characteristics and also the environmental issues tackled. These include:

- *Products that reduce fossil fuel consumption:* high energy efficiency; energy conservation.
- *Products that reduce natural resource consumption:* use less materials or other resources; made from recycled or waste materials/components; made from renewable materials and sustainable sources; designed for durability, repair and maintenance; designed for reuse, refurbishment, remanufacture or recycling)
- *Products that reduce pollution and damage to ecosystems:* reduced use of toxic, hazardous or ecologically damaging chemicals/materials; pollution monitoring and control equipment.

#### 2.3.3.5 Biothinking Strategies

Datchefski has developed a series of ecodesign principle based on the premise that to be sustainable design must mimic nature and utilize natural and ecological principles and processes (Datchefski, 1999a; Datchefski, 1999b). This 'Biothinking' model, "shows how technologies can become fully compatible with nature. The first three mimic the protocols used by plants and animal ecosystems" (p.49) and consist of:

- *Cyclic:* The product is made from organic materials, and is recyclable or compatible, or is made from minerals that are continuously cycled in a 'closed loop'.
- *Solar:* The product uses solar energy or other forms of renewable energy, both during use and manufacture.
- *Safe:* The product is non-toxic in use and disposal, and its manufacture does not involve toxic release or disruption of ecosystems.

The fourth requirement is based on the need to maximise the utility of resources in a finite world:

- *Efficient:* The product in manufacture and use requires 90% less materials, energy and water than products providing equivalent utility did in 1990.



In a similar vein though less product-related, are the strategies for ecological design promoted by van der Ryn and Cowen (1996). *“Taken together, these five principles help us to think about the integration of ecology and design”*. (P.51). Unlike other strategies and principles, Datchefski's and the ecological design principles are different than the others. In moving ecodesign more into the domains of ecology and the ecological, and uses principles borrowed from nature, shifting design from a largely technological and industrial, to an ecological and biological paradigm. They offer tangible principles and design criteria to the definition presented by Simon (1994) and Beard and Hartmann (1999) at section 2.3.1.4.

### 2.3.3.6 Business Re-Invention

Ottman defines five ecodesign strategies, termed 'business reinvention' (Ottman, 1999b; Ottman, 1999a). Rather than these being specific to design, she feels the more radical and innovative ecodesign approach poses strategic questions, to be dealt with at a more senior level. These are central to future business and used here as corporate innovation strategies and a means of redefining the business, and thus the products within them. However, designers working at this more strategic level may find these five strategies for reinvention transferable to design.

Reinvention Strategy	Explanation
1. Set outrageous Goals	The kinds of goals that make people drop their jaws in disbelief.
2. Think like a system	Look beyond your product in isolation, to the entire system in which it operates.
3. Dematerialise	Meet your customers' needs with as few resources as possible.
4. Make it fit	this means making products fit consumers needs as closely as possible
5. Restore	Why not develop products and marketing programs that can actually add something back to the environment or society?

Figure 2.12: Ottman's Strategies for Business Re-Invention (Ottman, 1999b)

### 2.3.3.7 **Summary of Ecodesign Strategies and Principles**

There is a proliferation of principles and strategies (and the resultant tools and methods) for 'incremental' ecodesign, and some presented here for the 'radical' and strategic approach. Van Hemel (1998) proposes one (of eight) strands to her LiDS wheel to this more radical form of ecodesign, which is perhaps a correct and true balance between existing product improvement and innovation. However, within the framework of sustainability this will not suffice, therefore special emphasis needs to be placed on more radical approaches, strategies and principles even if these are not an absolute and true reflection of current designers context or immediately practicable.

Those strategies and principles that are more radical in their nature tend to contain three core themes:

- Those that view the economy, products or in fact demand as providing 'service' to consumers. Then use the service definition or principles to re invent the product or the means to satisfy this.
- Those that more closely connected to 'Business Reinvention'. These appear to be aimed mostly at senior management but are relevant to designers.



- Those using an ecological approach to design, using ecological or biological metaphors and principles and aimed at being environmentally benign (restorative).

Strategies and principles are therefore very much shaped by the ideals and domain into which they fit.

### 2.3.4 Summary of Definitions and Descriptions, Models, Principles and Strategies

Earlier, the literature promoted two distinctive polarities which will here be termed the 'innovative' and the 'incremental' approaches to ecodesign. Throughout, the models and principles and strategies sections these polarities were to some extent confirmed (with some exceptions). In fact these polarities do not completely align, but offer a conceptual framework on which to 'hang' the literature. A summary these polarities are presented in the figure 2.13 below, and will be expanded in later sections.

Author	<b>INNOVATIVE</b> (Radical, Revolutionary)	<b>INCREMENTAL</b> (Improvement, evolutionary)
(Beard and Hartmann, 1997)	Creativity and innovation	Science & data
(Fussler and James, 1996)	Eco innovation	Eco efficiency
(van den Hoed, 1996)	Results, functions and needs	Product optimisation
(Zust and Luttrupp, 1998)	Effective	Efficient
(McDonough and Braungart, 1998)	Biological/ecological paradigm	Industrial Paradigm
(Jackson, 1996)	Preventative Cultural change	Curative Technological change
(Bras, 1997)	Across product/company	Within single product/company
(Ryan, 1996)	Rethink for new product	Redesign of existing product

Figure 2.13: Summary of ecodesign defined

The main contradiction occurs not in the distinctions of 'innovative' or 'incremental', but that their are different ways to achieve either the more innovative or incremental themselves, which these simple polarities do not describe. They do not describe the domains into which these focus (ecological, industrial, socio-cultural, etc) or the factors these consider (system, business, function, etc).

## 2.4 Defining Design

This section introduces design. Notions of and approaches to ecodesign are likely to be significantly shaped by opinions of the purpose and nature of design (Sherwin, 1999). Literature on design is broader, more diverse and well developed than that of ecodesign as it has a far longer. This does not mean however that there is consensus or agreement on the terminology (Thackara, 1997). On the contrary, there are myriad ways to define and describe the nature and operating principles of design (Viemiester (1995) points to 250 definitions proposed by the Canadian Design Institute).

The term 'design' crosses a variety of disciplinary boundaries: from the crafts and arts based disciplines; such as jewellery or woven textiles; to mechanical or electronic design, or from high or cutting edge technologies such as: software or information design; to hand-made ceramics or batch-produced furniture. The products of design can range from air or space crafts, to labels or leaflets. Design crosses a variety of subject matters, disciplinary boundaries, scales of production and outcomes making it difficult to pigeonhole. Design itself can also be viewed as: art; as problem-solving; as industry, as process, etc (Cooper and Press, 1994). Unlike many, perhaps younger disciplines, such as communication, a unique, distinctive and universally accepted



epistemology and accordant design community has remained illusive throughout the 20<sup>th</sup> Century.

*"The art of design as it exists today is pulled simultaneously in three directions by jealous guardians. It is pulled towards art and aesthetics because many designers are properly concerned with the form and appearance of products. It is pulled towards engineering and natural sciences because many designers are properly concerned with making products that work. And it is pulled towards the human sciences because many designers are properly concerned with communication and the relations between products and people." (Buchanan, 1990, p-200)*

The major design dichotomy highlighted by Dilnot (1998) is that unlike other disciplines, design can and is viewed fundamentally as either (or both) a process or agency, and also as artefact or outcome, consigning it to confusion and ambiguity.

#### **2.4.1 The Economics of Design**

The dominant (though not only) discourses on the subject discuss design within a business and economic context. Design here is traced and implicated with the key economic developments of the 20th Century such as the rise of the consumer society, and even back to its instrumentality in the Industrial Revolution (Sparke, 1983). From this view the role of design is connected to the activities of stimulating demand and differentiating products, whilst enticing increased purchase and consumption of goods and services. Designers thus ensure that products are easier, cheaper, more effectively produced and desirable. In linking design exclusively to economics in this way, a particular view of design and designing is developed in which its primary purpose is linked to business and economic ends, as a kind of 'economic laxative'. The quote below from Kotler and Rath (cited in Cooper and Press, 1994) summarises this view:

*"Design is the process of seeking to optimize consumer satisfaction and company profitability through the creative use of major design elements (performance, quality, durability, appearance, and cost) in connection with products, environments information, and corporate identity. (Kotler, P. and Rath, G.A. (1984) Design: a powerful but neglected strategic tool, Journal of Business Strategy, 5(2)"*

This strictly economic role also clearly connects design to the environmental and social deterioration most commonly associated with such economic growth (Fry, 1999; Papanek, 1995). In taking the view that the *raison d'être* of design is for economic advancement, we are in many ways talking design out of sustainability, a paradox is only beginning to be understood. Wood (1998) articulates this well in stating, *"Designers are in a fix. We know we are very good at helping to heat up the economy, but they have never before been asked to put economic growth into reverse"* (p.91).

#### **2.4.2 The Domains of Design**

Broader perspectives describe design as linked to notions of shaping the artificial, determining the man-made world or influencing the future. Margolin and Buchanan (1995) state, *"the central theme of design is the conception and planning of the artificial"* (p.199), seeing design less as a profession and more a way of thinking, planning or viewing the world. In this view design is all pervasive and not limited to business or economic activity. Fry (1999) believes it to be *the* primary agency in shaping and determining possible futures, and questions why it is not taken more seriously in political or academic circles.



Design practice is often described by a series of disciplines or domains in which it operates, and are generally broken down into: product design; environmental design (spaces, such as interiors or buildings); information (communication) design; and corporate identity design (Cooper and Press, 1994). Within each of these there will often be various design disciplines working, such as product design, where industrial, engineering and production designers may operate. Buchanan (1990) offers a differing description, consisting of the four domains (or orders) of design:

- *Communication*: involves signs, symbols, images and words.
- *Construction*: is essentially about physical products and things.
- *Strategic Planning*: involves activities, services, processes and is fundamentally about actions.
- *Systemic Integration*: is based on thinking, and involves systems, environments, ideas and values.

The first two focus almost entirely on product and/or artefacts, with the aim of making it fit better into the world (of business or society). The second two domains are more transformative and holistic, looking to systems (values, ideals) of the organisation and societies into which these components fit. There are clear connections between these domains and models of ecodesign innovation proposed by both Brezet (1997) and Stevels (1997) in section 2.3.2.3. Golby-Smith (1996) gives empirical evidence to Buchanan's taxonomy by describing his design experiences and the characteristics and approaches to designing in shifting between the first and fourth orders.

### **2.4.3 The Social Dimensions of Design**

Whereas many link design almost entirely to business and economics, particularly of the free-market economies, other authors state design as influencing and influenced by socio-cultural factors. Forty (1986) links design to the 'selling' and promoting of certain ideas and/or value systems through history. He shows how design was used to express and embody class distinctions, personal wealth and well-being, whilst also being central to the constructing notions of, for example health and cleanliness that helped lift society and domesticity out of Victorian squalor. He goes on to implicate design within many contemporary social constructs such as the promotion of materialism, comfort and convenience. These are not always linked to the economics of consumer capitalism, as Forty (1996) design locates design in Communist and Marxist ideologies.

*"Most of the literature from the last fifty years would have us suppose that the main function of design is to make things beautiful. A few studies suggest that it is a special methods of problem solving, but only occasionally has design been shown to have something to do with profit, and even with more rarely has it been seen as being concerned with the transmission of ideas."*  
(Forty, 1986, p.6)

Other authors (du Gay, 1997; Buchanan, 1990; Margolin, 1995) make similar claims of this 'socio-cultural' potential for design. The key relevance with these themes are not what ideas they embody, rather that they can do so and place the context and purpose of design firmly within a 'socio-cultural' as much as in a 'techno-economic' framework. Design can clearly embrace and influence such social innovations having great potential for sustainability as highlighted in section 2.1.1.1.

### **2.4.3 Design Methodology**



Design methodology (or design research) aiming to describe and often prescribe design, has made significant advances in understanding the nature of designing over the last 40 years. A comprehensive review of design philosophies, models, methods and systems helping indicate its complexity and the ways it is conducted and studied, is given by Evbuomwan, Sivaloganathan and Jebb (1996). They summarise various design models, presenting design as: an opportunistic process; an incremental activity involves an evolutionary process where changes are proposed to the current design to make them better; an exploratory activity; an investigative activity, inquiring into the clients needs and available techniques, previously similar designs and past solutions; a decision making process; etc.

## **2.5 The Design and Product Development Process**

Though design is viewed and described in many ways, the process of designing and developing a product is strikingly uniform in many cases and described as the product development process. The aim of product development is the successful design, development, production and launch of products to market. Design and product development models have a number of strikingly similar characteristics (Cross, 1992). These usually consist of either 3 or 4 sequential stages that describe the initiation of a product, through its design, to production and market launch. From the literature, it is clear that most models of design and product development see them as one in the same, even when product development stages are unlikely to be conducted by designers as such. This section selects a model not as the definitive design methodology, merely to illustrate some generic stages that most design and developmental projects might follow and particularly to highlight design within it. The model selected here (Roy, 1996) defines 4 critical phases of the design and product development process, being: task clarification; conceptual design phase; embodiment design phase; and detail design phase. (figure 2.14)



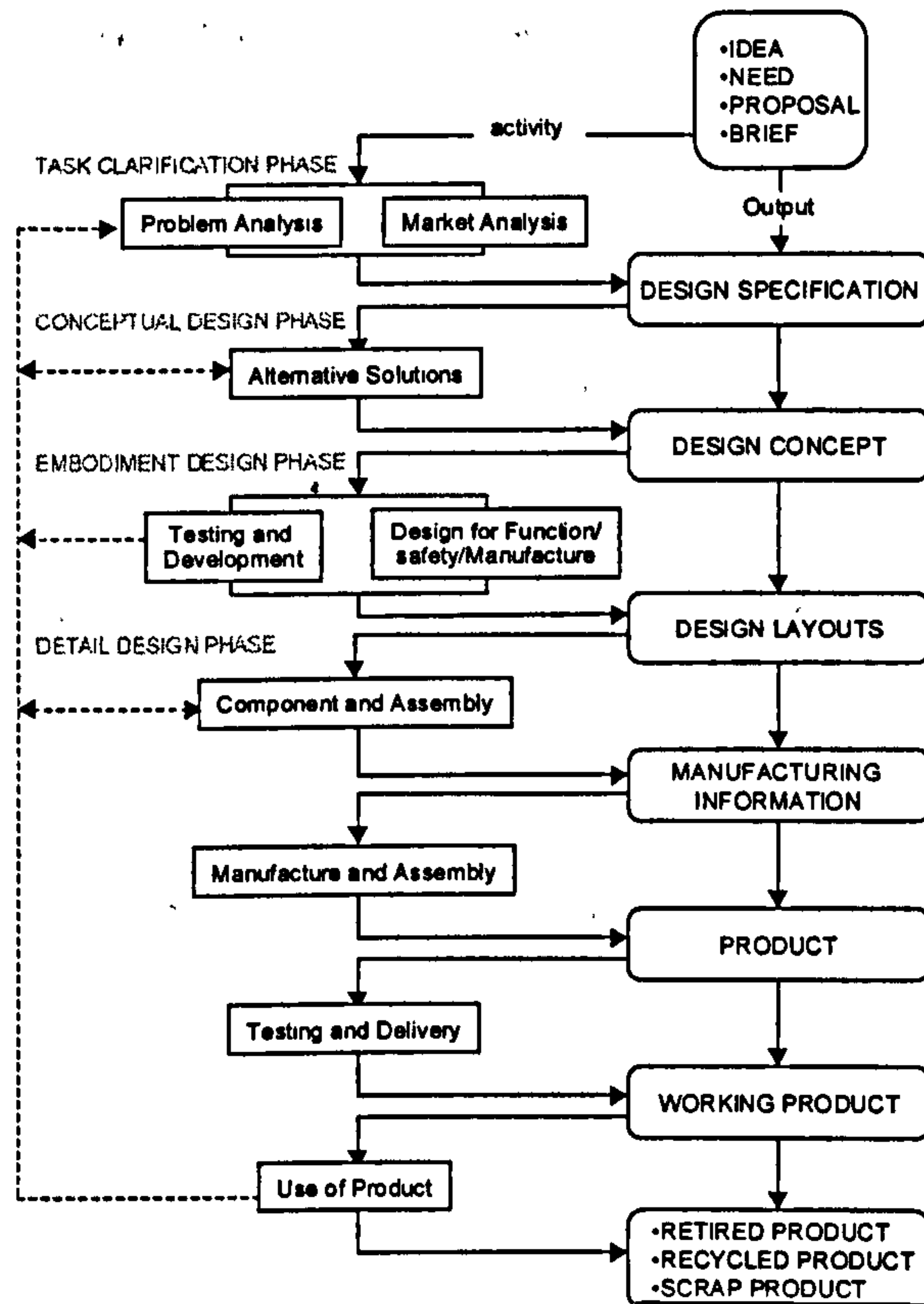


Figure 2.14: The Product Design and Development Process (Roy, 1996)

**Task Clarification:** consists of the identification of the needs of the project, which may be a market or competitor analysis, production requirements and will usually result in a design brief. A brief gives the design team a written set of objectives around which to operate. The brief is transferred into a set of specific requirements for the product as the project specification. These phases of product development are usually conducted and set at a more senior level or often led by marketing.

**Conceptual design:** is when the specification and requirements are transferred into a set of concepts. This stage usually consists of sketches, early technical or visual models and proposal of various ideas, approaches or alternative solutions to fulfill the task. Here there are the greatest degrees of design freedom requiring creativity and innovation. This stage results in a design concept which may be a drawing or model.

**Embodiment design:** sees the selected concept(s) translated into layout drawings or more comprehensive mock-ups, to enable decisions making and testing against financial and market acceptability. This stage results in design layouts or drawings.

**Detailed design:** consists of the transfer of layouts into a manufacturable product design. Thus the product concept is detailed and materials, tolerances and manufacturing processes are specified. Its manufacturability, safety and usability are considered and this results in detailed descriptions of components and assembly (design for manufacture, etc). This information is then used to organize the production stages of product development.



Subsequent stages see the detailed design used to plan or amend production planning and the design of the manufacturing processes. After testing the product will then be launched to market. The time of product development initiation to market can range from weeks for a simple product (such as a nail or paper clip) to years for a more complex product (such as a new airplane). It is widely accepted that the early (task clarification) stages that are of critical importance to successful product design and development. Designers tend to be involved most from conceptual through to detail design stages.

### **2.5.1 Some characteristic of design and designing**

Along with these descriptive and prescriptive models of the design processes advances there is also a tradition of research in design thinking. Summarising work of others, Cross (1992, 1995, 1997, 1999, 2000) has proposed characteristics of the processes and protocols of design. Often this involves research into cognitive strategies or perhaps creative design (Roy, 1993). It is not the aims of this research to describe these, merely to highlight that there is tradition of research into 'designing (the practices and processes of design) which this work extends into ecodesign. Dorst and Dijkhuis, (1995) also describes two design paradigms important to acknowledge in design research. The first is 'positivist' seeing design as rational, problem-solving activity grounded in logic and scientific method. It should be studied and understood using rigorous scientific techniques. In contrast, in the 'constructivist' paradigm design is more of a conversation between the designers and the situation and is not rational or logic at all. It cannot be understood as a linear, sequential process rather iterative and interconnected steps. Views of the nature of design (as a technical or social process) may significantly affect design and development processes as well as design research. This enquiry is in the 'constructivist' tradition.

## **2.6 Defining Industrial Design**

Industrial Design is a specific though relatively young design discipline. Heskett (1991) connecting its historic development to the distancing of the means of design and production brought about by the transition from crafts to industrial production. The 'industrial' placed with design emphasises its role in designing products for industrial production and mass-manufacture. Among the most useful descriptions of Industrial Design as understood today, is that of the Industrial Design Society of America (IDSA), (the country arguably its most successful exponents), who describe it as:

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

*Industrial designers develop these concepts and specifications through collection, analysis and synthesis of data guided by the special requirements of the client or manufacturer. They are trained to prepare clear and concise recommendations through drawings, models and verbal descriptions." (IDSA, 2000)*

The working practices of Industrial Design are unique and different from other designers in several ways. Industrial designers are responsible for preparing and embody principles in sketches, models and drawings. Industrial designers often work as part of a team (with management, marketing, engineering, etc) and their specific tasks is to embody the design requirements of the team within the product concept(s).



They are often described as the 'user-centred' design discipline, considering factors such as user needs/requirements and product use. Industrial designers are required to have manufacturing and material knowledge, which will help them design product concepts that are efficient and profitable to produce, whilst also being pleasurable or easy to use, thus serving two masters - companies and consumers alike (Svengren, 1997).

### 2.6.1 Industrial Design defined

Tovey (1997) proposes the design tasks of the industrial designers (in the automotive industry) as twofold:

- To represent the market and user requirement in determining the ergonomics (objective) and appearance (subjective) of the product
- To integrate market, user and engineering requirements into a whole design solution. This holistic view of the product concept set two further requirements of the industrial designer:
  - To visualize the product concept (communication)
  - To represent alternate design solutions (idea generation)

These latter points concerning the visual appearance and the visualization of the product concept(s), means that industrial designers are often (perhaps mis) understood as 'stylists'. Because of this requirement for visual literacy and communication skills, industrial designers tend to be educated in art school environments. Industrial Design today is largely operationally based within product development, though a number of authors (Svengren, 1997; Manzini, 1998; Bakker, 1995; Domus, 1998) promote its uses and benefits as a strategic resource.

#### 2.6.4.1 Industrial Design and Engineering Design

Difficulties with the identity of Industrial Design are that it is not the only design discipline with responsibility for 'product' design. Within many companies both industrial designers and engineers both have responsibility for the design and development of the product, ensuring it is easy and profitable to produce, whilst being safe, usable and desirable for consumers. However the role and remit of Industrial Design and engineering (often Design Engineers) are quite different, as are their design practices. *"Indeed the relationship between industrial design and... engineering is similar to that enjoyed (if that is the right word) by architects with civil engineers."* (Tovey, 1997, p.6)

Several distinctions can be made between the two, most common is that Industrial Design is "... commonly seen as 'people-centred' and engineering design is commonly seen as 'technology-centred'" (Bates and Pedgley, 1998). The same study commented on the skills and competencies of each discipline would bring to design. Engineers would more likely be 'experts' in one or two design topics, such as electronics, mechanics or ergonomics. In contrast, industrial designers would be 'familiar or proficient' at a wide range of subject matter, perhaps including: marketing, materials or structures and construction. Industrial designers therefore might be described as 'generalists' while engineers are more 'specialists'.

Tovey (1997) makes an even more simplistic distinction between industrial designers and engineers, in stating:



*"The sequence of activities in which the (industrial designer) are given responsibility for the early stages of the design program and then hand over to engineers gives further emphasis to the differences between their methods of co operation. Responsibility for the initial conceptual design in the creation of the new product rests with the (designer), and they take it to a fairly detailed stage with fully defined surfaces before engineering design assumes control. Much of the purpose of the engineering therefore is to make practical sense of the (industrial designers) proposals. This involves a lot of analytical thinking to optimize the design and sometimes, considerable ingenuity. It is not, however to any significant degree creative." (p.10)*

Important to note is that in reality the distinction between Industrial Design and engineering is more a continuum. In some contexts industrial designers and engineers are viewed as one in the same and educated as such (Industrial Design Engineering courses). This happens for example in the Netherlands, paradoxically where some of the most advanced ecodesign is developing (Larson, 1997). This research distinguishes between Industrial Design and Engineering Design (as does the case in question) as separate disciplines and draws generalisable conclusions for these distinctions.

### 2.6.1.2 Implications for Ecodesign

There are a number of implications when considering design, design methodology and Industrial Design against ecodesign literature. The first of these is this user orientation of Industrial Design described as 'bridging the gap' between production and consumption, between products and people (Dewberry and Goggin, 1996). These are consideration factors little mentioned in the ecodesign literature. A second key point emerges from considering design methodology and ecodesign. Industrial designers tend to be involved at the early design stages often in the conception and idea generation of new product concepts, towards which ecodesign is now developing again offering great potential for sustainability.

## 2.7 **Further Ecodesign Literature**

The section extends the earlier 'Defining Ecodesign' (section 2.3) in light of design literature. Various factors will be discussed in more detail below:

### 2.7.1 **The role of the designer in sustainability**

The nature of and the approach to ecodesign is likely to significantly influence the role the designer plays within the company and product development. Bakker (1995) describes two roles for designers within the product development process, the 'operational' and the strategic'.

- In the 'operational' role, the designer plays a more subordinate part, interpreting the design brief and specific requirements generally supplied by a client or senior management.
- In the 'strategic' role however, the designer has more influence in the initial decision making process highlighted as of critical influence to environmental performance. It is this strategic role that offers greatest opportunity for ecodesign.

Manzini (1993a) has similar roles describing them as the 'tactical' or 'strategic approach.



Other authors extend beyond product development discussing ideas about 'visioning' or envisioning, where the key role of the designer is to 'vision' more sustainable practices of production and consumption (including new products and services). Susani (1996) states that *"a vision of sustainability will not arrive by itself, we must design it!"*. Walker (1998) describes this process as to, *"put flesh on the bones of this potential"*, and sees design as instrumental within this. Such notions of 'visioning' are extended again by Manzini (1993b). He feels that for too long sustainability has been linked to 'hardship culture' and that a key role is in the definition of new 'criteria of quality' which are more in line with sustainability principles whilst also connecting to desirability and acceptability (as the user-orientation describes earlier in Industrial Design, section 2.6). He also describes designers as 'form-givers' able to envision new scenarios and possibility as much to redesign existing products (Manzini, 1995b). *"Design can generate scenarios, criteria of quality and value judgements in which the reduction of needs can be experienced as an increase in social quality"* (Manzini, 1993a, p.37). Only Ryan (1993, 1994) and perhaps more recently Walker (1998, 2000) have similar views of the role being the more qualitative dimensions of sustainable development.

Others place a special emphasis on designers themselves. Both Beard and Hartmann (1997) and Storen (1997), question science or data as ever being adequate for a truly radical or sustainable design. Beard and Hartmann (1997) suggests that the sustainable designer will be a chimera of scientist, artists and economist, merging the often-contradictory skills of analysis, with innovativeness, vision and creativity, in stating, *"(m)ere analysis of data will never give you a new idea, because all you're doing is drawing on the repertoire you already have"* (p.153). They promote the greater use of creativity techniques and innovative thinking within ecodesign (Beard and Hartmann, 1999). Papanek (1995) places a moral responsibility on designers to question the unethical preferences and decisions of clients, whilst also driving the incorporation of environmental criteria into projects and design briefs. Many such skills will come from within designers themselves.

## 2.7.2 The Early Stages

Much literature previously points to the early stages of design and product development as critical. It is clear that these early design stages are of greatest importance in determining the environmental impacts of products, as it is estimated that between 80% and 90% of a product environmental and economic costs are determined at these early stages (Design Council, 1997b; Burall, 1997; McAlone and Evans, 1997). Also the cost of any environmental intervention is at its lowest and most flexible at these early stage, known as 'front-loading' (Electrolux, 1997b).

The DEEDS (DEsign for Environment Decision Support) – a 3 year research project undertaken as a collaboration between Cranfield University and Manchester Metropolitan University and sponsored by the EPSRC (Engineering and Physical Sciences Research Council) aimed (amongst other things) to assess and describe the ways in which industry was integrating ecodesign (Simon et al., 1998; McAlone and Evans, 1997; Sweatman et al., 1997). A key conclusion from the research was that ecodesign needs to be integrated early, and included within or before the product specification, also described as task clarification of product development (figure 2.14).



*"A number of companies discussed this early stage of design and highlighted how important it is to ensure that the environment is considered as early as possible. There was recognition that beyond a certain point in the design process it is extremely difficult to alter certain product features that are key to the environmental performance" (Bhamra et al., 1999)*

Both van Nes and Cramer (1997) and Bakker (1995) draw similar conclusions about designers involvement at the early stage, but describe this as 'product planning' rather than pre-specification or task clarification. This requires design to be involved in not only the operational design stages of generating concepts and detailing designs, but also in more strategic decision making, such as what product to design. Van Hemel (1998) has correctly pointed out that in fact this form of innovative product development is more closely linked to new business opportunities rather than product redesign.

### **2.7.2.1 Characteristic of Early Stage Ecodesign Innovation**

As one moves up towards the early stages the nature of the task, the design process and the issues involved change. As such it is questionable whether, later stage design tools or methods will be automatically transferable or applicable. The very early developmental stages are described by Hirschorn et al (1993) as 'cultural' (rather than technological) change, as there can be significant opportunity to influence demand, and here considerations of a consumer, organisational or societal nature are paramount (see figure 2.10).

Van Berkel et al (in Hodgson et al, 1997 p.9-10) proposes a conceptual model of environmental issues within the product development. It indicates that the degrees of freedom (or design space) are greater earlier in the product development process. As one moves through detailed stages towards production and product launch, this 'design space', i.e. the number decisions or changes that can and should be made, reduce significantly. Figure 2.15 illustrates that the design space is largest in the product strategy stages, while being considerable smaller at the product specification stage adding design consideration to the product development model presented at figure 2.14. A summary of each section is available below:

- *Product strategy:* At this stage, the need for a design project is identified and requirements are formulated. The process may be guided by customer surveys, research into competitors' products, or process review within the company. It may involve development of a completely new product or modification of an existing product.
- *Product development:* A product is developed at the conceptual level into a detailed design, based on the requirements identified in the product strategy phase.
- *Product specification:* The designers formulate details of the components and materials to be used in the product, and develop guidelines for manufacture



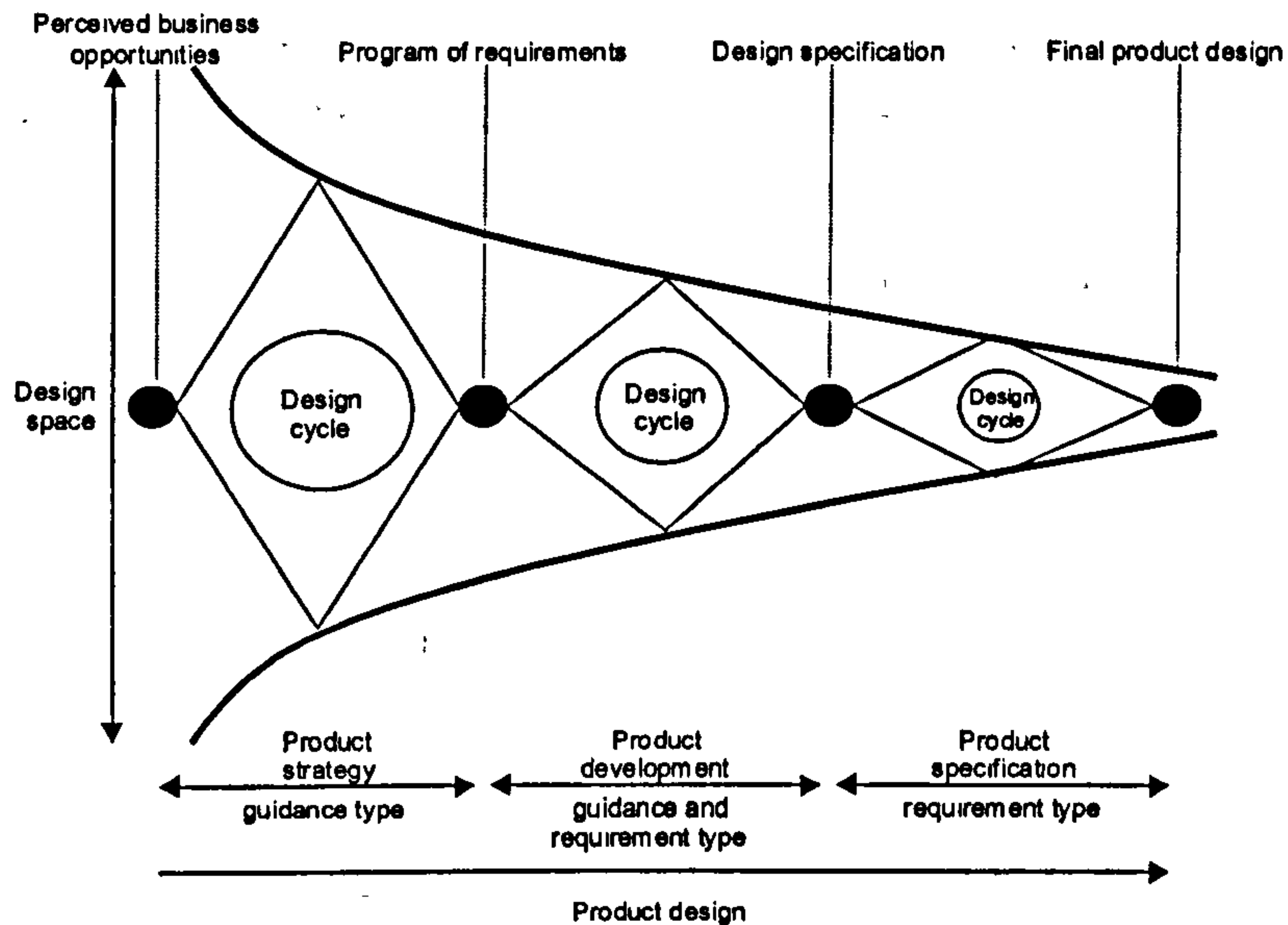


Figure 2.15: An idealized ecodesign process (Van Berkel et al, in Hodgson et al, 1997)

### 2.7.2.2 Tools & Methods for the Early Stages

Both Charter (1998b) and DEEDS (Sweatman et al., 1997, Simon et al., 1998) reviewed existing ecodesign tools and methods for differing stages of the product development process. The DeEDS review indicated that a variety of tools and methods were relevant for post-specification (general environmental strategies, LCA and Abridged LCA, concept demonstrators and workshops) but found few tools for 'pre-specification', paradoxically the stages they concluded were of greatest importance. This suggests a bias towards work directly links to the physical activity of designing and developing a product, rather than planning or strategic design (task clarification, product planning).

Though there is increasing acknowledgement of the importance of these early design stages, there are still few design tools and methods for them (van Nes and Cramer, 1997; Bhamra et al., 1999). Similarly the supply of ecodesign tools illustrates this gap, as Bakker's (1995) enquiry confirms :

*".....the current environmental information supply will be predominantly orientated towards designers working in an operational role, and that most information will support the 'technology-orientated' approach towards ecodesign. (Bakker, 1995, p43)*

Those tools usually considered for use 'early on' appear to be the more business than design orientated (such as marketing or management methods). This is of little surprise as at present ecodesign activities taking place 'early on' are unlikely to be conducted by designers and more likely to be senior management or more strategic business functions. Existing tools are also more for concept review (evaluation tools) rather than for concept generation or development (Charter, 1998b). There are some problems of these management or strategic tools relevance to designers working here. Both Simon et al (2000) and Dewberry (1996) indicate that such policy and strategy related methods do not sit particularly comfortably within design. Policy related methods do not automatically transfer into effective design strategy and are not an effective measure, stimulus or indicator of good ecodesign practice. They can often be more a hindrance than help. They are not effective measures or guarantees of success as such grand



visions and abstract concepts do not filter down especially well to design, and the design process. Specific working methods are needed for designers operating early on.

### 2.7.3 Ecodesign Innovation

Various authors (Johansson and Magnusson, 1998; James, 1997; Fussler and James, 1996) have written about the nature and role of innovation within ecodesign. To begin this any discussion on innovation needs to be framed. There is differing interpretation of the term innovation (Thackara, 1997) especially with reference to environmental issues as well as a number of ways to be 'innovative'. Innovation when related to design means different things to different people: ranging from product to process; from incremental to radical, etc. Environmental innovation (also known as 'eco-innovation') are generally seen as *"new products and processes which provide customer and business value but significantly decrease environmental impacts"* (James, 1997, p.53), and are usually connected to innovations when strictly environmentally driven. A more thorough review of the theoretical and conceptual framework of eco-Innovation comes from Johansson and Magnusson (1998), in relating to innovation literature and making distinctions such as radical vs incremental, niche, architectural, etc. Roy (1994) links the development of ecodesign to the evolution of design innovations more generally. He points out that new concepts, designs and ideas develop through universal phases or principles. These include:

- *exploration*: inventions and experimental designs
- *consolidation*: limited range of dominant designs established
- *mature*: shift from product to process innovation, product differentiation
- *re-innovation*: product families
- *decline*: displacement by alternatives - thus beginning the evolutionary cycle again.

He goes on to state that, *"ecodesigns are still located in the initial exploration phase of their evolution, with a few having moved to the consolidation phase. Those greener products that are reaching maturity tend to be modifications of existing dominant designs rather than new ecodesign concepts (p.364-5)."* Clearly ecodesigns in a relatively immature, early stage of their evolutionary development and needs will grow and mature in time.

In sharp contrast to this, there is an almost universal call for more radical innovation (of the revolutionary, discontinuous, or new concept based type) within the framework of sustainability (see section 2.1.1.1). Among the most vocal of these are Fussler and James (1996), describing the process of 'Driving Eco-Innovations'. They call for 'super-innovations' rather than the incremental approach unlikely to deliver sustainability. A case in point is the automobile, they point out as only 2% efficient. From this perspective a 100% efficiency improvement would still only be 4% eco-efficient and though better, not sustainable or be advocated in the longer term.

*".... without breakthrough improvements in mind, eco-efficiency would only be a new word for the optimisation of current business practice. It would not bring you much - certainly not innovation and value. Sustainable development requires radical improvements in products and services. They must provide customer satisfaction with much lower levels of environmental impact. But in practice the established technologies and lifestyles which create unsustainable development still maintain their dominance." (Fussler and James, 1996, p-xix)*



A similar and comprehensive call for more radical innovations comes in Factor 4: doubling wealth, halving resource use (Von Weisacker et al, 1997). Using examples and case studies, this book constructs a convincing and optimistic case for not only the technical and economically viability of future environmentally driven innovations, but as a revolution in progress. Charter (1999) points out that though these two comprehensive and convincing texts illuminate need for 'eco-innovation', "*what they don't do is show you how to innovate!*". The aims of this research are in part to bridge this gap.

## 2.8 Ecodesign practice

Current and 'best' ecodesign practice lags some way behind the maturing theoretical and research framework. This section of the thesis aims to describe such ecodesign practice. To do so it will relate various studies on practice and 'best' ecodesign practice back to the theoretical framework to build an overall picture. Ecodesign is explored here on a multi-disciplinary level and includes the following terms and issues: attitudes to ecodesign, behaviour of designers and companies, current company and design practice. This section draws literature from the following interconnected fields: ecodesign practice; ecodesign integration; managing ecodesign; and characteristics of successful ecodesign.

### 2.8.1 Design practice

Surveys of ecodesign practice within the UK are those by Dewberry (1996), and Sherwin and Chick (1997), both highlight its immaturity. Both in-house and design consultancies demonstrated a poor levels of ecodesign awareness and little practice. Dewberry's (1996) original research aims of surveying 'best' practice had later to be revised to 'better' practice, as ecodesign was so undeveloped. She concluded that the most advanced companies were nowhere near 'sustainable design', with most having isolated examples of 'green or ecodesign' (section 2.3.1.4). The key conclusions were:

Issue	Conclusions
Current state of the art for UK designers attitudes to ecodesign	Generally reactive; confused; sympathetic but have little understanding of environment; frustrated and cynical; cope and comply with clients/management
Opportunities and constraints for ecodesign	Time is critical factor; cost savings are seen as opportunity; ecodesign increases design criteria and creativity
Information for ecodesign	New information is needed, which needs to be: specific and focused; understandable in presentation; accessible; 'hands-on'
Positioning of ecodesign	Ecodesign is not a priority; designers are not involved in strategic decisions within product development; there is a lack of communication

Figure 2.16: Conclusions from UK ecodesign survey (Dewberry, 1996)

Van Hemel (1998) and Brezet (1998), both describe ecodesign 'best' practice as at level 2 (Product Redesign) of Brezet's earlier ecodesign innovation model (section 2.3.2.3). Here the product concept stays the same, but parts of the product are developed further or replaced by others. This ties in with both the above surveys that ecodesign practice is currently in its infancy. Both Van Hemel (1998) and Simon et al (2000) state that ecodesign integration and practice tends to be evolutionary in their nature, or more incremental in the approaches defined here.



Other studies of ecodesign in the design and product development process (Dermody and Hamner-Lloyd, 1995; Simon et al, 2000). An Open University study of Green Product Development (Smith et al, 1996), found that leading ecodesign products were generally developed without any specific environmental requirements or goals. It was often after the development process had begun that the environmental benefits were recognised and exploited.

*"...it is not surprising that most of the companies adopted an incremental or ad hoc 'green' design' approach to the incorporation of environmental factors in product development.... None of the firms in this study routinely adopted a systematic 'ecodesign' approach to product development in an attempt to reduce/balance environmental impacts over the whole life cycle of the product from 'cradle to grave', including both product and process impacts..., None of the firms, however, had considered sustainable product design.." (Smith et al, p.51)*

## 2.8.2 Ecodesign Integration

A comprehensive overview of how industries are integrating ecodesign comes from McAloone (1998). Building on work from the DEEDS project (section 2.7.2) he proposes an integration model for the Electrical/Electronics sector, consisting of five factors seen as of critical importance to success. These were: initial and sustained motivation; communication/ information flow; whole life thinking; hands-on environmentally conscious design; and positioning in the world, which in turn have a number of criteria and are described below:

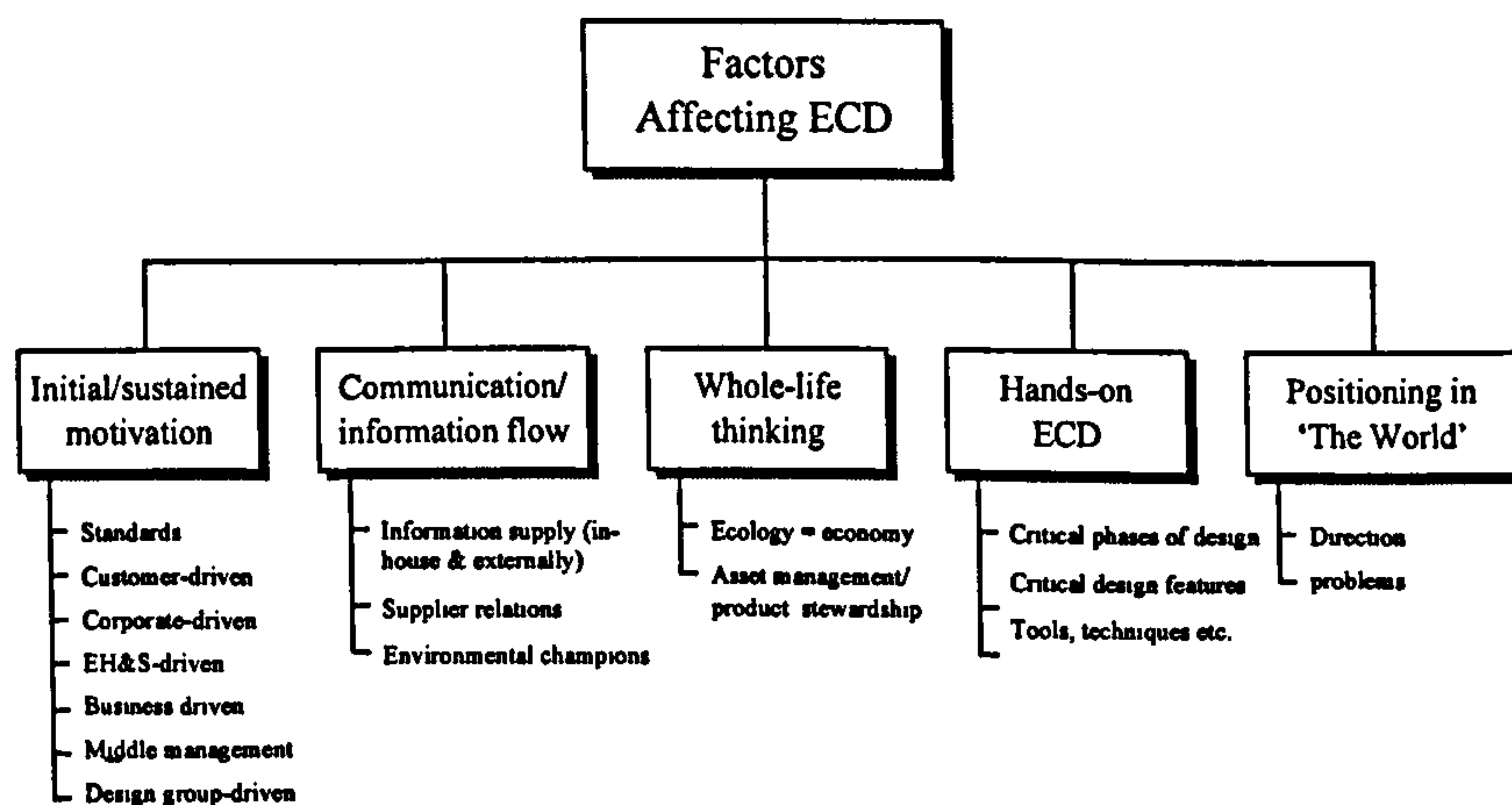


Figure 2.17: Model of Ecodesign Integration (McAloone, 1998)

McAloone (1998) extends this work in his Ph.D. by exploring several of these integration themes in greater detail. The 3 factors describing the way companies integrate ecodesign are illustrated below:

- *The timing of environmental decisions is key to environmentally conscious design:* environmental decisions made in the pre-specification stage of design have greater impact on the product
- *Enthusiasm is key to environmentally conscious design:* involvement of decisions makers who have the enthusiasm to find solutions to problems is more important than detailed environmental subject knowledge (companies tend to appoint an environmental champion)



- *Senior management commitment is key to environmentally conscious design: without top management commitment (manifested through the provisions of resources; company environmental visions statement; the commitment to achieve recognised environmental standards; the support of environmental training schemes; and corporate membership of external environmental forums) environmentally conscious design does not become an integral part of the design process.*

Further empirical evidence of many of these factors comes from Stevels (1998, 1997) at Philips and Baynes(1999, 1998) with Sony.

The main obstacle to more successful and innovative ecodesign often described as external to design (Dewberry, 1996; Goggin, 1997; Simon, 1997). These can include: the structure of the organisation, the profile and role of the design team, or nature of design task specified. Dewberry (1996), Bakker (1995) and Sherwin and Chick (1997), all concluded that designers work mostly in the operational role, rather than the strategic (see section 2.7.1). Here design briefs, product specifications and important decisions were made by clients or senior management. Designers have little influence over these more strategic, 'early' design decisions that are so critical to successful ecodesign innovation:

*Surprisingly, a large proportion of the designers interviewed indicated that for many of the design projects they undertake, the design brief is basically decided before it is even handed to them. One might presume that the design decision process is taking place at a management level within the company or client. (Dewberry, 1996, p151)*

### 2.8.3 Managing ecodesign

Within organisations, ecodesign tends to be managed in a certain way within companies. Interestingly, ecodesign appears currently to be the ownership of environmental functions within companies (Environmental Affairs or Environment, Health and Safety) (Sherwin and Charter, 1996; Charter, 1996; Clark and Charter, 1996). The main barrier to ecodesign practice is that these functions are not design orientated and often have little involvement in everyday product development. These departments tend to work more closely with policy-related matters, legal and compliance issues, or else environmental communication. Traditionally, marketing tends to drive product development, and the relationship between them and design is poor (Charter, 1999). Language barriers also occur between the environmental and design departments. Where design teams conduct ecodesign, its tools and traditions tend to be more engineering design related, as it historically developed out of these stages of product development (Sherwin and Bhamra, 1999), creating difficulties for those earlier stage designers involved in such projects.

### 2.8.4 The PROMISE Approach

One of the more comprehensive and well-developed tools for ecodesign integration into product development is the PROMISE Manual (Brezet and Van Hemel, 1997). This is a prescriptive toolbox for companies to embrace and conduct ecodesign. Of interest to this enquiry is that the PROMISE manual prescribes an incremental, product orientated approach for companies and designers. This is based on the selection and environmental evaluation of an existing product, which is then used as the basis for



subsequent product design using the information provided from the environmental audit:

*“One of the main conclusions (from PROMISE) was that the best approach to creating ecodesign awareness and initiatives in a company is to establish a link with the company's specific type of products and development process. A good way to guarantee this strong relation was to select one of the company's products and assist the company in applying the step-by-step approach to this specific product.” (van Hemel, 1998, p20)*

Paradoxically this incremental approach to ecodesign integration has been extensively highlighted as unsuitable for the radical innovation required for sustainability (Manzini, 1995b; Walker, 1995; Margolin, 1998a), and called for extensively within the literature. This again highlights the gap between theory and practice (section 2.1.1.1).

## 2.9 The lifecycle principle

The most recurring theme within the ecodesign literature and ecodesign innovation is that of the ‘life cycle principle’ (Dewberry, 1996; Dewberry and Goggin, 1996; Fletcher, 1999; Simon et al., 1998). The lifecycle of a product is a holistic concept where all the stages of a product ‘life’ are considered (material extraction; production; distribution; use and disposal). Lifecycle thinking is a powerful tool to visualise, define and reduce the overall impacts of a product. The concept is also describes as ‘cradle-to-grave’ (Mackenzie, 1997b) or the product-system (Ryan, 1992), and a schematic illustration is presented in Fig 2.18 below (SETAC, 1993). The central premise of the life cycle principle is that products are developed and designed using several universal phases (or lifecycle stages) each of which have resource and energy inputs, and outputs as waste. Decisions made at certain stages of this life cycle have potential effects both up and down stream, not only on material extraction, but also on the inputs and outputs of each or all stages leading up to and from that. Similarly, recycling wastes back into the lifecycle system can potentially reduce resource extraction at its initial design.

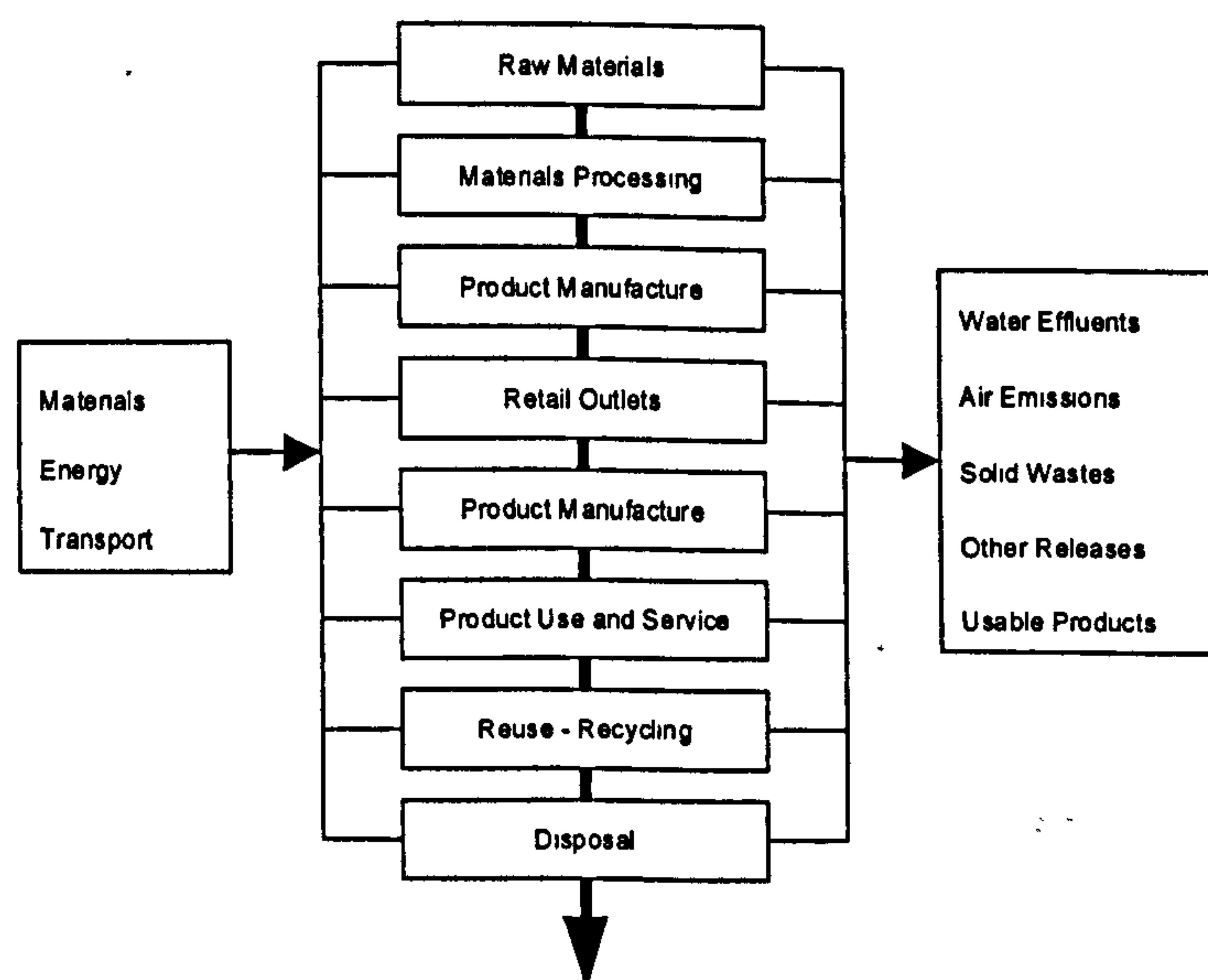


Figure 2.18: SETAC Life Cycle model (SETAC, 1993)

The lifecycle principle has a central status within ecodesign literature. Indeed often ecodesign is considered to be ‘Life Cycle Design’ – determined entirely by the lifecycle



principle and approach (Keoleian and Menerey, 1994). When not described as Life Cycle Design, descriptions of ecodesign are closely tied to these principles (Dewberry and Goggin, 1996). Its real benefit is in connecting design to a much broader systems of material extraction and energy use, production and utilisation, and in shifting the emphasis in design from blinkered product thinking to wider systems (Ryan, 1995; Keoleian and Menerey, 1994). There are however, several limitation emerging with the lifecycle principle. This increasing reliance on life cycle principles has been criticised by a number of authors (Sherwin et al., 1998; Sherwin and Bhamra, 1999; Walker, 1995). The real problem is when life cycle principles are considered to be the 'optimal' or *only* approach to ecodesign, it neglects other equally valid and perhaps more appropriate ecodesign strategies.

### 2.9.1 Life Cycle Analysis

A related concept is Life Cycle Analysis (or Assessment) - LCA. The life Cycle Analysis is a quantitative, analytical method to assess and define the environmental impact of particular products or processes. It works by using the life cycle framework and defining values to environmental or material factors, such as energy use, material extraction, or the content of toxic materials. This can include: resource or energy inputs; or environmental impacts such as Co2 emissions, pollutants and toxins. LCA tools come in many forms, with their number, variety and effectiveness increasing rapidly. Life Cycle Analyses usually consist of the following stages:

Goal Definition	What is the purpose of the LCA? Who is the target group? Which decisions must the LCA support? What is the extent of those decisions?
Scope definition	Which product is to be assessed? What is the service provided by the product? How much of the product system is to be included? Which inputs and outputs are to be ascribed to the service?
Inventory	What is the data requirement? What is the quality of the collected data? How is the product system modelled?
Impact Assessment	Which resource consumption & environmental impact potentials does the product contribute to? Which contributions are the most important? Which sources are the most important?

Figure 2.19: EPA Stages of Life Cycle Analysis

LCA's can help highlight the key (and often hidden) environmental impacts of a product performance, especially where these might be invisible or outside the normal (production and use) lifecycle stages of the considered by designers. There is however a growing body of literature highlighting the limitations of LCA tools and methodology (Hook, 1996; Billet, 1996; Billet et al., 1996; Dewberry, 1996). Walker (1995) states "*In order to carry out an LCA, the product must exist, or at least be precisely defined;...*" (p.17), which he feels is not especially appropriate for design and especially not the early, conceptual stages. This limitation is especially relevant to this study, in dealing with these early, conceptual phases. Though Life Cycle Analysis is a powerful tool, it is clearly not universally applicable. "*It is important to underline that LCA's prime purpose is environmental analysis and assessment and not to provide design guidelines. In short, LCA indicates where the environmental problems are, but it doesn't suggest ways to solve them..*" (Vezzoli, 1999, p.31). Perhaps the most striking limitation is that



the more fundamental questions of sustainability – such as about lifestyle change, the nature of demand, or how to transform consumption patterns - can simply not be answered by LCA (Dewberry, 1996; Billet, 1996).

### 2.9.2 Review of Life Cycle and Information tools

Both Vezzoli (1999) and Sweatman et al., (1997) review Life Cycle tools and define two types: evaluation tools – assess and quantify the critical environmental impacts of products (LCA); improvement tools – define environmental improvement design strategies.

As figure 2.20 illustrates, through the product development process design interventions are more effective at the early stages (see section 2.7.2). Whereas existing (largely life cycle based) tools become more effective as the product develops and becomes more detailed towards the later stages. This is strangely paradoxical as with LCA tools, the later better whereas design should be early. There is a major gap between the demand and supply of ecodesign innovation tools and information, which is as yet unresolved. There is clearly a need for tools and methods to help facilitate such early innovations

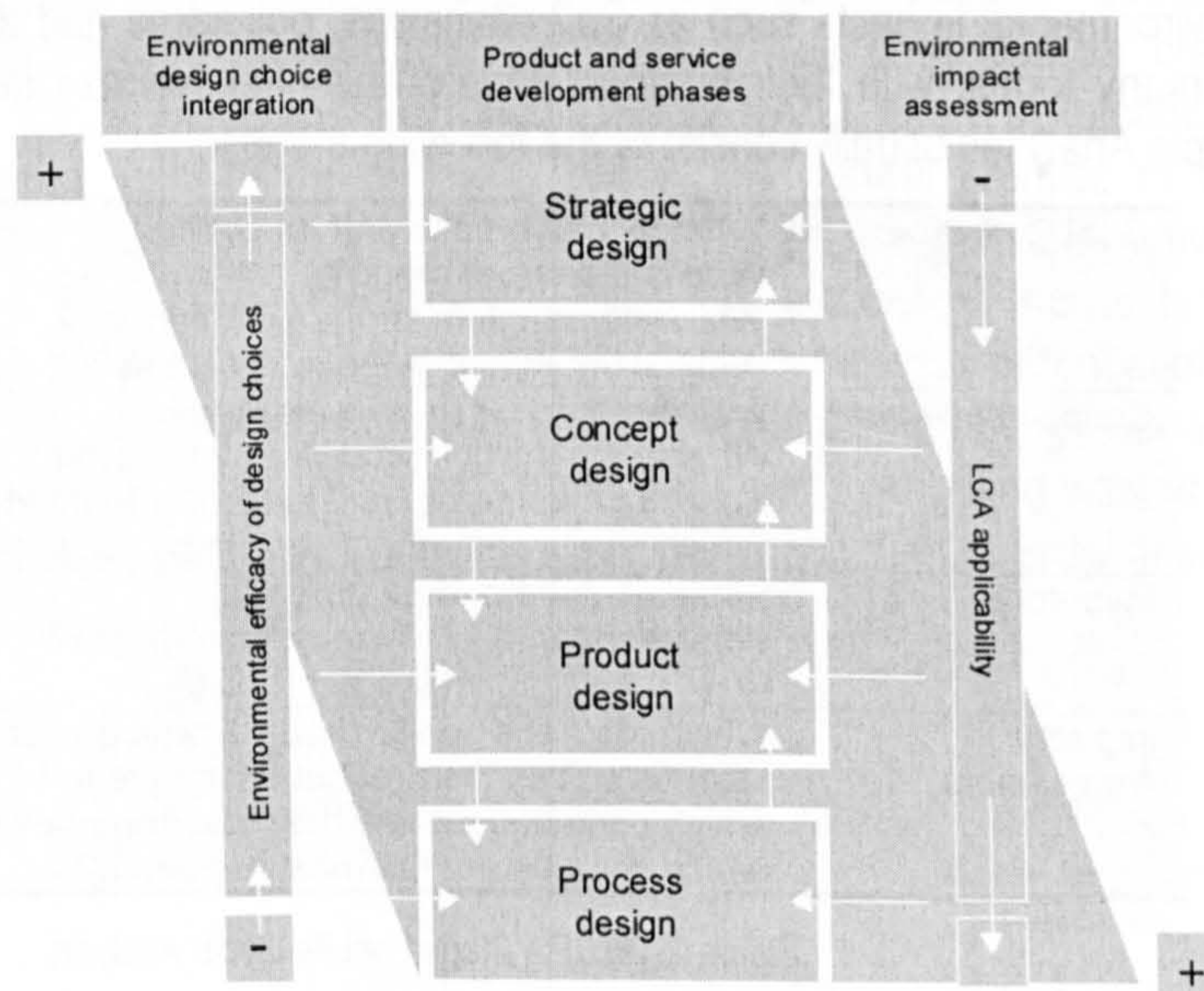


Figure 2.20: Relationship between LCA applicability, the environmental efficacy of design choices and the product development process. (Vezzoli, 1999)

### 2.9.3 ***The Dichotomy of Ecodesign theory and practice***

A striking dichotomy emerges when relating ecodesign practice back to the theory. Paradoxically, the few studies of current ecodesign practice within the design and product development process indicate that it is and should be incremental, and based on existing product redesign rather than new product concepts. Most tools, methods and information tend to support this 'incremental' approach. In contrast, the ecodesign literature describes various roles and approaches, as well as several principles and strategies to facilitate a more radical, innovative approach to ecodesign for new product concepts. The literature and requirements of sustainability universally promote this more radical and fundamental approach, as the incremental will not suffice.



#### **2.9.4 Research agenda for future ecodesign practice**

Studies by both Argument et al (1998) and the Foresight Program (1997) propose a research agenda for the future of ecodesign. In highlighting the agenda for the future research, the Foresight Program propose both 'new products/service concepts' while also promoting socio-economic and management research. The report 'Design for Environmental Sustainability' gives more detail of this stating that future research and design practice should include: new products, services and scenarios and involve: product-to-service transformation; dematerialization; lease economy/joint ownership; the societal brief; product stewardship/responsible care; sustainable lifestyles; envisioning; and scenarios. These later points regarding new consumption patterns and sustainable lifestyle patterns also emerged from the study by Argument et al, who indicated a significant gap between views of the research and future ecodesign agenda between researchers and practitioners. The survey highlighted a major need for research into 'eco-lifestyles', which ecodesign researchers rated as the key issue for ecodesign in the future. This future research need is clearly connected to the call for more radical and lifestyle related eco-innovations from the sustainability literature and detailed extensively elsewhere.

#### **2.10 Related terms**

This section introduces some concepts related to ecodesign. The diversity of these related topics means that only a selected few themes are described here only when connected to this thesis.

##### **2.10.1 Eco efficiency**

The concept of Eco efficiency is defined as:

*"...the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the lifecycle, to a level at least in line with the Earth's carrying capacity." (Schmidheiny et al, 1992)*

Eco efficiency is a business and design concept and connected closely to traditional ideas of efficiency, waste reduction and doing more with less. In this case however the drivers are environmental and advocates are quick to promote the clear connections between ecology and economy, thus marrying traditional business terminology more happily with environmentalism. It is no surprise therefore that eco-efficiency is one of the more acceptable and widely used sustainability concepts. In many ways 'eco-efficiency' is analogous to the incremental approach to ecodesign being fundamentally a term for the efficiency and optimisation of existing practice. It has been criticised for its 'business as usual' attitude, in that its environmental improvements are often cancelled out by increased sales and consumption rates (Tuppen, 1998; McLaren et al., 1998), while also focussing only on the environmental dimensions of sustainability. It is acknowledged as being unable to deliver sustainability in the long-term (Cooper, 1998a; van Weenan, 1998; Bujanowsky et al., 1998).

##### **2.10.2 Clean production**

Clean Production is also referred to as optimising production processes. The concept of clean production is an umbrella term generally understood to mean production



processes and strategies aimed to reduce environmental impacts within the production and manufacturing stages of product development. Originally it was more used for process design, however it has more recently turned to products as well. Van Weenan (1997) proposes a number of related terms including waste reduction; non-pollution production; production energy efficiency; safe and healthy work environments; environmentally sound products; and environmentally sound packaging. Clean production is stated as reactive and reductive.

### **2.10.3 Industrial Ecology**

Industrial Ecology is an organising and organisationally based strategy where industrial cycles mimic the processes of nature and natural cycles. It is:

*"A discipline which focuses on the design, development, operation, renewal and decommissioning of industrial facilities as ecological systems, with an emphasis on the optimisation of resource efficiency." (WBCSD, 2000)*

Such concepts usually transcend product or process design boundaries to re-conceptualise the way in which resources are used and disposed of within and between companies. Industrial ecology asks manufacturers to use natural metaphors and principles, such as 'waste equals food' (Graedel and Allenby, 1995). Here waste products from one industrial processes or cycle become the raw materials of another, effectively 'closing the loop' of production and consumption. In practice Industrial Ecology requires an holistic, systems view which must increasingly look beyond a single manufacturing plant or company boundaries. This has seen the promotion of Industrial Ecology parks where the 'wastes' from one cycle might become the 'food' for others, such as the famed example of the 'Kalundborg' Industrial Eco System (Van Der Ryn, 1996).

### **2.10.4 Sustainable Consumption and Lifestyles**

The sustainable consumption and lifestyles debate represents the demand-side shift described in section 2.1.1.1. Due to its complexity, here it will be summarised. Environmental problems are more traditionally associated with unsustainable forms of production or technologies, as well as poverty and global inequitable distributions of resources. In many ways however, they are the results of unsustainable western consumer lifestyle and consumption patterns (ERM Limited, 1993; Pantzar et al., 1995; Heiskanen and Pantzar, 1997; SustainAbility, 1995), societal dimensions largely missed within the 'technocentric' sustainability discourse. (Redclift and Benton, 1994):

*"Consumption is the only reason why anything gets produced, and consumption and production together are the source of all man-made stress on the natural environment. In a market economy the main responsibility for environmental degradation thus lies with the consumer." (Pantzar et al., 1995, unpaginated)*

Opinions on the interventions needed usually either ask us to revise our notions of consumption (SustainAbility, 1995), concentrating on non-material means to satisfy needs (Jackson, 1996; Meadows, 1992) or focus on 'real' needs (Max-Neef, 1992; Kamenetsky, 1992). An alternative view defines consumption as delivering 'units of service', to consumers (Giarini, 1992; Meijkamp, 1998; Meijkamp, 1997, Stahel, 1999; Stahel and Jackson, 1992). The key benefit of the latter is that there are number of ways to satisfy or deliver these units of service, some of which might offer greater potential environmental reductions. However, what all proposals share is a wish to



transform unsustainable consumption practices. This sustainable consumption and lifestyle debate is a potentially powerful tool to re-conceptualise and redefine more sustainable ways of living.

#### 2.10.4.1 Green Consumers

Much discussion on sustainable consumption and lifestyles focuses on green consumerism [Elkington, 1987; Elkington, 1998]. Green consumerism and research into the subject tends to discuss three differing, but related factors: attitudes – to environmental protection and sustainability; behaviour – in relation for instance to energy or water conservation or changes in product usage or consumption patterns; purchasing – buying patterns of environmentally preferable products. Some headway is being made here and though consumer behaviour is still almost impossible to predict, we are now beginning to understand their nuances better. A comprehensive study in the Netherlands concluded that new sustainable lifestyle options should be 'attractive, acceptable and affordable' and promoted the following policy and design related approaches (ERM, 1993): rationalise access; act communally; circulate goods; buy services not products

The most comprehensive study of green consumerism in the UK comes from the National Consumer Council (1997). It illustrates the values and opinions of very differing green clusters with differing lives and opinions. It clearly shows that strategies aimed to promote more sustainable consumption and lifestyles, as well the design of new products and services must respect this diversity, and highlights the importance in acknowledging this in design.

<b>SCEPTIC (28%)</b>	<b>CAREFUL SPENDERS (19%)</b>	<b>YOUNG GREENS (17%)</b>	<b>RECYCLERS (19%)</b>	<b>AFFLUENT GREENS (19%)</b>
Not environmentally aware or motivated	Semi-skilled, clerical workers	Young, often students	Regularly recycle	Committed buyers of eco-products
Wide age range	Home/car owners, not wealthy	Live in rented accommodation	Do not save energy, water or gas	25-50, female, wealthy
Unskilled or low income	Save energy, gas and water	Active recycler's	Not green shoppers	Recycle frequently
Not green consumer	Buy cost related eco-products	Conserve through necessity	Male and female - older	Avoid pesticides and buy unleaded
May conserve to save money Do not recycle	Not environmentally aware or active Do not recycle	Buy eco-products, but not wealthy	Wealthy – major consumers Keen gardeners	Environmental committed Buy and eat organic

Figure 2.21: UK 'Shades of Green' Consumers in summary. (NCC, 1997a)

There are however dangers in treating green consumers and green consumerism itself as sustainable consumption. First and foremost green consumers are 'consumers' and only marginally 'green'. As well as this, green consumerism focuses attention on 'what' rather than 'that' we consume.

#### 2.10.5 **Eco efficient services**

The concept of 'service' and 'services' in many ways is an individual ecodesign strategy. Its increasing use and promotion as a design strategy to dramatically reduce environmental impact giving it an almost mythical place in contemporary ecodesign theory. The central premise of 'eco-efficient services' is to offer greater potential for radical environmental improvement because of their non (or less) materially intensive nature. In this sense if production and consumption shifted from selling products to delivering services (from material to non-material means of satisfying needs), the



economy would be radically dematerialised (Hockerts, 1998; Meijkamp, 1998; Meijkamp, 1997; Meijkamp and Aarts, 1997; Schrader, 1996; Schrader, 1999; van den Hoed, 1997).

The basic premise is that products are 'consumption technology' and consumer actually require and purchase 'units of service' (Meijkamp, 1998; Meijkamp, 1997) rather than products or material goods. Both Jackson (1996) and Stahel with Jackson (1992) and Giarini (1992) have written extensively about the benefits of a service-based economy, in terms of resource productivity, product durability and fuller employment opportunities. The environmental implications of service come from the specific role that materials play within this service delivery. In the industrial (product orientated) economy profit is maximised by resource and energy throughput and use. In the service economy profit is maximised by delivering the required service in as efficient manner as possible, thus dramatically saving resources and energy. Such developments allow breakthrough innovations and radically reduced resource productivity, potentially in line with sustainability targets.

Central to this, are notions of economic maturity, environmental pressure and the nature of modern consumption. Though there are questions arising particularly from the consumption literature as to the possibility of reducing consumption to such 'utilitarian' notions of consumption (Verbeek and Kockelkoren, 1997; Walker, 2000), eco-efficient services offer great possibilities and potential:

- *Business Perspective:* Company's are now realising that it is more profitable to meet customer needs through selling 'services' rather than hardware, and is potentially more flexible and environmentally responsible. (Mackenzie, 1996)
- *Consumer Perspective:* There is evidence that modern consumers are less 'materialistic' *per se* and actually interested in getting 'results and solutions'. With services, consumers get the benefits, function and results, without the constraints of product ownership (cost, maintenance, and disposal) and also give greater flexibility. (Schmidt-Bleek, 1993)
- *Environmental Perspective:* Material and energy use is disassociated from economic output and success - one of the major causes of environmental deterioration. Though materials and products are required to deliver services, the primary purpose of economic activity in the service economy (of design and production) is to provide 'service' to consumers rather than provide products. (Stahel, 1999)
- *Innovation Perspective:* Services offer a new way to look at design and manufacturing – a new design paradigm. This offers a whole new series of 'levers or triggers' for designers and company's. (Elsen, 1997)

'Eco-efficient services' concepts also appears in a variety of other guises, as: product-service systems (Roy, 2000); product/service mix (Manzini, 1999); sustainable services (Elsen, 1997); or as systems innovation most notably in the SusHouse project (Vergragt, 1998).

## **2.11 Pulling together the terms**



This section summarises the above literature and helps justify the research undertaken within this study. There are clearly a variety of ways to describe, define, categorise and understand ecodesign. These are sometimes polarised into 'innovative' (revolutionary or radical) and 'incremental' (evolutionary or improvement) approaches. The first tends to deal with the design of new concepts, products, service and systems of production and consumption. The latter deals more within the realms of the redesign of what exists, existing product redesign and patterns of production and consumption. The innovative approach is more likely to achieve targets set by the sustainability literature, though the majority of tools and methods, and current ecodesign practice adopt the more incremental approach. There are few tools, methods and examples for the innovative approach as well as very little research or understanding in these design processes.

These polarities however, mask subtle differences and diversities in the literature, which need to be acknowledged in any literature review. Even within the more innovative approach to ecodesign there is variety. For example, some authors discuss a broadening of the design space and its consideration factors, such as is characterised by 'system' innovation (Brezet, 1997; Vergragt, 1998). Whilst others promote a shifting design paradigm, from an industrial and technological model, to one of ecology and biology (Datchefski, 1999a; Datchefski, 1999b; McDonough and Braungart, 1998; Beard, 1997). Along with this there are various timings of design interventions (Vezzoli, 1999; Hodgson et al., 1997; Manzini, 1993a) as well as differences in the focus and context of design – single/multiple product, company/society (Bras, 1997). Different approaches are also proposed, such as 'repair', 're-design' or 're-think' products (Charter and Chick, 1997), or considering innovation or improvement (Bakker, 1995). Fundamentally the innovative and incremental approach to ecodesign are a conceptual framework around which to understand this complexity. This is represented in figure 2.22, aimed to summarise these often disparate and sometimes contradictory terms.



	INNOVATIVE		INCREMENTAL	
<u>Dominant paradigm</u>				
<i>Margolin , 1996</i>	Equilibrium		Expansion	
<i>McLaren et al, 1998</i>	Sufficiency		Efficiency	
<i>Pepper, 1996</i>	Eco centric		Techno centric	
<u>Company mindset</u>				
<i>Beard &amp; Hartmann , 2000</i>	Restorative	Proactive	Compliant	Reactive
<i>Jackson, 1996</i>	Preventive		Curative	
<u>Context</u>				
<i>Bras, 1997</i>	Society	Companies	Products	
<u>Nature of innovations</u>				
<i>Bakker , 1997</i>	Product Innovation		Product Improvement	
<i>Domus Academy, 1997</i>	Sustainable solutions		Redesign of the existing	
<i>Van Hemel , 1998</i>	Revolutionary		Evolutionary	
<i>Zust &amp; Luttropp , 1998</i>	Eco-effective		Eco-efficient	
<u>Design stages</u>				
<i>Manzini , 1994</i>	Strategic		Tactical	
<i>Vezzoli , 1999</i>	Strategic Design	Concept Design	Product Design	Process Design
<i>Hodgson , 1997</i>	Product strategy	Product development	Product specification	
<u>Design approach</u>				
<i>Charter &amp; Chick, 1996</i>	Re think	Re design	Re fine	Re pair
<i>Brezet , 1997</i>	System innovation	Function innovation	Product redesign	Product improvement
<i>Dewberry, 1996</i>	Sustainable design		Ecodesign	Green design
<i>Van den Hoed, 1996</i>	Sustainable Innovation		Ecodesign	
<u>Design focus</u>				
<i>Luttropp , 1999</i>	Needs	Products	Properties	
<i>Van Hemel , 1998</i>		Clean products	Clean technologies	Cleaning technologies
<u>Design focus</u>				
<i>Van Hemel , 1998</i>	New product/concepts		Existing product/concept redesign	
<i>Ryan, 1996</i>	Ecodesign		EcoRedesign	

Figure 2.22: Schematic representation of relationship in ecodesign literature

The model points to a number of important factors. The more innovative approach to ecodesign, which is the focus of this study, clearly operates within differing socio-economic frameworks, in which there may be changes to consumption or societal change. Companies require a more proactive view of sustainability using the preventative environmental approach, and in the long-term restoring (rather than reducing) environmental quality. Such factors engage not only groups of companies, but also ultimately require societal engagement. The types of innovation required will be more revolutionary than evolutionary. These place an increasing emphasis on 'effectiveness' (doing the right thing) as much as 'efficiency' and are likely to focus on the needs or functions of the product, rather than the product itself. Such questions are strategic in their nature and require creative thinking and insight. In these cases designers need to 're-think' and 're-design' whilst also reconsider the system. Such approaches are likely to result in entirely new product concepts and new business opportunities (working at the early conception stages of product development) more than existing product redesign.



## 2.12 Summary of Ecodesign literature

This section summarises ecodesign theory and practice fitting it into a body of design knowledge, and highlighting the important points and implications for this study. It closes by highlighting the knowledge gaps of importance to this study.

- Current patterns of living, of producing and consuming are unsustainable. Sustainable development requires dramatic changes and both radical and socially orientated innovations. This implicates all stakeholders, not least companies and the designers working within them. That negative environmental effects are associated with industrial production and consumption places a special responsibility on product development and on design.
- Ecodesign literature tends to describe these innovations as either/or polarities of 'innovative' or 'incremental'. The more radical approach is more likely to achieve sustainability, but is little understood or practised, with most ecodesign being of the more incremental nature. Current tools and methods are insufficient for the innovative approach or for sustainability.
- The early stages of product development (pre-specification, product planning, concept design or strategic design) are recognised as of critical importance to these more radical environmental improvements and innovations. This implicates design and especially Industrial Design as the 'early stage' designers. However there is a shortage of work and tools and working practices or research at these early design stages.
- Serving both consumers and company, as well as being responsible for idea generation, new concepts and creative input, Industrial Designers have great potential for the nature and scale of innovation required for sustainability.
- Industrial Design has some responsibility for the generation of (new) product concepts, as well as their development and detail. However, though designers offer great potential for strategic and creative input, they are rarely involved in the more strategic and 'early stage' decision-making so important to more innovative ecodesign. They are mostly employed in more operational contexts.
- Ecodesign theory and practice has developed with no place for and unsympathetic to Industrial Design. This can be explained by its historical advancement up the product development process, only now moving to the early stages. Ecodesign research makes little acknowledgement for industrial designers in its epistemology, theory or practice being largely resigned to later developmental stages.

### 2.12.1 Research Justification

*"On the basis of these arguments, it can be concluded that a process of step-wise adaptation (incremental improvement) will probably not be enough for attaining sustainability. More radical changes are needed involving not only technological innovations, but changes in consumption and production patterns as well." (Bakker, 1995, p-46)*

Incremental improvements as most commonly practised to date will not deliver sustainability. There is a clearly a need for more fundamental, radical and revolutionary ecodesign. Very little work, few tools and methods are available to designers to conduct this form of ecodesign and it is little understood.



*"To date, little experience has been had with revolutionary product systems innovations since these are more complex and involve more risk than environmental product modifications. Future longitudinal research might reveal whether evolutionary environmental product improvements enhance or block the way to revolutionary environmental product systems innovations." (van Hemel, 1998, p.19)*

There is a clear need for research into both Industrial Design practices of ecodesign and more innovative practices of ecodesign with designers working at the early stages of product design and development. It is these questions that are the domains of this research.

### 2.12.2 Visualising the literature and research focus

This section presents a visual representation of the literature and the domains of this research (figure 2.23). It clearly indicates that the focus of this research is towards the innovative approach to ecodesign. These will be explored using the research questions stated previously (section 1.3.3).

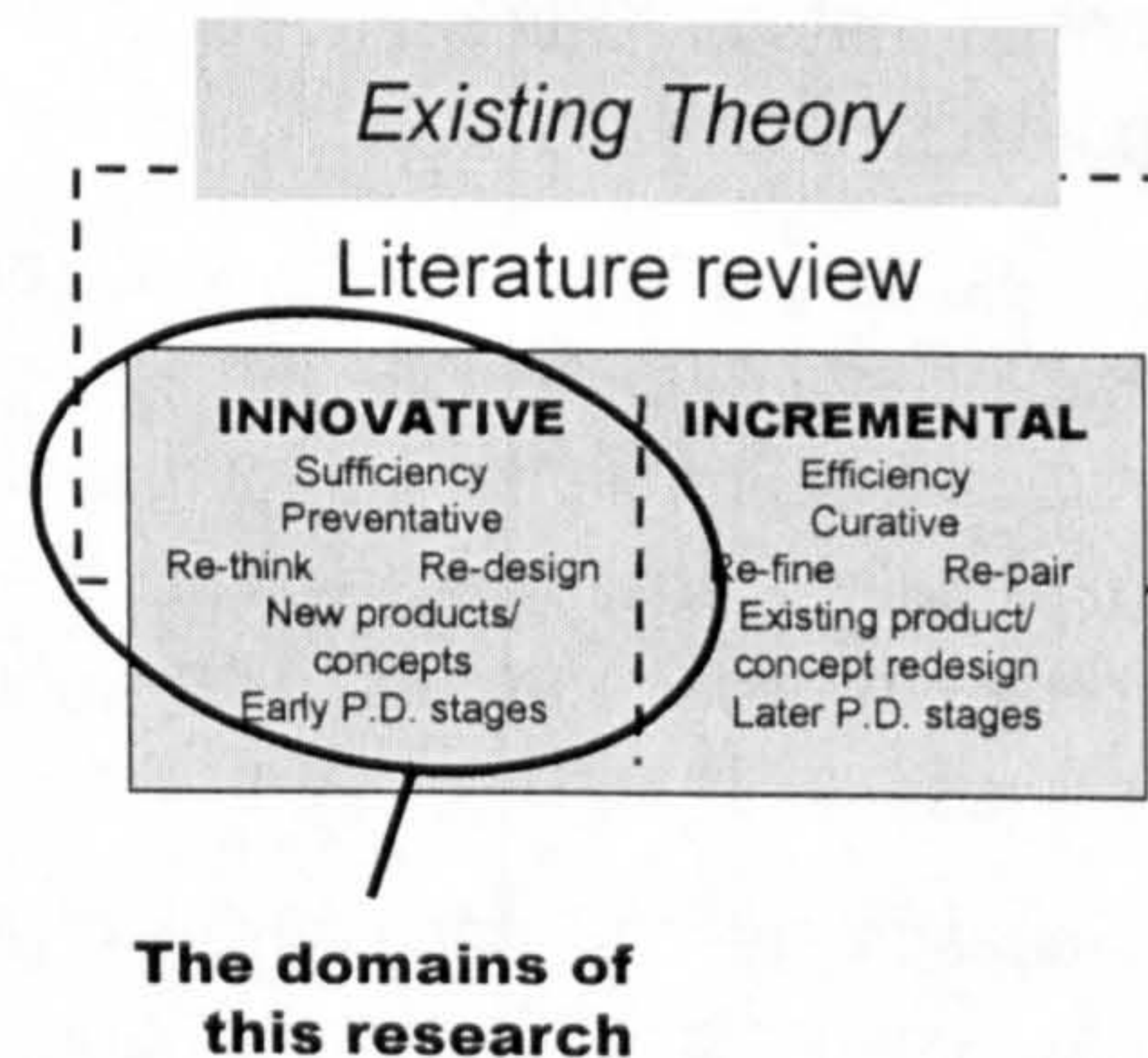


Figure 2.23: Visualisation of the literature and research focus

For the purposes of this enquiry, 'innovative' approach ecodesign will be studied largely through: the early stages of the product design and development process; an Industrial Design department as well as Industrial Design practice.



## **THE CASE STUDY: ELECTROLUX & INDUSTRIAL DESIGN**

# Chapter 3

*This chapter introduces the single case on which the research was conducted. It begins with the background and history of the company, then describes its operational and product development procedures. The chapter then discusses the company's approach to product design and introduces the department of Industrial Design. The practice and culture of the Industrial Design Centres is explained and the chapter closes with some previous examples of the companies and departments approaches to both design innovation and ecodesign.*

### **3.1 Background and History of Electrolux**

Originating some 100 years ago as AB Lux, Electrolux is now a global leader in the manufacture of electrical and electronic products, domestic and professional appliances, white goods, and other forms of consumer products. Their history can be traced back to innovations as the vacuum cleaner, and kerosene lamps for use in lighthouses. Being based mostly in Sweden throughout the 20<sup>th</sup> Century, the company has now emerged as one of the world's largest manufacturing corporations, growing mostly through product and market innovations and recently through acquisition. The company is the market leader in white goods in Europe, as well as the third largest in the US; the World leader in Floor-care products, with a global market share of approximately 20%; while also being the World's largest producer of such items as lawn mowers, garden tractors and lawn trimmers.

In more than 100 countries the companies produces and sells more than 55 million products annually. Its largest markets are the European (approx. 50%); the USA (approx. 40%); with the rest of the world constituting of around 10% of its annual sales. The Electrolux Group itself, formed in 1919, now consists of some 46 major brands: including Zanussi, AEG, Husqvarna, Flymo, Frigidaire, Kelvinator and a variety of others. The group is split into three major business areas: Household Appliances; Professional Appliances; Outdoor Appliances. Household appliances comprise the largest areas consisting of around three-quarters of group sales. Within this business area there are a variety of product lines (or categories) such:

- *White goods, split into:* Cold – refrigerators; freezers; Wet – dishwashers; washing machines; dryers; Hot – cookers; ovens, hobs; cookers hoods; microwave ovens
- *Floor-care products:* vacuum cleaners
- *Leisure appliances:* hotel minibars; refrigerators for trailers and mobiles homes
- Components

These product lines are organised into separate business groups, and described as: European Household Products - EHP (the largest business sector); White goods and outdoor products, North America; New Markets, Components, Direct Sales;



Professional Appliances; Outdoor Products; and Floor-care Products and Light Appliances.

With 100 years experience in manufacturing, the company's tradition, strength and competence are in production. It is however ever expanding and developing its core business through innovation and acquisition. Within the company, there is a slow and progressive move from this manufacturing competence towards being market-led and customer-driven. This is reflected in the 'semantic' shift from defining the product lines as Hot, Wet and Cold, to 'Foodcare, Clothescare, etc.

### 3.2 The Integrated Product Development Process (IPDP)

All activities within the company follow the Integrated Product Development Process (IPDP), "a market-orientated process that integrates all concerned functions on the product and feature development process" (Electrolux, 1997b, p.5). IPDP involve all business functions and actors in a development process aiming to maximise the use of resources while providing greater value to the customer in terms of: quality; innovation; precision and efficiency.

IPDP is conceptually owned by the IPDP steering committee, but operationally is the responsibility of business areas and brand/company managers. Major projects (those with a high level of complexity) are ordered by a project owner, but require a full-time project manager and the designation of a project team who manage and drive the project. Their responsibilities are to source and appoint the correct skills and staffing and the hands-on management to ensure projects are successfully complete. The stages of IPDP are illustrated in figure 3.1.

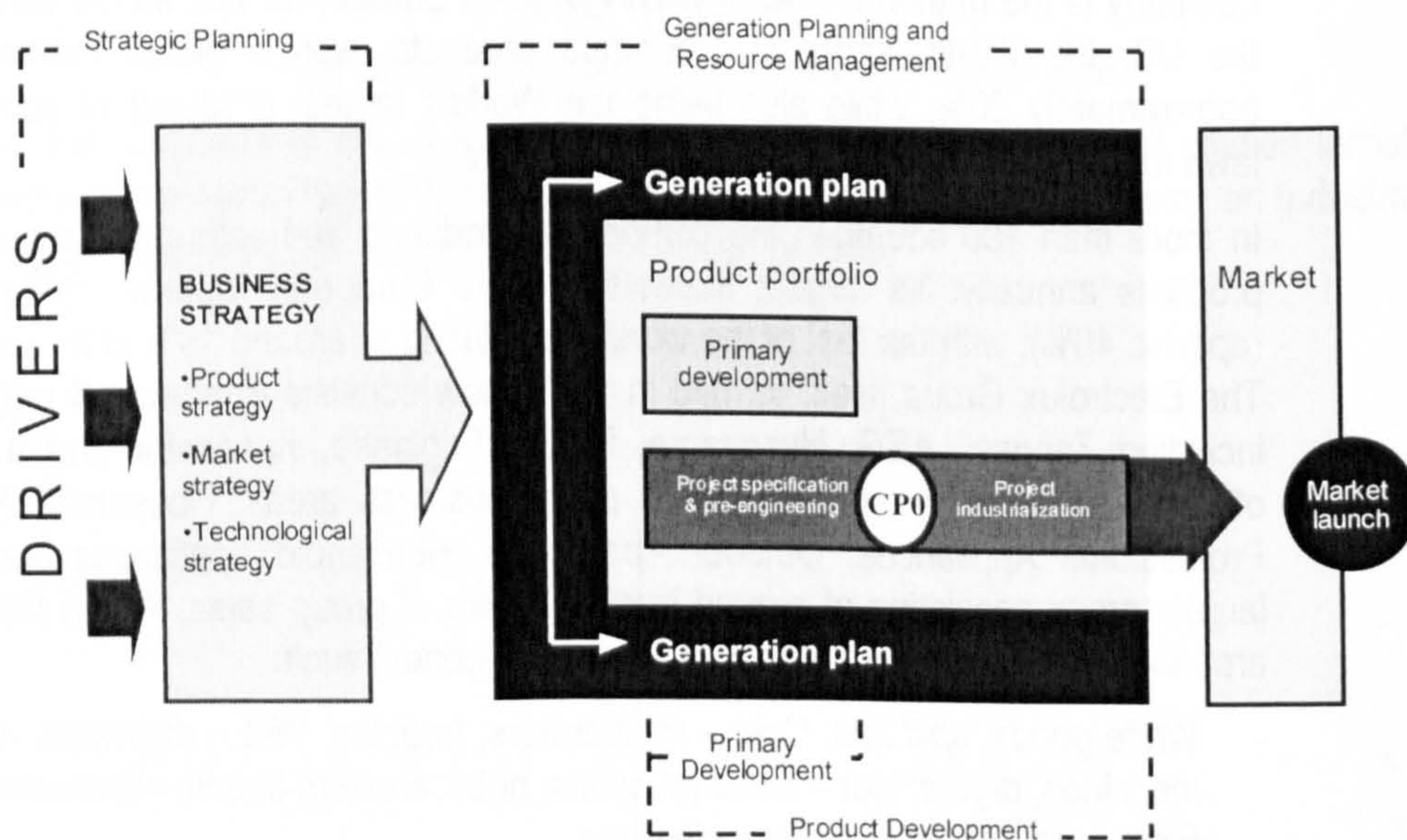


Figure 3.1: The Integrated Product Development Process (IPDP) (Electrolux, 2000)

IPDP is split into 4 sections, which are introduced and summarised below: Strategic Planning; Generation Planning and Resource Management; Primary Development; and Product Development.



## Strategic Planning

This ensures the company works on the correct projects and helps guide corporate developmental directions. As the title suggests this is a strategic activities, including considerations and review of the business drivers such as the Electrolux group statements, customer needs and reviews of the business environment to formulate Business, Product and Market and Technological Strategies. Further responsibilities are to review and amend the strategic planning process as and when needed.

## Generation Planning and Resource Management

This aims to ensure projects fit strategic objectives, are financially attractive and have available resources. It also outlines the business strategy and illustrates the need for new products generations and families. These activities result in the Product Portfolio.

### **3.2.1 Primary and Product Development within IPDP**

Primary Development and Product Development fit into this Product Portfolio (defined at more senior levels) and are the more operational phases of IPDP. Both processes are organised via a series of checkpoints (gate-reviews) aimed to review the project at various stages. At each of these IPDP phases, checkpoints are completed to ensure various product development criteria have been fulfilled and that the project can move to the next stages. The most important checkpoint is CP0, where projects pass through to the industrialisation (production) stages of product development, and where the highest cost, time and risk are committed. At CP0 decisions are made as to whether the project should continue, change or end. Considerable efforts and resources are allocated to product development before these stages, described as the 'front-loading' where design changes and further developments can take place with a minimum of cost and disruption (Electrolux, 1997b). It is these early stages highlighted as of critical importance to reducing the environmental impacts, and equating to the 'pre-specification' or the 'early' design stages (McAloon, 1998; Simon et al., 1998, see section 2.7.2), and also the product planning stages (van Nes and Cramer, 1997; Bakker, 1995) of product development.

### **3.2.2 Primary Development**

Primary Development is the systematic testing of new technologies, marketing concepts and production methods for the creation of new or next generation products, and business. The aims are to test and explore topics and subject areas with 'a high degree of uncertainty'. Often these cannot and should not directly pass into product development, product ranges or market launches. Primary development represents all the different business functions: primary marketing, primary engineering and primary design and covers the following areas:



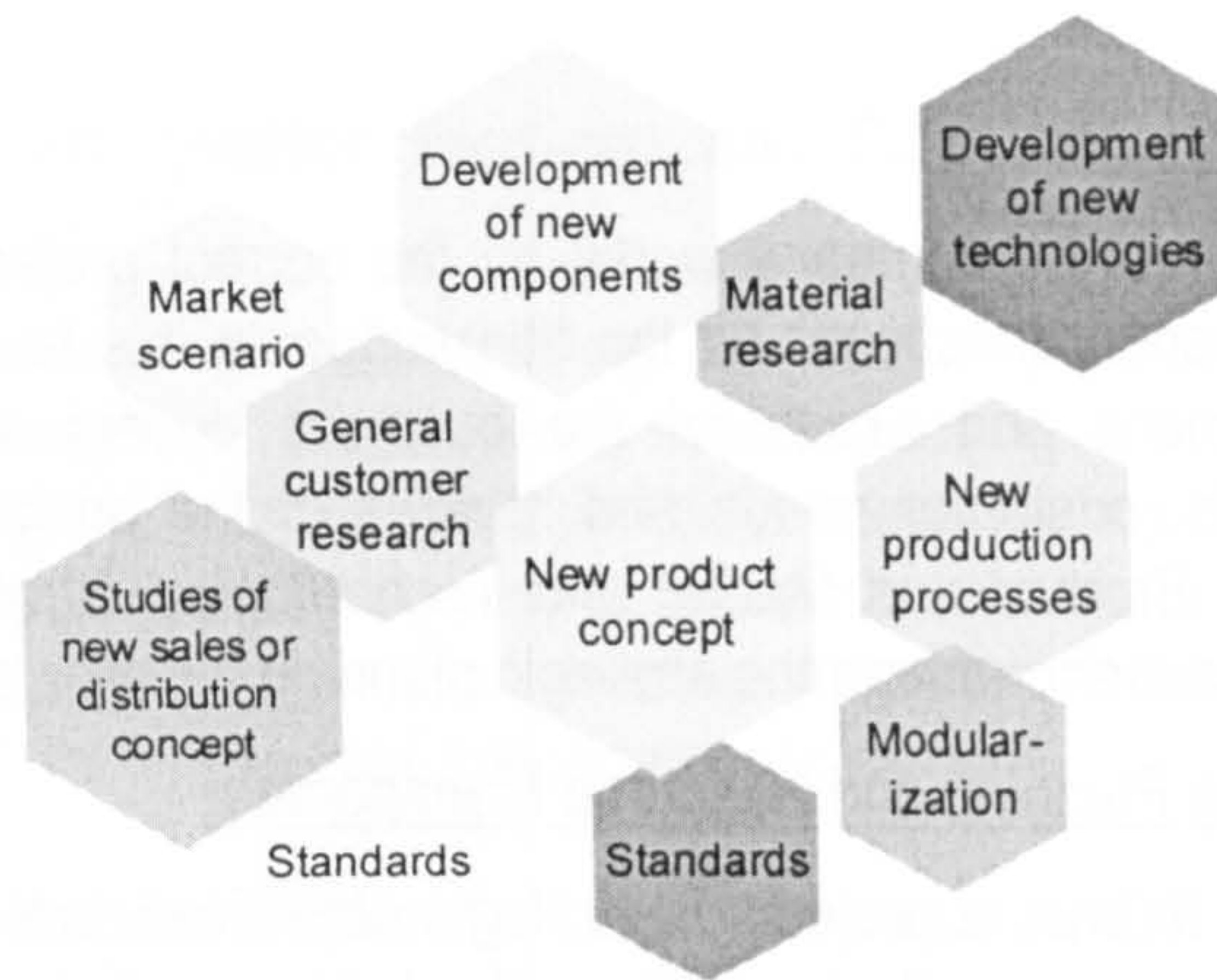


Figure 3.2: Examples of areas of Primary Development (Electrolux, 1997b)

The selection criteria for Primary Development projects are: that the projects should support the business strategy; should be innovative; should add value; and have a clear market message. The results of Primary Development are stored in the Primary Development bank. The transition of Primary to Product Development is not automatic or guaranteed, but consists of two key transitional phases: pre-engineering – which helps adapt primary concepts, products or technologies to greater product development suitability; and also the transfer of knowledge and ownership. These processes take place between PCP1 of Primary Development and CP0 of Product Development (see figures 3.3 and 3.4). In reality the filtration of primary design results into product development is more informal, as Primary Designs are described as ‘flipping-down!’ into product design and development:

*“...ultimately there is no formal process for primary into core... It’s more of a social process.... We talk. We see somebody and say, ‘Hey, come and look at this!’ Here’s a new idea, etc. It’s an informal process. It’s not particularly structured. If it was, it would be wrong!”*

Primary Development also consists of generic stages distinguished by checkpoints described in figure 3.2. The pre-study (Checkpoint PP1) checks and defines the fit of primary development projects to the Generation Plan and into the Project Portfolio, while also allocates resources and time. The resultant stages of Primary Development consist of: Creation of Ideas (idea generation or concept design); Solution and Verification (concept selection, embodiment design); Hardware and Solution (detail design and prototype).

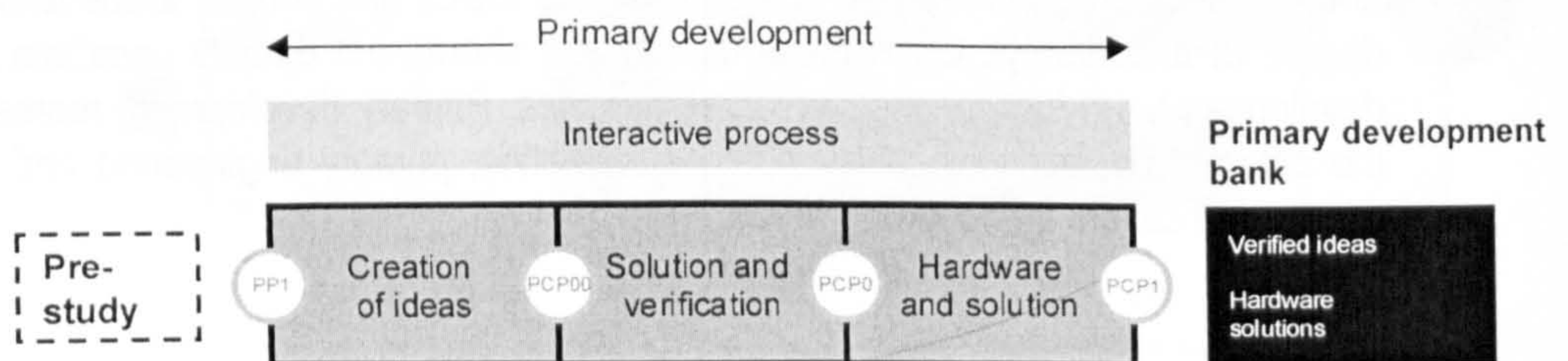


Figure 3.3: The Primary development Process (Electrolux, 1997b)

### 3.2.3 Product Development

Product Development encompasses the development phases from specifying and designing a product concept, through to its production and launch to the market. Essentially Product Development consists of three overall phases: project specification



and pre-engineering; project industrialisation; and production phase. These three phases consist of a number of individual stages and checkpoints as illustrated in figure 3.3:

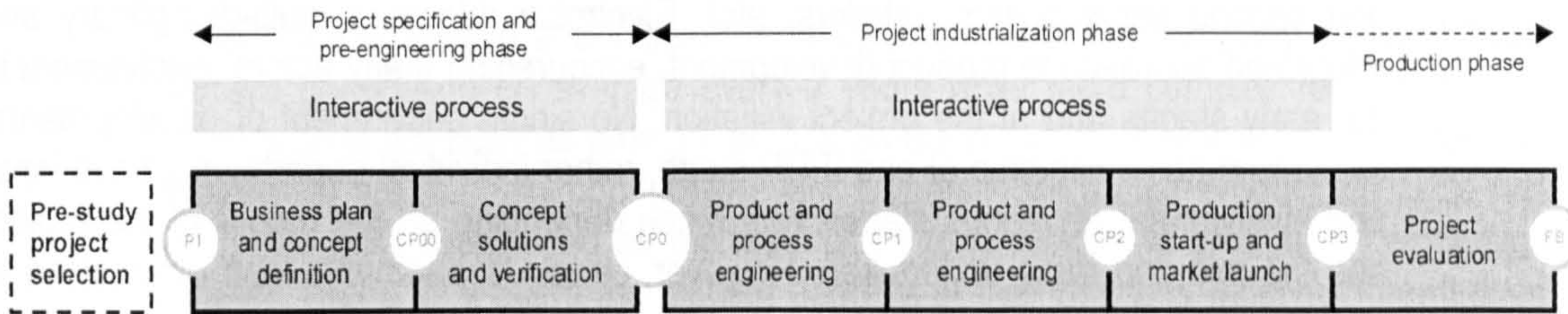


Figure 3.4: The Product Development Process (Electrolux, 1997b)

A more thorough breakdown of the activities undertaken within each of these IPDP stages is represented in the figure 3.5.

PROJECT SPECIFICATION AND PRE-ENGINEERING				PROJECT INDUSTRIALIZATION		
P1	CP00	CP0	CP1	CP2	CP3	FB
Product Development Pre-Study	Business Plan and Concept Definition	Concept Solutions and Verification	Product and Process Engineering	Process Verification	Production Start-Up and Market Launch	Project Evaluation
Market message Target formulation Project organisation proposal Idea about time plan and budget	Market message-refined Target formulation updated Competitor analysis Product concept definition Design verification Test plan Project organisation Project plan Check patent situation	Market message-final Target formulation Results from market data Final product concept Industrialisation plan Environmental analysis Manufacturability Design for variation Design verification results FMEA-safety analysis Functional prototype Key suppliers selected Investment request Project plan	Market launch plan-first preliminary Instruction book draft Industrial system-detailed planning Testing and design verification Authority approval plan Fully representative functional prototype Agreement with key suppliers	Market launch plan and sales material Installation of production equipment First training of production team Instruction book Status and test results from prototype tested Field test preparation and start	Final preparation for market launch Production process finalisation for production Printed instruction book Service instructions Spare parts plan Follow-up plan Follow-up of pilot series Authority approvals obtained Follow-up of field test	Summary of feedback from market Follow-up of production target Preparation for production ramp-up.

Figure 3.4: Product Development phases and checkpoints (Electrolux, 1997c)

The Project Specification and Pre-Engineering phases, up to CP0 are aimed at reducing uncertainty and to evaluate and analyse target market, consumers and sales message. Primary development and design work is considered and included here also. The resulting Business Plan and Concept Definition (CP00) is the first product specification from a marketing perspective. Here a decision is made about whether to proceed or not, made at a senior level by the project manager and project team.

After this decision in the Concept Solutions and Verification phase, various analyses (including market, manufacturability and environmental) are conducted and at this stage, the product design and production system are specified and a functional prototype is constructed. Here an investment request is submitted, and the project proceeds (is revised or halted) into the Project Industrialisation phase. The purpose of the Project Industrialisation phase is to create a finished product, production processes and prepare for launch to market. This includes product and process engineering, process verification, then the subsequent production start-up and market launch. The final phase is the production phase (Checkpoint FB) and consists of the product evaluation and market feedback. In many ways this model strongly resembles models of the design and product development process reviewed and introduced in section 2.5. Here P1 and CP00 could be described as task clarification (Figure 2.14), CP0 is



concept design, CP1 and CP2 are the detail stages of product development. CP3 and FB are the production and market launch stages.

Product Development may involve many business functions and organisations (first and second tier suppliers, retailers, etc). Electrolux adopts a multi-disciplinary and integrated approach to product development, encouraging many actors' involvement in the early stages and at the project initiation. No single department or developmental specialism has ownership of one IPDP stage, rather individual departments have input and involvement at various stages very much depending on the nature of the project and the role and tasks undertaken. However, certain departments lend themselves to specific stages and it is recognised that a particular department such as Industrial Design, might conduct certain types of generic design activities in which they would be specialists. The survey by McAloone (1998) indicates the specific responsibilities in Product Development were understood (by Design Engineers) as follows: Styling - Industrial Design; Performance requirements -marketing; Technology development - development department at HQ

### 3.3 Product design within IPDP

Product design within Electrolux is conducted by two departments: Industrial Design and Design Engineering in very much the ways described in section 2.6. The job of these two departments is to transfer market information and requirements into product, concepts and details, and by liaising with production and manufacturing, to ensure that these are easily produced, cost effective and attractive. Though both are located towards the middle of the product development process and both do 'product' design, they conduct different types of design activities.

Larson (1997) highlights the difference between the Industrial Design and Design Engineering disciplines within her study of ecodesign integration in Electrolux. Figure 3.5 proposes Industrial Design as the more market-orientated design department dealing extensively the 'product software' and being people-centred. In contrast, Design Engineering is the technology-orientated design discipline dealing more with the product hardware.

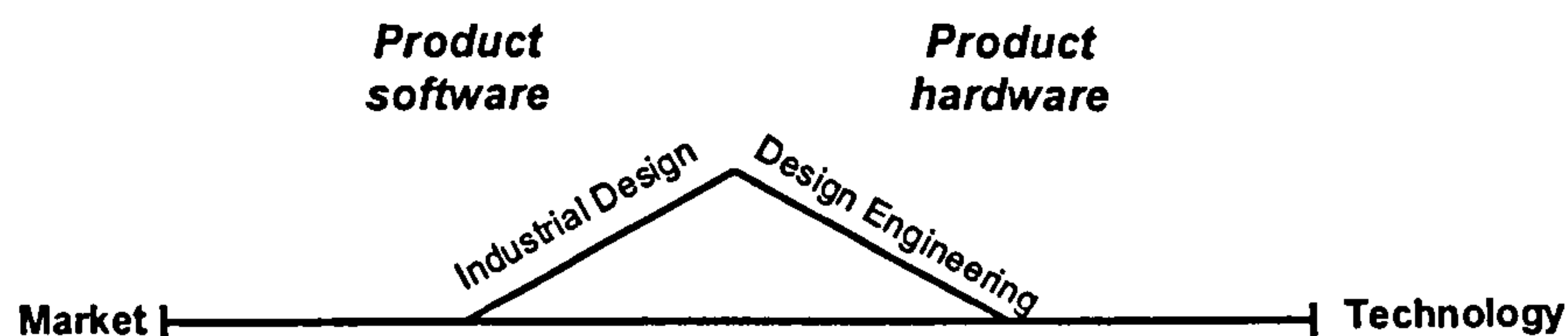


Figure 3.5: The role of the departments in product development (Larson, 1997)

She also states:

*"Industrial designers could be described as part of a bridge between the market and technology, staying closer to the market mooring, while their counterparts, design engineers, have a greater interface with the more technical and production aspects ...." (p.9)*

There is integration between these departments across projects helped by the introduction of IPDP (McAloone, 1998), however they remain quite separate in identity and personnel. Industrial Design Centres for example do not employ anyone with an



engineering background. The major departmental gap in Product Development highlighted by (McAloone, 1998) are between marketing and the two design functions.

### 3.3.1 Project initiation

Projects are organised and initiated regularly intervals in the company. Product 'face-lifts' are undertaken on average every 2 years while more complex redesigns (new platform projects) such as next generation products (which may involve new products or features) are normally conducted every 5 years. This 5 year product life cycle has previously been recognised as the ideal place to redesign the product for ecodesign (Larson, 1997), as it offers the highest degrees of freedom. It is widely acknowledged that projects are led by Marketing, with the requirements and specifications set at these stages by the marketing department (McAloone, 1998). Within the product design stages, it is generally Design Engineering that drive the projects (Larson, 1997).

## 3.4 Industrial Design within Electrolux

With some 100 designers working across the product spectrum, Electrolux Industrial Design has centres located in: Stockholm, Nuremberg, Pordonne, Spennymoor, Cuitiba and Anderson. The Industrial Design Centres work mostly with Household Products (Consumer Durables) and the two offices with which this study had most contact – Stockholm and Spennymoor – are part of the European Household Products business area. Their design remit consists of white goods (washing machines, cookers, dishwashers, fridge's/freezers), floorcare and home comfort and some small appliances. Traditionally, the Industrial Design Centres were located within the specific brands and company's, but now work across these brand categories.

The department consists of two design disciplines – Industrial and Graphic Designers – whom undertake a variety of design tasks. These are split broadly into 3 types: Primary Design, Core Design and Continuous Improvement (Lofthouse et al., 1999, Lofthouse, 1999).

Description	Design criteria
<i>Primary Design</i>	Innovation driven – concept based, looking towards the future
<i>Core Design</i>	Present day projects – continuation of families of products
<i>Continuous Improvement</i>	Improving parts of existing products

Figure 3.6: Description of approaches to Industrial Design (Lofthouse, 1999)

As an internal service within the company, the type and nature of the projects are mostly decided and defined elsewhere. The distinctions between the 3 types of design approaches are not so clear as above and there is much overlap, with a 7 scale ranking of project complexity from continuous improvement to core design. A grade 1 project for instance might demand a single designer and few person-hours, whereas a grade 7 core project could involve a design team and greater time and complexity. The characteristics and design criteria of each of these design activities may also be quite different. Primary Design may have high levels of design freedom, whereas continuous improvement projects however have much smaller degrees of freedom and may include design issues such as the improvement in certain parts for manufacturability, durability or assembly. This might also be 'face-lifts' to an existing product to help boost



flagging sales more commonly associated with Industrial Design as 'styling', and be more a visual update with little conceptual input (Sherwin and Evans, 2000).

Designers themselves, conduct a whole range of design activities depending on skills and experience with the exception of the Concept Design team, who focus entirely on Primary Development projects. However, Continuous Improvement and Core Design is "where 90% of industrial designers within this organisation are.... in the doors, handles of a new fridge..., you want a different colour?" Whatever the type of design activity or project undertaken, the design department has a universal design philosophy of 'Total Design', consisting of four guiding design principle - Physical, Emotional, Viable, and Responsible.

### 3.4.1 Industrial Design within IPDP

McAloone's (1998) survey within IPDP though related to the floorcare division, does illustrate the different function's responsibilities as described by engineering designers and is especially relevant for Industrial Design. Within figure 3.7, a '√' represents where the IPDP task is related to a function/department in the company literature, while a 'x' marks where respondents thought responsibility lay. From this, we can see that Industrial Design has chief responsibility for "the overall look and feel of the product and also in ensuring that the concept design is suitable and successful." (p.55). This is confirmed and expanded by Larson (1997), who adds two further subjects, that of usability (ergonomics, pleasurability and semantics) as well as branding identity. All comments are chiefly product, appearance or use related for industrial designers.

Design Decisions  
In your opinion, who has a role in each of the topics below?

Decisions	Production planning	Marketing	Design manager	Project leader	Engineering design	Industrial design	Purchasing	Testing	Quality
Quality targets	xxxx	xxx			x	x	√		√xxxx
New ideas	√xxxx	√xxx	√x	√x	√x	√xx			
Material types		√xxxx	√		√x	√xxx	xxx		√
Colour		√xxxx			√	√xxx	x		
Packaging		√xxx			√xxxx	√xxxx	x		
Styling		x			√	√xxxx			
Ergonomics	xx				xx	√xxxx			
Final shape		x			√xx	√xxxx			
Weight	xxx				√xxx	√xxx			
Efficiency vs power	√xxx	√xx			√xxx				
Capacity	√xxx	√x			√xxx				
Level of technology	√xxxx	√xxx							
Filter life	√xxx	√			xxx			xxx	xx
Input & suction	√	x			√xxx				
Power	√xxxx	√xx			√xxx				
Production requirements			√xxx	x	√xxxx				
Tooling			xxx		√xxxx	√xx			
Life-time	√xxxx	√xxxx						√	√x
Serviceability	√xx				xxx	√xx		√	√x
Recyclability	√xx				√xxxx	√x			√
Environmental decisions	√xxx	√			√xxxx	√x			√x

Figure 3.7: Matrix used to gather opinions from Company A's designers (McAloone, 1998)

Industrial Design is involved in specific phases of the product development process. Both McAloone (1998) and Larson (1997) describe the involvement as being from P1 to CP1, and from P1 to CP2 respectively (see sections 3.2.4 and 3.2.5). The phases and tasks (as described by Larson, 1997) in which industrial design is involved are summarised below:



IPDP phases	Larson's description
P1	*Participate in brainstorming
CP00	None
CP0	Receive technical and market brief, loose set of requirements, sometimes as simple as reduce costs, keep same performance. Make up to 10 product suggestions in sketch form, then make models of several and create graphics, present one of more product suggestion, create product information manual for design team.
CP1	Adapt the selected product to market changes, process requirements, make detailed drawings and new models.
CP2	Work closely with design engineer, visit factory to inspect product prototypes.
CP3	See product through market launch, monitor success of product.
FB	None

Figure 3.8: Industrial Design within IPDP (Larson, 1997)

McAloone (1998) described a similar process drawing more on the visual aspects, and adding an extra criterion towards the project completion (specification fulfilment). Clearly within IPDP, industrial designers greatest involvement are towards the earlier concept design stages, but stop towards the project specification highlighted as of great importance for innovative and successful ecodesign. However as Larson (1998) points out, "*occasionally industrial designers are involved in phase*" (prior to CP0), but states, "*this is not always the case, in many cases industrial designers do not join the team until phase 2 (post CP0), after requirements are set and technical and marketing concept are decided upon.*" (p.13-15). She also concludes that a strong manufacturing competence (as is the case here) tends to stifle the uses of industrial designers also.

### 3.4.2 Concept Design

The four strong Concept Design team has the specific responsibility for Primary Development activities across the whole of European Consumer Product Business Area. This small, but dynamic team undertakes the types of activities described earlier (section 3.2.4) for Industrial Design, and defines itself as:

*"..a global, strategic team within the Electrolux group. The mission of the team is to focus on enhanced living, combining design and knowledge of the customers needs as future users. The team generates user process driven concept proposals and marketing messages, which creates innovative and unique product solutions for the future."* (Electrolux, 2000)

These are the more consumer orientated design criteria and when involved in Concept Design projects, "*you are interpreting and acting on the consumers behalf inside the company, to make sure that the business has met their needs and to ensure that their needs are met*". This falls very much in line with Larson's (1998, figure 3.5) description and others of Industrial Design.

As a design team, Concept Design has a number of critical characteristics. It is exploratory and experimental, and undertakes design projects with a high level of risk, creativity and design freedom, which often result in entirely new product concepts. It undertakes consumer and life style driven activity, and in many ways the team is the Industrial Design interface with both marketing and the market. It is less about design details such as of cost, manufacturability or quality and has high degrees of freedom. Concept Design, fitting into Primary Development is also the earliest possible Industrial Design activities likely to be undertaken in any formal way (actually being pre-product development). This also connects it closely to (and suggests it has great potential for)



areas such as product planning and strategic design highlighted as of such critical importance for successful and innovative ecodesign.

### **3.4.3 Industrial Design Culture**

Within the Industrial Design department there is a particular type of design culture, which is important to understand in this enquiry. The Industrial Design department is heavily involved in the activities of design, which are recognised as hands-on, and labour (rather than knowledge) intensive. As one designers puts it: "*We design!.... We are interested in design and glossy models.. That's what we do!*" (02.09.98). Designers sketch, draw, work at computers and make models, and needs to be seen to do this, to be 'doing' design. The performance measurement for design is in fact quantity of output (in terms of projects completed, rather than products developed), rather than quality of work or contribution. There is little time, patience or interest in reflection or research within this culture. The language of Industrial Design is very much designing and the design projects. New subjects and topics are usually explored (in Concept Design) through design projects and very little is valued unless it is transferable to design or relevant to design projects in some way.

This is of particularly relevant for a new topic such as ecodesign, where there are unlikely to be quick or immediate answers. The inability of researchers to provide definitive answers to complex environmental questions is potentially demotivating to designers, particularly in this atmosphere. The design project and activity of 'designing' is perhaps the best way to engage industrial designers.

## **3.5 Electrolux and the Environment**

Electrolux is recognised as a world leader in the design, production and market introduction of environmentally conscious products. Its transition to environmental protection and responsibility is acknowledged as the concerns related to the Hole in the Ozone layer and the strong connection made to CFC use. "*The worldwide media attention on the CFC issue caused Electrolux's top management to consider environmental issues a potentially strategic imperative*" (Shopley, 1997). Catching the company initially unawares as a major user of CFC's, it decided to adopt a more proactive stance on environmental issues encouraging them not only to work to current and impending legal developments but in some instances exceed them, setting precedents and standards for others. The company now embraces and utilises the strong connections between 'economy and ecology' and most initiatives are customer driven using concepts such as life cycle costing and resource efficiency to focus on customer needs and value, rather than on legislative compliance.

### **3.5.1 Environmental Drivers**

Environmental strategy and the resultant management system are shapes by three overriding factors, widely recognised as the key drivers for the greening of business in general (McAloone, 1998):

- *Regulations:* such as increasing legislative framework
- *Market awareness and demand:* such as the rise of the green consumer and current expectancies for market acceptance of eco-products



- *Resource and cost efficiency*: the simple equation that 'economy = ecology' and that 'green' business is good business.

There are also various global trends acknowledged as of critical importance in helping shape corporate environmental goals such as: growing populations; economies and resource use. These drivers led to an environmental management approach consisting of Visions, Policy and Strategy

### **3.5.2 Vision**

Environmental Vision sets out the basic framework of the system and the values on which it is based and contains the basic principles of environmental stewardship and citizenship. This recognises environmental limits as well as stating environmental responsibility, "*will be a continuous component of our operations, as well as the hallmark of our daily work.*" (Electrolux, 1998, p.8 )

### **3.5.3 Policy**

The Environmental Policy contains seven principles around which the company operates, which include: Responsibility; Precaution; the Total Approach; Preparedness; Priorities; Market leadership; and Profitability. Implementation of the environmental policy is decentralised and responsibility placed in the hands of each business group manager. Each business group has a senior environmental co-ordinator, directly accountable to the CEO. The Environmental Affairs department is responsible for the development and implementation of the policy as well as of tools, methods and guidelines for more operational environmental activities.

### **3.5.4 Strategy**

The environmental strategy consists of two simple criteria. Electrolux will:

- Lead the development of environmentally sound products and processes
- Work to encourage demand for environmentally sound products

## **3.6 Electrolux and product design**

The company adopts an incremental, step by step approach to the integration of environmentally issues into product design and development. Consideration of and incorporation of the latest and best environmentally sound technologies into products drive this. The 'total' or life cycle perspective is used, considering all phases of the product life. This is a holistic perspective, in which all business functions are required to work towards environmental targets and overall excellence. Particularly promoted in design, are materials selected and specified as well as the construction of products. As the greatest environmental impact of Electrolux product's (80%) comes from the use phase of the life cycle, the company strives for ways to improve resource efficiency, such as refrigerators using less energy, or washing machines with less water and energy, etc (Electrolux, 1998, Electrolux, 1997a).

The company uses a three level approach to ecodesign within product design and development, described as (Shopley, 1997):

- *Continual improvement and fine tuning existing technologies and materials*: eg. energy, water and exhaust reduction



- *Introduction of new technologies to improve existing products:* e.g. using catalytic converters with chain-saws, direct water sprays in washing machines, and vacuum insulation panels in fridge's.
- *The development of new product concepts, resulting in the most significant improvement in the longer term:* e.g. a solar-powered lawn mower, aqua-cleaning that replaces perchloroethane used in dry cleaning water-based biodegradable detergents.

This 'step by step' approach results in 'one off', innovative product concepts or product improvement projects. Product development therefore is based on an understanding of the life cycle impacts of a product, upon which new product ideas, and technologies or opportunities for the improvement of existing projects are based. This is illustrated along with some specific examples in figure 3.9.

Step-by-Step improvements			New technology			New concepts		
								Solar-powered Lawnmower
							Aquaclean by Wascafor	
						Electrical gardening equipment		
					Catalytic technology			
				Rack-type dishwashers				
			Absorption refrigerators					
		Washing machines using 40 litres of water						
	Low-energy refrigerators							
Dishwashers using 15 litres of water								

Figure 3.9: Three level approach to Ecodesign (Shopley, 1997)

### 3.6.1 Ecodesign initiative and information

Various ecodesign information initiatives have been undertaken by Environmental Affairs within the company previously. An Electrolux Environmental Handbook was produced for each product line (Hot, Wet and Cold) within the European Household Products business area. This consisted of Life Cycle information on various products, as well as materials more preferable to specify and those to avoid. A comprehensive survey of European Hot Products (the Euro Oven project) was also conducted to benchmark best and better practice. However product design related environmental information is usually generic, to the two product design functions rather than specific to Industrial Design. The total or lifecycle approach assumes the same approach and information is relevant to product design generally. No distinction is made (or perhaps understood) between the provision of ecodesign information, principles and practice for industrial designers or design engineers.

Ecodesign related product information is supplied to consumer via a number of differing media, such as handbooks, booklets, at the retail outlet, or the Internet. It is also clear that market interventions are seen as created through this information provision rather than design.

### 3.7 Ecodesign within Industrial Design

Ecodesign in the Industrial Design Centres is not especially well developed. The literature previously indicated that it was highly unlikely for this or any other design



department to have well-developed ecodesign programme, projects or design processes. Most literature discusses design generically, assuming all product design is the same. Where Industrial Design is referred to it is in new and other contexts outside of the corporate (Margolin, 1998a; Margolin, 1996; Walker, 2000; Walker, 1998). In short the industrial design – ecodesign relationship is little understood.

Within the department however, there had been some ecodesign activities previously. These had included:

- The development of an ecodesign management programme
- A few concept projects with strong environmental emphasis (though not being explicitly ecodesign projects)

These help give an interesting illustration of industrial designer's approach to ecodesign and are discussed in the following sections.

### **3.7.1 Managing Ecodesign in Industrial design**

Prior to this study, the department had commissioned a study entitled 'Managing Ecodesign' conducted by an independent researcher/consultant (Larson, 1997). The aim of this study was to develop and implement a management system to help integrate ecodesign into all Electrolux Industrial Design Centres and design activities. The study contains a number of interesting recommendations and conclusions for this thesis and for ecodesign more generally. The study recommended 'remanufacturing' (product take-back) as the best environmental strategy for Electrolux and that Industrial Design would play a significant role within this, especially with (re)branding of secondary use products. The main outcome are summarised below:

- The new Ecodesign Management System should be part of the Environmental Management System.
- Concept design is the strategic location of ecodesign, being located within the Product Portfolio. IPDP is the operational home
- Appoint ecodesign champions to implement ecodesign in each office. These individuals should be motivated, interested and good communicators
- A training programme should be developed, consisting of lectures and seminars of key ecodesign concepts
- The environmental communication channels should be improved
- Set specific ecodesign targets for projects (e.g 15% toxic material reduction, etc)
- To motivate designers set incentives such as competitions and awards schemes for ecodesign projects

The resultant ecodesign training and management plan though under the umbrella of the Environmental Management System should be specific, not generic. Larson highlighted that tools and methods for Design Engineering (those most commonly developed) and generic design tools were not transferable to Industrial Design. She notes: *In order to optimise the practical role it is vital that the term 'product designers' be separated into engineering and design and the task allocated clearly. (p.72).*

Though Larson's program was well structured and insightful, it was not especially well received and only some of it implemented. The feeling within the department was that its style and outcome were not especially suited to Industrial Design, which tends to be



managed in an informal 'ad hoc' way. Several recommendations were implemented within the department, including a training programme and the appointment of individuals with responsibility for ecodesign in each design office. The initiatives however were not always successful.

#### 3.7.1.1 Ecodesign Seminars and Training

Following the 'Managing Ecodesign' study, a member of Environmental Affairs with responsibility for developing design guidelines (hazardous materials database, life cycle studies for all EHP product categories – hot, wet, cold products), visited Industrial Design Centres to introduce concepts of ecodesign and various life cycle based studies and information. However much of the information was not seen as relevant and rarely used.

#### 3.7.1.2 Ecodesign Co-ordinators

The department also appointed ecodesign responsibility to co-ordinators located in each office. After an initially enthusiastic start from these individuals, and the development of a simple set of ecodesign principles and guidelines, to be distributed and followed by practising designers at each design centre, this initiative lost momentum, and individuals interest:

In many ways, the Managing Ecodesign study conducted within Industrial Design did ecodesign and research in general' more harm than good, as the department became disillusioned with both. The Environmental Design Co-ordinator at the time described the document as 'impenetrable'; stated that it took two weeks to condensed it into six usable pages for the department. General the reports' relevance was questioned and the department failed to see how the conclusions were transferable to design and designing. In many ways it failed by its own standards, in highlighting ecodesign management practice and language unsuitable for Industrial Design, it then made the same mistakes in its own recommendations, conclusions and linguistic style. Any ecodesign research work conducted after this or as a result of this had very much to work within these parameters.

#### 3.7.1.3 The context of ecodesign

This was the context and view of ecodesign in February 1998, which was the commencement of this research. Within the department, designers and management remain motivated and committed, and were still interested in 'doing' ecodesign. There was clearly a gap between the management systems and the practice of ecodesign left from the Managing Ecodesign program. Designers wanted ecodesign tools and methods that 'generate' ecodesign innovation, rather than evaluate or assess it ('pre' rather than 'post' ecodesign tools).

*"We have plenty of checklists which say.. have you done this, did you do this.., did you consider this? And if course designers go along and tick them all. But they are of no use! We need things for the beginning of the design process, not things for after, to do things reflectively. We need to consider this stuff at the start of designing rather than after we've designed the thing!"*

Along with this there was also senior management commitment to ecodesign, as the President of Industrial Design "stated, he wants to be photographed next to the best-in-class environmental cooker in the world!", encouraging the department to focus on tangible product outcomes.



### 3.8 Some projects and examples of Electrolux Products

This section lists some recent examples of design, product development and innovative projects undertaken by the company. This aims to give an idea of the nature of innovation and ecodesign within the company. Whilst illustrating organisational innovations, these also aim to indicate the types of projects and activities in which industrial designers might or might not participate.

#### 3.8.1 Some Strategic Innovation project within Electrolux

The two projects below are examples of major organisational wide innovations and the development of new product concepts, new technological applications or business areas:

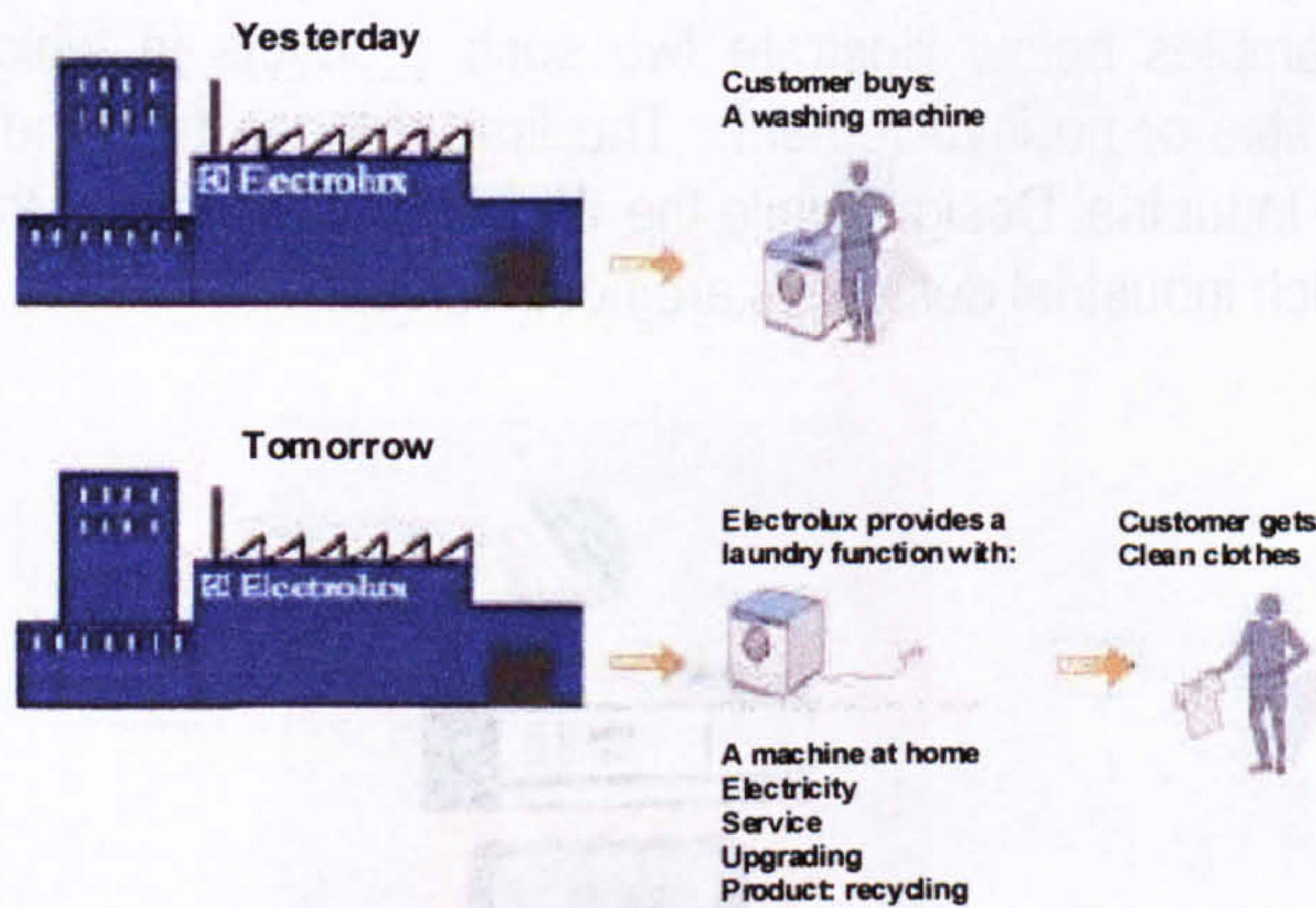


Figure 3.10: The Functional Sales concept



Figure 3.11: The Screenfridge

The Functional Sales project (Fig. 3.10) piloted in Gotland aims to explore the concept of selling service instead of products (see Design for Service, section 2.10.5). Here the company leases washing machines to households whom then pay per wash (per unit of service), rather than paying an initial fee. All costs are included (water, electricity, detergent) within this single payment and the price is communicated to consumers via displays on the products, aimed to give consumers a truer reflection of the real life cycle costs. Though not initiated as an ecodesign project, there are clear environmental implications. By providing a service rather than a product, the company can manage and optimise the total service delivery, such as water, electricity, detergent, etc. This also disconnects profit from a single sales, and means that the company increases its profit by delivering the service more efficiently rather than selling more and using more resources

Like the Functional Sales project, the 'Screen Fridge' project (figure 3.11) was not initiated as an ecodesign project but has some environmental implications. The 'Screen Fridge' is an information interface displayed on the façade of the fridge and allows internet access to order food for home delivery, etc, and download useful advise or food information. This product is more an illustration of new technological innovation and applications of information technology but also has potential environmental benefits. The information revolution is promoted as offering potential for 'dematerialization' or dramatic reduction in material and resource use. Similarly home shopping is proposed as a means of optimising delivery procedures, where companies



deliver to many houses or neighbourhoods at one time, thus reducing individual travel, car and petrol use.

### 3.8.2 **Internal Environmental activities**

A number of internal information based tools have been developed for used on the company Intranet. These have various aims and applications, including environmental information sharing, training or awareness raising, and also contain databases of for examples materials to select or processes to specify in product design and development. Examples of these include the ENVA database, the Eco Know How tool and the Hazardous Materials database.

### 3.8.3 **General ecodesign project**

The company undertakes a variety of ecodesign activities and has already a number of 'ecodesigned products. The examples below illustrate two such products in which industrial designers would have little or no involvement. The first of these uses new technologies outside the remit of Industrial Design, while the WE66MP comes from the professional product range in which industrial designers are not involved.



Figure 3.12: ER9199B



Figure 3.13: Wascators WE66MP

An average combined refrigerator/freezer consumes 610 kWh per year. The ER9199B (figure 3.12) uses a frequency controlled compressor and vacuum panel isolation in the door to bring annual electricity consumption down to 219 kWh/year, or 36 percent of the EU average.

The popular washing machine WE66MP (figure 3.13) for shared washing facilities in apartment buildings received license to use the Nordic Eco label the Swan, for its low energy consumption and minimal water consumption, while maintaining high washing and rinsing quality. In addition, 90% of the material weight can be recycled.



### 3.8.3 Informing the Customer

Electrolux's proactive market stance aims to create demand for green products requiring market intervention. This is chiefly done with the provision of information to consumers and stakeholders. The most frequently used method involves either Internet based information tools, such as the EcoEco Saving Guide (figure 3.14) a tool to help consumers assess the impacts (energy, resources or cost) of environmental decisions on local, regional or national environments. Another such tool (the Eco Saving Guide), for use within retail outlets helps consumers calculate and understand the total life cycle costs of purchasing a specific product. Often cheaper initial cost prices hide more expensive running costs over say 10 years. The company also publishes and distributes booklets and leaflets containing environmentally conscious behavioural advice for consumers.

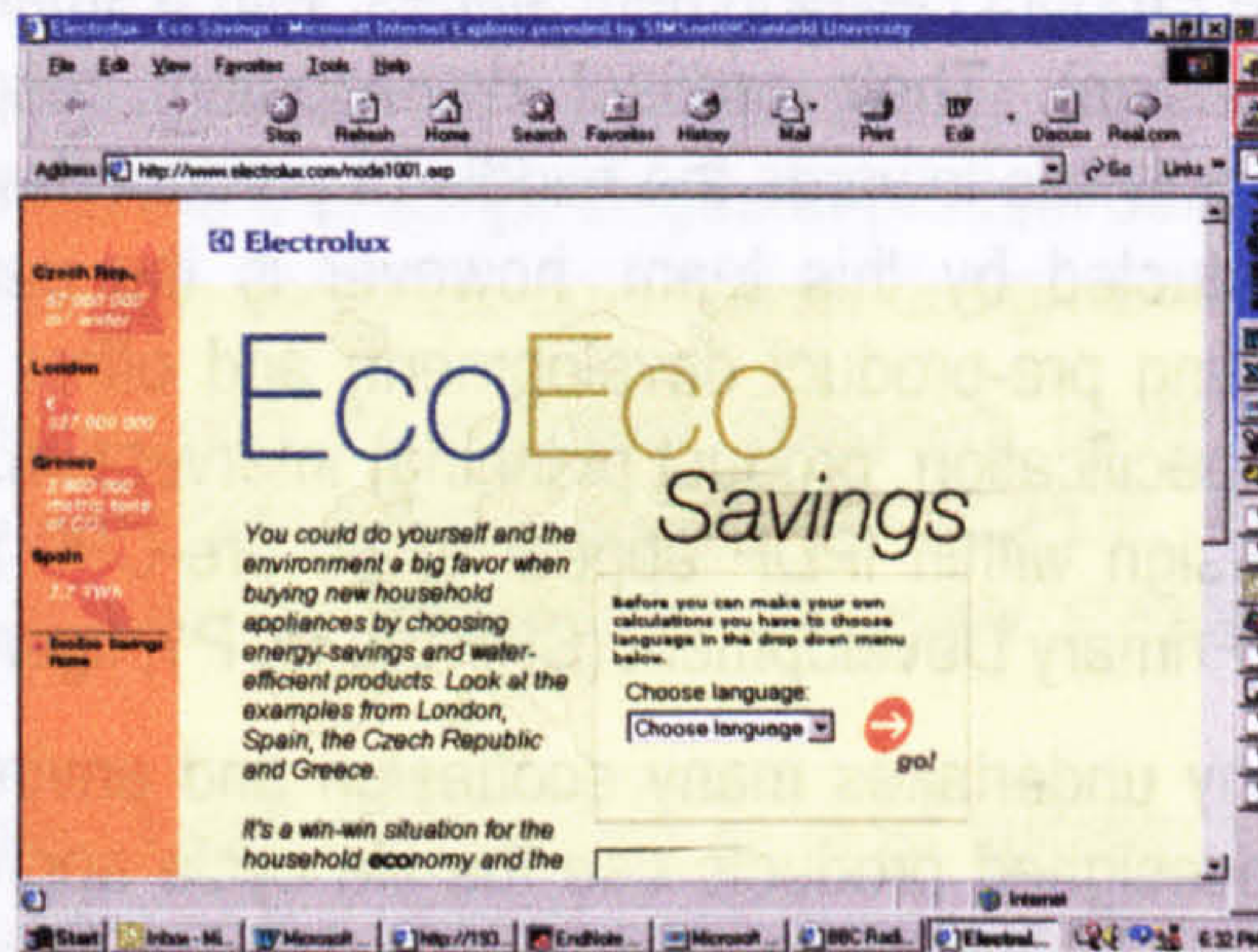


Figure 3.14: EcoEco Savings

### 3.8.4 Industrial Design based Ecodesign projects

Prior to this study, the Industrial Design department had undertaken some projects, which resulted in ecodesigns. These help illustrate the nature of Industrial Design based ecodesign, and are illustrated below:



Figure 3.15: Essential Range washing



Figure 3.16: Lighthouse cooling unit

The Essential Range washing machine (figure 3.15) is placed above the toilet, thus saving space. It is ergonomic and has a water tank that reserves the last rinse for the next wash or to flush the toilet. The project brief was to design a group of free-standing appliances for the first time buyer, with a stylish unique design incorporating simple functions. The criteria were aesthetics, innovation and recyclability.



The 'Lighthouse' project is an idea for cold food storage for the future (figure 3.16). This centrally based product displays the food, so consumers don't waste energy opening doors to view the contents. By having various draw or doorway entries, the fridge does not lose all its cool air when a single door is used. In making the food visible it affords it an icon-like quality.

### **3.9 Conclusions for Electrolux, Industrial Design and Ecodesign**

Electrolux is recognised as leading the way in corporate environmental activities and the design and development of environmentally conscious products. All departments and business functions are challenged to work towards corporate environmental excellence. The company uses the Integrate Product Development Process (IPDP) to design and develop products, involving all business functions. Industrial designers work mostly in the Product Development stages, with a small group in Primary Development (Concept Design). Their product development responsibilities tend to be more operational activities towards the middle of product development. The Concept Design context conducted by this team, however is the earliest type of Industrial Design activities (being pre-product development) and offers the greatest potential for early stage (pre-specification, product planning) intervention. The phases identified for early stage ecodesign within IPDP appear to be pre-CP0 in Product Development (figure 3.4), and in Primary Development (CPP1 to PCP1, figure 3.5) for designers.

The company undertakes many ecodesign and environmentally based activities and existing ecodesigned products use the life cycle approach considering materials and end-of-life issues. Using a step-by-step, incremental approach to ecodesign, the company considers the latest environmentally conscious technologies and integrates these within both improved existing products and also 'one-off' new product concepts. New markets and demand are created and stimulated by providing information to consumers.

The Industrial Design and Design Engineering departments conduct product design, but approach design in different ways. No distinction is made in the ecodesign tools and methods produced for these differing product designers. The tools, information and methods most widely used within the company to date, appear of little use to industrial designers, being of most use to other departments in IPDP. Ecodesign within the company thus far has developed almost entirely without the input of Industrial Design. This latter point is of little surprise due to the immature nature of Industrial Design based ecodesign research and literature. In many ways it is not simply the information, tools and methods that are to blame for this, but the Industrial Design departments profile within the company i.e. the stages of IPDP in which it is involved.

There is clearly a need for specific Industrial Design based ecodesign projects and activities. Little is known of this and research should be exploratory in nature, having a high level of research novelty. The ecodesign within Industrial Design to date is unsystematic and poorly developed, but has great potential. Any future work needs to acknowledge and respect Industrial Design culture, to use their practices and processes and work with and towards their specific needs. Designers and the department remain interested and motivated 'to do' ecodesign, but activities need to



connect more to the activity of designing – must stimulate and facilitate design' rather than evaluate or assess products.

### **3.9.1 Summary**

- Project requirements and specifications are usually set elsewhere than Industrial Design within Product Development.
- Environmental issues are not formally considered in IPDP until CP0.
- Previous ecodesign activities within Industrial Design have been either unsystematic or inappropriate and somewhat unsuccessful.
- In many ways the companies existing ecodesign activities and means of organising product development appears to exclude industrial designers from conducting ecodesign.
- Industrial Design is involved in the more operational, rather than strategic phases of IPDP. Whereas the more strategic stages of product development offer greatest opportunity for ecodesign and great potential for design involvement.
- In many ways the barriers to industrial designers conducting more innovative ecodesign are in organisation and management of IPDP, as designers have little involvement and virtually no influence in the early stages, the design brief or specifications.
- The Industrial Design locations identified as most suitable for ecodesign are post CPO (pre-specification) or in primary development (concept design).
- Many internal and existing ecodesign tools, methods or information are identified as unsuitable for Industrial Design practice. Industrial designers require ecodesign methods that suit their approach to design and their role within IPDP.
- Industrial designers have a number of relevant design skills that offer great potential for more innovative practices of ecodesign. The nature of industrial design (concept based, consumer led) means it offers great potential to conduct the more innovative ecodesign identified earlier. At present it is an under-utilised resource.

Many of these aims and objectives mirror 'state of the art' ecodesign practice as summarised in Chapter 2. This was very seen as an ideal context to locate this research and satisfy the research aims as stated below and also the research questions:

- To explore and describe the integration of ecodesign at the early stages of the design and product development process.

It satisfied the research objectives in being Industrial Design practice, this department being located at the early stage of product design and development and capable of more innovative design practice.



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# THE RESEARCH AND METHODOLOGICAL FRAMEWORK

## Chapter 4

*This section aims to provide an overview of research methodology, then go on to describe the selection process and justification for the methodological framework and methods selected within this enquiry. A basic understanding of certain methodological questions as well as a clear research topic and set of questions or themes is essential for successful research and PhD completion.*

### 4.1 What is Research?

A Ph.D is a research degree. Archer describes research as, “*systematic enquiry, the goal of which is knowledge*” (cited in Cross, 2000, p.46), whereas Saunders et al (1997) suggest that “*people undertake research in order to find things out in a systematic way, thereby increasing their knowledge*”. In relation to a Ph.D, Philips and Pugh (1987) state that it “*...is primarily a training exercise to get you from being a mere beginner in research to the level of a full professional*” (p.46). To do this the researcher must conduct research in a rigorous and systematic way and make an ‘original contribution’ to knowledge. The key to this systematic enquiry is the research methodology, which is applied to a new topic where or in ways that it has not been applied before. Methodology is the ‘science of finding out’ (Robson, 1993), giving directions, purpose and method to an enquiry. Before describing the research and methodological frameworks to this study, the aims and objectives as well as the key research questions will be reiterated.

### 4.2 Research Aims and Objectives

This enquiry aims to contribute to ecodesign epistemology its theory and practice. It is an empirical enquiry into early stage ecodesign integration, design processes and characteristics of its practice. Its specific aims and objectives are as follows:

#### 4.2.1 Aims

- To explore and describe the integration of ecodesign at the early stages of the design and product development process.

#### 4.2.2 Objectives

- To critically review ecodesign literature and to summarize into “state of the art” theory.
- To identify the characteristics of the early stage ecodesign integration
- To describe the nature of Industrial Design based ecodesign
- To explain how designers conduct innovative ecodesign by building a descriptive model



### **4.2.3 Research Questions**

The key research questions are:

- How does an early stage (industrial) design department integrate ecodesign?
- How do industrial designers conduct (innovative) ecodesign?
- What are the characteristics of Innovative (or early stage) Ecodesign?

### **4.3 Research Paradigms**

The research approach, strategy and methods selected are likely to be informed by philosophical and ontological questions. Particular research strategy and methodology have distinct and historical traditions representing different views among other things the role of theory, the manner in which the research will be conducted, and more broad questions about causality and the nature of reality (Berg, 1989). These differing views are often polarised into the 'positivist' and 'phenomenological' (or hermeneutic) (Saunders et al., 1997).

- The positivist research paradigm is more closely linked to what is traditionally considered 'scientific' research, in that it uses deductive methods to test and validate theory. To do this, clear hypotheses are stated and tested via experiments or empirical data. It is a structured and methodical process in order to enable replication and ensure scientific rigour and validity. The positivist tradition aims to be value-free; is hypothetico-deductive; reductionist; relies on generalisations to develop theory; and also provides cross-sectional analysis and conclusions. The researcher remains objective and distanced from the subject of enquiry (Robson, 1993).
- The phenomenological research paradigm is characterised by a focus on the meaning that research subjects attach to social phenomena (Saunders et al., 1997). An attempt is made by the researcher to understand what is happening and why it happened in this form of research. It has a specific view of reality that involves the subject within the phenomena. The phenomenological approach is more holistic and traditionally viewed as more appropriate to social phenomenon with small samples (Robson, 1993).

The positivist and phenomenological research traditions are informed by particular ontologies. The former sees the world as reducible to its constituent parts or elements for description or explanation. Truth is objective and subject to universal laws and rules. In contrast the phenomenological view is holistic and sees reality as more than the sum of the parts and not reducible. Here reality is subjective and significantly influenced by the view of the observer and by the observation itself. Neither approach is 'better' than the other, but are more or less appropriate to differing aims and enquiries. These research paradigms and ontological questions are likely to underpin both the research design and methodology.

#### **4.3.1 Qualitative or Quantitative Approaches**

Research approaches are often contrasted between the types of data collection and analysis they rely on, either termed qualitative or quantitative (Berg, 1989; Robson, 1993). Qualitative and quantitative research each have very specific characteristics,



procedures and philosophical groundings. The differences in these are summarised in the table below:

Quantitative data	Qualitative data
Based on meanings derived from numbers	Based on meanings expressed through words
Collection results in numerical and standardised data	Collection results in non-standardised data requiring classification into categories
Analysis conducted through the use of diagrams and statistics	Analysis conducted through the use of conceptualisation

Figure 4.1: Distinctions between quantitative and qualitative data. (Saunders et al., 1997)

Qualitative and quantitative data are often (though not exclusively) split between the methods of data analysis used research or the deductive and inductive research approaches.

- The deductive approach develops a theoretical or conceptual framework (usually a hypothesis) and tests and verifies this for its truthfulness against data.
- The inductive approach in contrast explores data and develops theory from this. It does not begin with a predefined theories or framework, though does have research questions or themes.

Others distinguish research types as laboratory based or field (real world) research, where the latter studies social phenomenon in their real or uncontrolled circumstances (Robson, 1993), while in some ways align to the qualitative/quantitative dichotomy.

*In the 'real world' - or the 'field', as the world outside the laboratory is often referred to by psychologists and other behavioural or social scientists - that kind of control is often not feasible, even if it were ethically justifiable. Hence, one of the challenges about carrying out investigations in the 'real world' is in seeking something sensible about a complex, relatively poorly controlled and generally 'messy' situation. (Robson, 1993, p.3)*

There are many misconceptions and assumptions about research which for instance link quantitative data exclusively to the deductive approach, or study social phenomena (such as management or design) using only the phenomenological or qualitative approach. In fact the research strategy and methodology should be selected on its suitability for the enquiry, the research aims and objectives. Robson (1993) also adds more pragmatic reasons for selection, such as the preferences or experiences of the researcher or the tradition or history of the institute in which the research takes place. In summary:

- Qualitative research deals with groups, taxonomies and meaning, looks for patterns and convergence (Saunders et al., 1997) while aiming for diversity and classification (Langrish, 1993). It refers to concepts, definitions, characteristics, using metaphors, symbols and descriptions of things (Berg, 1989).
- Quantitative research deals with populations and causal links (Robson, 1993), aims for underlying principles or laws through simplification (Langrish, 1993). It counts and measures things (Berg, 1989).



### 4.3.2 Designing the Enquiry

Robson (1993) describes three traditional types of research strategy: experiments; case studies and surveys:

- *Experiments*: measure the effects of manipulating one variable on another variable.
- *Survey*: collect information in standardised form from groups of people.
- *Case study*: develop detailed, intensive knowledge about a single 'case', or of a small number of related 'cases'.

He goes on to describe three differing aims of a research enquiry: exploratory, descriptive and explanatory:

- *Exploratory* research deals with the novel and new and aims to find out or identify what is happening
- *Descriptive* research aims to portray an accurate description of events, etc
- *Explanatory* research explains events, situation or problems usually through causal links

The relationship and further characteristics of these research strategies and their aims are summarised in figure 4.2. The applications and relationships of these research strategies and the types the distinctions are not rigid, as Yin (1989) points out that for examples, case studies can be used for exploratory, descriptive or explanatory purposes.

	<i>Assumed to be:</i>	<i>Questions</i>	<i>Requires control?</i>	<i>Focus on current events?</i>
<b>Exploratory</b> <ul style="list-style-type: none"> <li>• To find out what is happening</li> <li>• To seek new insights</li> <li>• To ask questions</li> <li>• To assess phenomena in a new light</li> <li>• Usually, but not necessarily, qualitative</li> </ul>	Experiments	How why	Yes	Yes
<b>Descriptive</b> <ul style="list-style-type: none"> <li>• To portray an accurate profile of persons, events or situations</li> <li>• Requires intensive previous knowledge of the situation, etc. to gather information</li> <li>• May be qualitative and/or quantitative</li> </ul>	Survey	Who what Where How many How much	No	Yes
<b>Explanatory</b> <ul style="list-style-type: none"> <li>• Seeks an explanation of a situation or problem, usually in the form of causal relationships</li> <li>• May be qualitative and /or quantitative</li> </ul>	Case study	How why	no	Usually but not necessarily

Figure 4.2: Summary of research classifications and strategies (Robson, 1993)

### 4.4 Design Research

This research aims to contribute to the theoretical field of ecodesign, and in doing so is in the design research and to some extent the design management tradition. As such it is important to acknowledge the history and development of design research throughout the 20<sup>th</sup> Century. Section 2.4.3 introduced design methodology (also known as design research). Here the 'state-of the art' design research and methodology is expanded to clarify the research domain into which this thesis fits.

Cross (2000) states that "*our concern in design research has to be the development, articulation and communication of design knowledge.*" (p.46), or domain specific knowledge. He and others (Krippendorf, 1998; Glanville, 1998) have also made



repeated calls for a design research community, helping not only to study design in a scholarly manner, but also build its profile and promote its uses and applications. Attempts to define a coherent design research community over the last 40 years remain largely unsuccessful however.

*There have been continuous efforts, particularly among design educators, to rigorously ground design in a body of domain knowledge that they believe will insure its social acceptance as a serious endeavor. However, there has been no agreement as to what this knowledge consists of. (Margolin, 1998, p.1)*

Within the literature this lack of consensus can, to some extent be explained by the differing definitions and ways of understanding design elicited in section 2.4.?. Here two differing design paradigms described there as the 'positivist' and the 'constructivist' approaches (Dorst and Dijkhuis, 1995). In many ways these opposing views of design are similar to the two research paradigms, in that the 'positivist' design tradition assumes design is a rational, logical process that is reducible to various mathematical steps and universally prescribed. The 'constructivist' paradigm in contrast sees design from a more holistic view, which is specific and personal to the subject and task, described as a reflective conversation between the two. This process, though increasingly open to description, has unique 'designerly' characteristics (Cross, 1999, Cross, 1995) and is unlikely to be successfully prescribed.

Such views of design – especially those of design science – have led to a particular types of design research which very much 'borrows' research traditions and methods from either the natural sciences, social sciences or the arts and humanities. For example, Cross (1992, 1997) summarises research methods that are of most use for research into design thinking, including: interviews with designers; observations and case studies; protocol studies; reflection and theorising; simulation trials. Margolin (1998b) calls for an increasing use of 'History, Theory and Criticism' in the development of a design research community, very much in the Arts and Humanities tradition.

Whilst dismissing the scientific method and its systems of procedure and validity as a model for design research, Dilnot (1998) sheds light on its possible nature. He feels that science and social science traditions are both inappropriate to design in that fundamentally both are about describing certainties, or laws (even prescription is a form of description of the future). Design on the other hand deals more with the 'possible' than the certain. As a discipline it is distinct by the absence of universal rules and laws, especially in that it aims to change (shape and determine) the future. There can be numerous solutions thus no universal laws or description. He goes on to propose design as the science of the 'possible' or of the imaginary solution.

It is not the intention of this thesis to resolve such design research dilemma's merely to highlight them and acknowledge the uncertainty that this brings to any design enquiry. Owen summarises this discussion well:

*"Design is not science, and it is not art - or any other discipline. It has its own purposes, values, measures and procedures....., those who seek to work more rigorously look to scientific and scholarly models for guidance, and we find references to 'design science' and examples of 'design research' that would seem to fit more appropriately in other fields." (Owen, 1998, p.10)*

Design research remains at best, in its infancy, at worst resigned to eternal immaturity. Despite numerous calls, the discipline has been unable to develop its own unique



research culture and methodological toolbox. For this reason and in the absence of other, more appropriate methods unique to design, the researcher like many others before will also borrow methods from other research traditions.

#### 4.4.1 The Domains of Design Research

Though design research remains poorly developed, there has been some headway. Various authors have proposed frameworks for the nature and purpose of design research. Cross (2000) distinguishes three domains for design research as 'people, products or processes'. These he expands as:

- Design epistemology – study of design knowledge (people)
- Design praxiology – study of the practices and processes of design (processes)
- Design phenomenology – study of the form and configuration of artefacts (products)

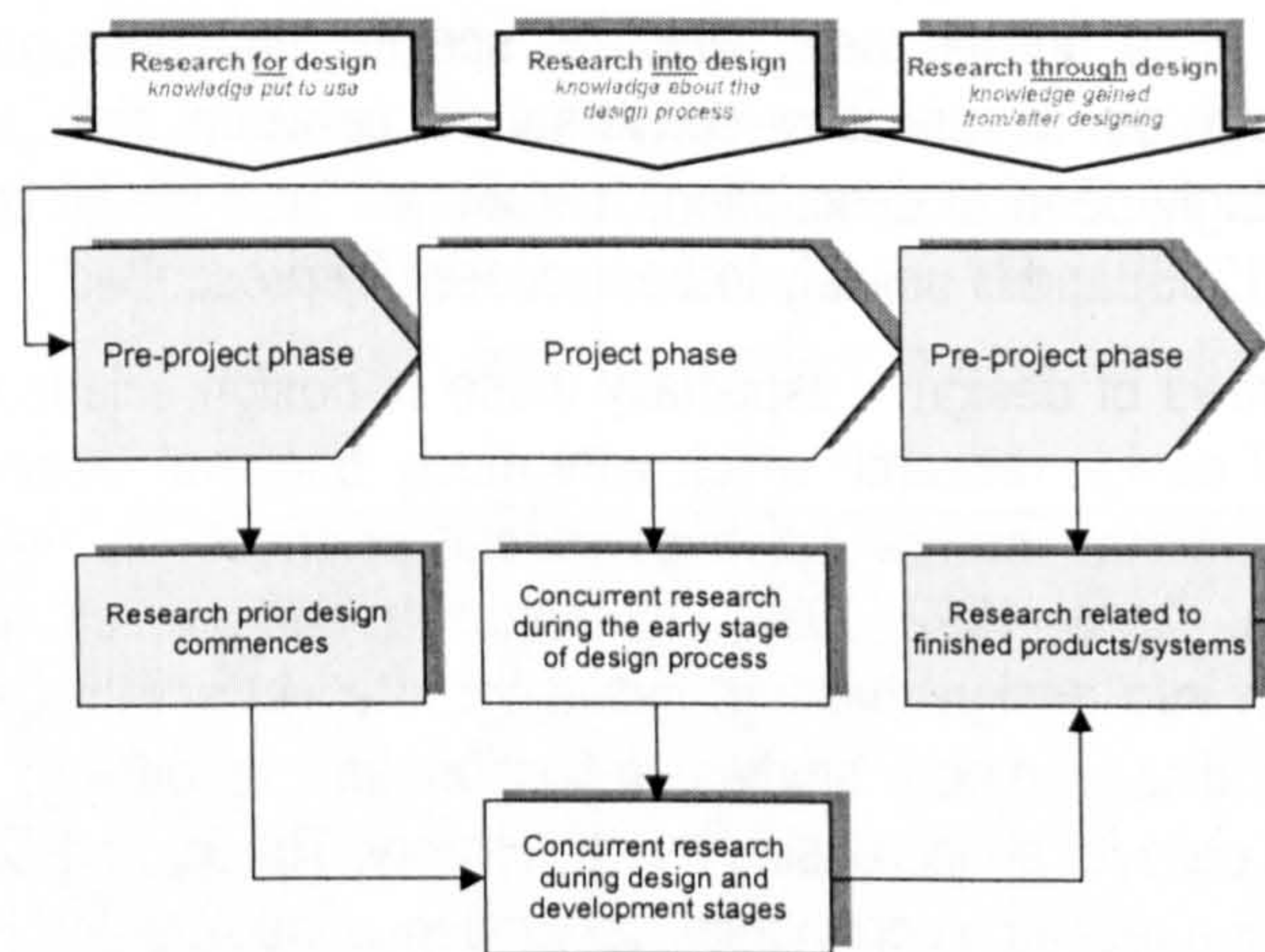


Figure 4.3: Research and its relation to project phases (Popovic, 2000, with Frayling, 1993/4 and Woolley, 1998 added)

Others relate design research more closely to schematic representations of the design process. Frayling (1993/4) has famously proposed a typology of research for art and design (as research for, into and through design) which Woolley (1998) expands. A similar model of design research comes from Popovic (2000), though she adds a fourth design research area to the above three. This latter model with the distinctions of Frayling and Woolley added, is summarised in figure 4.3

This model of the design research domains link clearly to the design and product development process (figure 2.14). In the above diagram: Research for Design connects to task clarification (input, information and direction into design). Research into Design links clearly to the design process itself – the actual processes of designing and development (concept, embodiment and detail design, plus those other subsequent stages of product development). Research through Design is the post design phases of research (including evaluation or studies of use or the artefacts social or economic context). Popovic (2000) terms these pre-design, design and post-design phases, and adds an extra research stage as research carried out 'concurrently' with design.



This research deals with the first two of these design research domains: the pre-project phase or research for design (inputs into ecodesign); and the project phase of research into design (the processes and practice of innovative ecodesign).

## 4.5 The Research Design

This section describes the selection of the research strategy and the development of the research design and methodology for this enquiry. To do this it will describe the methodological and research development together as it is difficult to separate the two, as is traditionally the case with phenomenological research.

This enquiry began with the original aims:

- To explore and describe the integration of ecodesign at the early stages of the design and product development process.

The literature review conducted during the first period, as well as familiarising the researcher with the subject in question also highlighted, not only knowledge gaps, but also gaps in practice. There were few examples or research into Industrial Design based ecodesign or the more innovative practices of ecodesign and little of an empirical or systematic nature. Those projects and research that do, tend to focus more on the results or outcomes rather than design processes or integration. In short they focus on the outcomes or the need for innovative ecodesign rather than how you do it, or what happens when you do. This lack of empirical work highlighted a need to focus on the practices and processes of designing and for this research to be initially exploratory then move to more descriptive phases. A pilot study would bridge the gap between the literature review and a more substantive and descriptive phase of the main study.

### Description of research development

Due to this lack of examples, such Innovative Ecodesign research would have to be initiated and undertaken by the researcher. Such research therefore would have a high degree of novelty and be initially exploratory, thus a single case study was selected as suitable for the depth and intense level of involvement required for such an enquiry. Case study methodology has a tradition of successful application in design research (see for example Design Studies, Vol. 14, No. 4. Special case study issue). The limited number of examples of more innovative ecodesign, suggested an action research approach with the researcher involved as a change agent, to initiate and facilitate the kinds of processes and initiatives required for this research.

#### 4.5.1 Case study methodology

Yin (1989) describes a case study as: *"an empirical enquiry that investigates a contemporary phenomenon within its real-life context when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used"* (p.23). Case study methodology has the potential to provide rich data and deep insight into social phenomena, and are most commonly associated with descriptive and explanatory research (Robson, 1993). The key benefits of the case study are that they contribute uniquely to our knowledge of individuals, organisations or social phenomena whilst also retaining the holistic and meaningful characteristics of real-life events (Gummesson, 1991). The benefits of case studies is their inherent



flexibility and ability to adapt to changes in the research design due to changes in circumstances, whilst still maintaining its overall focus.

*“Very few case studies will end up exactly as planned. Inevitably minor if not major changes will have to be made, ranging from the need to identify a new ‘case’ for study, to the need to pursue an unexpected lead. The investigator must remember the original purpose of the investigation, but then must be willing to change procedures or plans if unanticipated events occur. (Yin, 1998. p.64)*

This flexibility was seen as of critical importance for this research as there is uncertain outcomes when dealing directly with the social world, especially design. A further characteristic of case study research is its reliance on multi-methods or multiple sources of evidence. Robson (1993) and Yin (1989) promote the use of different sources, methods, investigators or theories to add validity and credibility.

Gummesson (1991) describes two types of case studies: those that derive general theory from multiple cases; or those seeking to arrive at specific conclusions for a single case because they are of particular interest. Yin (1989) however splits these again into four types of case study:

	Single case design	Multiple-case design
<i>Holistic – single unit of analysis</i>	Type 1 Single-case (holistic)	Type 3 Multiple-case (holistic)
<i>Embedded – multiple units of analysis</i>	Type 2 Single-case (embedded)	Types 4 Multiple-cases (embedded)

Figure 4.4: Types of case study (Yin, 1989)

Multiple cases have the advantage of increasing the generalisability of results. Single case studies on the other hand are often criticised for this limitation though offers the potential for rich and deep insight into the social or organisational phenomena under enquiry. Single cases can be either holistic, where the researcher retains a critical overview of the subject as a whole) or embedded (where the researcher analyses individual units). The former gains a comprehensive insight at a more operational level providing more detailed analysis, while the latter provides detail while enabling the focus on the specific and not losing sight of the original goals.

Langrish (1993) describes a variety of ways of selecting the cases:

- *The comparative*: where a few cases are selected for comparison.
- *The representative*: based on vague notions of statistical validity.
- *The best practice*: if the idea is to improve practice, it makes sense to select examples of ‘best’.
- *The one next door*: where selection of examples is limited by practical reasons.
- *The ‘cor’ look at that*: where unusual cases are selected.
- *The taxonomic*: the subgroups of the case being investigated.

Yin (1989) describes three reasons to select a single case: the critical case – when used to test a well formulated theory only once; extreme or unique cases where phenomenon or case studies is rare; revelatory case – when the investigator has an opportunity to observe and analyse a phenomenon inaccessible to scientific investigation previously. As will be described in later sections a single case was selected here due to its novel and revelatory nature and that, such an in depth and



comprehensive enquiry had the potential to provide empirical insight into entirely novel ecodesign phenomenon.

#### 4.5.1.1 Limitations of case study

Criticisms of case study as research method tend to centre on the validity and the generalisability of the results. Case studies are generalisable to theoretical propositions and not to populations. In this sense they do not represent a sample rather the goal is to expand and generalise theory (analytical generalisations) rather than enumerate frequencies (statistical generalisations). Yin (1989) notes that case studies and qualitative research in general are often viewed as mushy and soft, bad research whereas numerically based quantitative research is 'good'. Qualitative research and case studies especially are seen as 'making up the results', rather than conducting rigorous research in the science tradition.

*"In the philosophy of science, the idea that science consists of attempts to prove hypotheses is as dead as a dodo.... If you have an idea and then try to find out what is wrong with it, there is then scope for improvement. If you have an idea, conjecture or hypothesis and then try and show how good and idea it is, you are left with the same idea which can be a bit boring" (Langrish, 1993, p.362)*

The idea of 'good or 'bad' research does not relate to specific strategies of methods, rather to the systematic manner in which they are conducted. The former criticism will be resolved by the aims of this study being to generate new ecodesign theory rather than universal truths (laws) for ecodesign, while the latter is resolved by conducting the research in a systematic and rigorous manner.

#### 4.5.1.2 The role of theory

A major discussion point is the role and use of theory with case studies. Langrish (1993) suggests the biological paradigm for case study use in design research. He promotes their use not as a means of testing specific hypotheses (the scientific tradition, but of little importance to design) rather that research should develop classes and clarification. Indeed the role of theory development within case studies is to develop theory from literature and use this to test conclusions from, as a form of data analysis rather than research design. The researcher generalises to broader, descriptive theory, not create theory from findings, thus theory is generated rather than verified (Miles and Huberman, 1984).

Key research objectives within this study are the processes of Innovative Ecodesign conducted by industrial designers. The most widely used and recently developed method for this is Protocol Analysis. This research technique studies design practice in a controlled laboratory-type, constructed experiment. Designers are often filmed or observed, and asked to verbalise their thought processes and experiences.

Protocol analysis was not seen as suitable for this empirical enquiry into ecodesign processes as the participants were unwilling to participate in such a 'false' design experiment. An artificially created design project also fails to give insight into the company aspects of this research, whereas involvement in a 'live' project has much greater potential for more 'real' insight to occur. Protocol analysis also has other methodological laws for the study of design, highlighted by others (Pereira, 2000).

#### 4.5.2 **Research Context**



In February 1998, the researcher and institute in which this study was based, made initial contact with the single case in question, initiated by the company itself. Senior management pressure now required the Industrial Design department to integrate and conduct ecodesign. The department contacted Cranfield University whom had previous experiences in ecodesign and with the case in question, offering the opportunity for 'real world' involvement in ecodesign, and insight into its integration into the department from the earliest possible stages. Industrial designers also satisfied the research requirements of being located the early design stages of product development, while also having some level of involvement in more radical innovation, satisfying the research aims and requirements.

The research identified a pilot project seen as a suitable topic for the research in question. The aims of this pilot project (described in the following chapter) were to build suitable relationships with company and especially an Industrial (or early stage) Design departments for further enquiry. This led to the selection of single case study and action research as a strategy and methodology. Cranfield has a tradition and expertise in both single case studies and action research.

#### 4.5.2.1 A note on the single case selection

Case studies often select cases of best practice, using highly recognised or acclaimed examples (such as environmental award winners as is the case with the Open University, Smith et al., 1996), or financially successful examples (see Roy, 1997). The case selected here could not be described as 'best' practice in the same way as designs had yet to be produced. For this reason the novelty of the research subject, the relatively young stages of integration within the department as well as the opportunity for in depth access to reality were seen as reasons enough to treat this single case as suitable for study. It therefore represents Langrish's notion of the 'Cor, look at that case!' and Yin's description of the revelatory or highly novel individual case and this case represents new or novel, rather than best practice. As well as these elements of research novelty there was an element of opportunism within the single case study selection.

#### 4.5.3 **Data collection techniques**

Among the benefits of case studies are in allowing and in fact requiring multiple data sources and collection techniques. Multiple sources of data has the added advantage of helping triangulate data via source, type, time while also being flexible.

Various authors describe a variety of data collection techniques or methods of use for real-world research and or relevance to case studies (Robson, 1993; Yin, 1989). These include: literature reviews; observation (in an active or passive role); experiments; documentation; forums/workshops; questionnaires; and interviews. Along with these Robson (1993) highlights two further methods of use to case studies in the real world context, these being action research and ethnography

Yin (1989) promotes a number of data collection sources specific to case studies, including:

- Documentation – letters, emails, memo's design drawings or sketches.
- Archives – formal documents, reports, websites
- Interviews



- Open-ended – insight, opinions
- Focused - more clear, formal and focussed
- Structured interviews – formal survey, like a questionnaire
- Observation
  - Direct – formal or casual
  - Participant observation – where the observer is not merely a passive observer
- Physical artefacts – *“artefacts may be collected or observed as part of a field visit and have been used extensively in anthropological research” (p.94)*

Within this case study: archives; documentation such as reports, letters, memo's, emails and notes from telephone calls; participant- observation via several focus groups and workshops; semi-structured interviews; as well as artefacts in the form of new design concepts were used as sources of data.

#### 4.5.4 Action Research

Action research (or science as it also known) is a specific form of research dealing with change and intervention. In sharp contrast to many scientific traditions, action research involves the researcher within the change or improvement process. Its key benefits are in that *“the role of change agent created substantial opportunities for access and that it might open up useful research possibilities” (Gummesson, 1991, p.47)*. Action research was selected as the most appropriate (though not only) method for use within this single case, for a number of reasons.

- The first of these was the element of control it affords the researcher regarding the topic, of particular relevance in that little work is undertaken within this area, and had to be initiated by the researcher himself. In many ways the work within the company and the resultant research would not have taken place without these interventions also.
- The second of these is in that perhaps only an action research method was suitable for the 'culture of designing within Industrial Design Centres at Electrolux (section 3.4.3). There is little interest or benefits attached to research, thus the consultant role as a change agent is more likely to be appealing and taken up.

Involvement in process of change and implementation makes action research controversial among some research communities and subject to questions of objectivity and validity (though widely used in management practice). Gummesson (1991) also describes three factors critical to the success of action research:

- Access – to empirical data and information;
- Preunderstanding and understanding – of the organisations and/or cultures; quality – substantiating the findings,
- Rigor- reporting and presenting lines of reasoning and conclusions.

Action research has many benefits and characteristics, including that the researcher and organisation learning together. It requires co-operation and feedback from both parties, is especially useful in social systems and most successful within the phenomenological research paradigm. Action research involves the dual requirements of solving a problem for the client and also contributing to theory and knowledge.



Both Gummesson (1991) and Robson (1993) link action research to cases, stating that the units of data collection and analysis of the action researcher are cases. Svengren (1993) however offers insight into both the action research and case study methodologies relating to design research. Through her own experiences she relays the benefits and weaknesses of an action research over a case study methodological approach. She notes that action research is a potentially powerful method offering some control over events and potentially deep and rich insights into events in real-time. Most interesting from her own experiences is in highlighting the importance of flexibility in the research methodology as her research changed from case study to action research due to unforeseen circumstances and changes within the company

#### 4.5.4.1 Limitations of action research

There are several potential weaknesses with action research. The arguments against it, tend to focus on the researchers role within the intervention and change process, and the close often blurred connections between action research and consultancy. Action research is also criticised for its lack of objectivity and unbiased observation in the data collection of the researcher, who is effectively within the research. Care and attention has to be taken to ensure, as much as possible impartiality, and an often-clear distinction between the researcher and consultant role. More analytical methods such as case, subject or time triangulation help ensure this also. By working with cases, action research has similar questions as to the generalisability of the findings:

*"Action research can hardly ever be objective, in the strict sense of the word. Moreover... Action research is almost always 'situation-specific.' The term situation-specific reminds us that ..its findings only reliably apply to the place, time, persons and circumstances in which that action took place." (Acher, 1995, cited in Dilnot, 1998)*

This problem of generalisability of action research is resolved by the research aims of generating new descriptive theory, rather than 'truths' universal to a particular population.

#### 4.5.4.2 The Researcher's Role

As highlighted above, though action research was used extensively and as the basis for the main methodology and researchers role, it was not the only one. During differing periods, the researchers role changed from that of the researcher/consultant, to a more passive role of participant-observer, where the researcher was not driving the project but adopted a more peripheral role to which the company would turn for occasional advice and input. A more thorough explanation of this is available in the following sections.

### 4.6 **Research Structure**

As highlighted in chapter 1, this research is split into three stages:

- Phase 1: literature review
- Phase 2: pilot project
- Phase 3: main study

Throughout these, the research moves from the exploratory to the descriptive phases and from exploratory to substantive phases



#### 4.6.1 Phase 1: Literature Review

The literature review aimed to build a comprehensive picture of 'state-of-the-art' ecodesign theory and practice, and to further develop and refine the research themes and questions. This was summarised and described in chapters 2 and 3.

#### 4.6.2 Stage 2: Pilot project

A pilot study aims to familiarise the researcher with the subject area and case in question to initially pursue lines of enquiry and questioning before the main study. Its purpose however is not a pre-study, as its aims are to develop some conceptual clarification also. The enquiry pilot can be much broader than the ultimate study and can help refine and substantiate the focus (Yin, 1989). In this case it was also seen as a means of developing more long-term relationships with the company. The pilot project was identified and used as a means to contact companies of interest to this research. The project selected the 'Eco-Kitchen' project, will be summarised here and described in more detail in Chapter 5.

#### 4.6.3 Phase 3: Main study

In the main study the research moves from the exploratory to the descriptive stages. Following the pilot, further work was commissioned leading to the employment of a further researcher commencing in October 1998. The company sought to continue further innovative ecodesign projects and for this researcher to provide new topics and subjects on which to base these.

The company now had two researchers working on ecodesign with responsibilities split into two clear subject areas:

- *Using ecodesign to innovate*: further innovative ecodesign projects, conducted with the Concept Design team as part of primary design and development. Responsibility lay with this researcher
- *Integrating ecodesign into Integrated Product Development Process (IPDP)*: aiming to integrate ecodesign into the more operational levels of product development at and before CP0 in IPDP (figure 3.4). This was the responsibility of the other researcher.

The distinction between the two researchers was not so clear-cut in practice, allowing the each access to the others area, aiding data collection, triangulation and validity. However, a clear change in the enquiry had occurred here leading to a new and hitherto unexpected research subject and context. Though the focus was still on Industrial Design based ecodesign, the emphasis had shifted from the early stages of product development (before CP0), to pre-product development (primary development). Ecodesign had thus moved from the early stages of product development, to the early stages as primary development and concept design.

##### 4.6.3.1 Change of research design and research questions

The original research enquiry aimed to study and describe the process of ecodesign integration into the early stages of product development. Post-pilot, the emphasis had shifted away from product development to the even earlier stages, which are Primary Development. The enquiry therefore moved from an emphasis on product development



'integration', to that of describing the nature and characteristics of this new Primary Development or Concept Design driven ecodesign, as this new context had a high degree of research novelty. In many ways this new concept-led context was also more suitable to describe the characteristic of Innovative Ecodesign and is described in more detail at the end of the next chapter.

#### **4.6.4 Research Access**

Over the two-year period, the researcher built a trusting and strong relationship within the department, giving unique research access to data and processes of change. The researcher was not only seen in a consultancy capacity, but in many ways as *the* ecodesign consultant. The ecodesign co-ordinators turned to the researcher's experiences and expertise for many forms of ecodesign advice, even when they were not connected to collaborative or financed projects.

However, access was not always completely controlled by the researcher. The informal manner in which design projects are conducted meant that the researcher could not always be present during, observe or participate in key project events. For instance, brainstorming session might take place as and when there is the time and motivation to do them, or when suitable people are available. Similarly the department may contact the researcher as and when a problem or opportunity arose, and it was here that the flexibility of case studies proved their worth. This meant data could be collected reflectively, and even when such events were missed it was vital that a rigid methodological structure does not hinder the research, allowing subjects to be revisited and data collected through interviews and other means. This flexibility was especially true regarding distance and location. Ethnographic methods were not possible so the main contact could only be visited infrequently, due to its location in Northern England (Spennymoor), while the Concept Design team are located in Stockholm, Sweden.

#### **4.6.5 Data sources within the single case**

The main data sources for the pilot was the 'Eco-kitchen' project, also used as a template for subsequent collaborative projects and described in more detail in Chapter 5. The main study was based on data from a number of sources.

The subject of these various projects is of little relevance, rather that they were considered to be and conducted by Concept Design, thus qualifying them as innovative ecodesign. These are conducted in a unique way, which requires some explanation. Concept Design projects tend to be undertaken for exploratory or educational purposes, though fitting into overall Primary Development and Product Portfolio. Concept design projects also have a rather ambiguous notion of completion as they can often commence, but not result in new concepts and still be seen as successful. Often concept projects or topics are picked up elsewhere and projects often 'morph' and merge into others. This makes clear links from beginning to end difficult, whilst also making 'success' rather illusive. Concept Design projects are frequently commissioned to universities or design consultancies to conduct the design and detailing work. The results are seen as useful for educational and explanatory purposes, even when the department does not conduct design itself.

A key factor within Concept design projects undertaken and their level of completion is the financing of project and allocation of 'person-hours'. This became the major



determining factor for this researchers level of involvement within the department. Projects with the funding were undertaken with the researcher in an action research capacity. Those that did not, might be proposed by the researcher, but would either not be undertaken or would only allow the researcher access in a more passive participant-observer role. Both these roles however were invaluable sources of data and further details are listed in the pilot and main study chapters.

## **4.7 Data Analysis**

Qualitative data analysed through the inductive approach has the benefit of generating theory from the data (also known as 'emergent' theory), rather than verifying theory from hypotheses. This makes the resultant theory potentially a much truer reflection of social reality (Miles and Huberman, 1984). Within this study the data was analysed by coded and clustered throughout, in order to build patterns that describe certain characteristics of Innovative Ecodesign and its practice by industrial designers. These were formed initially from the pilot study and early phases, then refined, revised and expanded in the main study.

The absence of any numerical coding system makes qualitative data more difficult to analyse. Whereas quantitative researchers would look for confirmations and numerical certainty, qualitative data analysis looks for patterns, categories and emerging themes (Robson, 1993). This means that theory is built from data, which is used to expand and validate emergent conclusions. The data collection methods used within the main study consisted of: Documentation – such as emails, notes, correspondence, etc; archives – in the form of previous ecodesign material from this and other departments; semi-structured and informal interviews conducted in person or by telephone; artefacts in the form of designs and concepts resulting from the various projects; observation of design projects and processes

### **4.7.1 The coding and clustering procedure**

The coding procedure in qualitative research derives meaning from words (Miles and Huberman, 1984, Robson, 1993), by allocating codes to specific data, then grouping those with similarities. Data was transferred to computer format – interviews transcribed, email transferred, telephone discussion and notes typed up and placed in predefined data format (a sample interview can be seen in Appendix A). Comments were 'coded' using predefined coding systems to sort the data into suitable categories. These were then placed into the clusters identified in the pilot project and throughout corresponding to their meaning. The coding procedure consisted of two stages, which are described then illustrated below:

- *First stage coding*: to locate data into macro cluster.
- *Second stage coding*: to break down data into sub-clusters describing specific properties (or sub-clusters).

#### **4.7.1.2 First stage coding**

Data can be broken down into various units or sizes, most relevant and manageable to the study and the researcher (Berg, 1989). In this case, the first stage coding treated paragraphs, complete answers or comments as a data unit and allocated a macro-code and shown in figure 4.5.



Inno/info/pro	Ecodesign co-ordinator	<i>OK I don't want to send out woolly messages to you, but I think it's a case of its stimulus that helps us. Its pools....! The thing is with designers is that they cover the walls with mood boards, you know that photocopiers down there never stops because we are constantly collecting things. Its not plagiarism, its just information, and its that kind of excitement that's missing. But that means, you may have other people in this workshop that aren't straight designers, like environmentalists who can give another. You see most of the environmental affairs guys come over and have been trained as chemical engineers and business managers and have got into it, they are not environmental design people. And there job is to take environmental issues and the business and link them together and our job is to take the business of the future and do something in between.</i>
	Researcher	<i>Ok that's one of your projects, one of the things you do?</i>
	Ecodesign co-ordinator	<i>OK that's in terms of concept design saying what we'd like to do</i>
Inno	Researcher	<i>It also might be that something comes out of this that you can do right now,. Like future business concepts, that demands no level of technological innovation. There might be a market out there that is prime. That might be the case, but it might not.</i>
Info	Ecodesign co-ordinator	<i>Well its only like, well I'll buy a car, but I'll be a taxi driver and drive that thing to different destinations. But there is no re invention of the car for a taxi.</i>

Figure 4.5: First stage coding procedure

#### 4.7.1.2 Second stage coding

The second-stage coding broke these comments down further into more manageable, illustrative and descriptive sizes, with the appropriate sub-code added.

Info-stim	<i>OK I don't want to send out woolly messages to you, but I think it's a case of its stimulus that helps us. Its pools....!</i>
info-eg/info-vis	<i>The thing is with designers is that they cover the walls with mood boards, you know that photocopiers down there never stops because we are constantly collecting things. Its not plagiarism, its just information, and its that kind of excitement that's missing.</i>
pro-par	<i>But that means, you may have other people in this workshop that aren't straight designers, like environmentalists who can give another.</i>
inno-bus	<i>You see most of the environmental affairs guys come over and have been trained as chemical engineers and business managers and have got into it, they are not environmental design people.</i>
pro-str/pro-bus/pro-pro-end	<i>And there job is to take environmental issues and the business and link them together and our job is to take the business of the future and do something in between.</i>
	<i>Ok that's one of your projects, one of the things you do!</i>
inno-str/pro-fit	<i>OK that's in terms of concept design saying what we'd like to do</i>
pro-bus/inno-str	<i>It also might be that something comes out of this that you can do right now,</i>
pro-bus/inno-str/pro-con	<i>Like future business concepts, that demands no level of technological innovation.</i>
pro-con/inno-con	<i>There might be a market out there that is prime. That might be the case, but it might not.</i>
info-eg/info-sim	<i>Well its only like, well I'll buy a car, but I'll be a taxi driver and drive that thing to different destinations.</i>
pro-app	<i>But there is no re invention of the car for a taxi</i>

Figure 4.6: Second stage coding procedure

#### 4.7.1.3 The final codes

Though the codes were predefined from the pilot to the main study, they also developed throughout collection and analysis. Nearing the research completion however these clusters and properties (or sub-clusters) became more static for the purposes of validation and confirmation (a final sample cluster is available in Appendix B). The final macro clusters and properties are shown below:

- *Info*: dealing with information and stimulus for the design process and industrial designers.
- *Pro*: dealing with data regarding the design processes followed by industrial designers and the characteristics of these types of projects.
- *Inno*: dealing broadly with the nature of the ecodesign innovations undertaken here and by Industrial Design.



INFO	Information and Stimulus Cluster
Info-sim	Simple
Info-vis	Visual
Info-con	Demand-side
Info-app	Transferable and applicable
Info-app-bri	Via the design brief
Info-emp	Empowering
Info-mot	Motivation
Info-mot-inno	Motivation - to innovate
Info-mot-per	Personal motivation
Info-cha	Challenging and stimulating
Info-sub	Substantiated
PRO	Design Process cluster
Pro-con	Consumer orientated
Pro-con-tas	Household tasks
Pro-con-beh	Consumer behaviour
Pro-con-lif	Lifestyle patterns/profiles
Pro-con-nee	Needs, functions, results
Pro-pro	Product orientation
Pro-pro-end	Product as ends/goal
Pro-pro-sys	System thinking/consideration
Pro-pro-hin	Product as hindrance
Pro-bus	New business

Pro-eco	Eco in ecodesign
Pro-eco-neg	Eco as negative
Pro-mod	Use existing models
Pro-goa	Moving the design goal-posts
Pro-man	Eco as a management issue
INNO	Nature of Innovations
Inno-hol	Systems based and holistic
Inno-par	Participatory (links, partnerships, etc)
Inno-expl	Exploratory
Inno-edu	Educational
Inno-exp	Express, communicate
Inno-ide	About ideas
Inno-des	About desirability
Inno-dif	Different/in advance of company
Inno-re	Re-design and re-think
Inno-re-dim	Diminishes towards operational design
Inno-con	Social innovations
Inno-str	Is strategic design
Inno-str-sea	Searching questions
Inno-str-bus	New business

Figure 4.7: Completed coding system

## 4.7.2 Selection criteria

Qualitative data does not rely on numerical frequency to draw conclusions (Robson, 1993). The properties or sub-clusters on which the conclusions were based were developed in such a way as to emerge from the data. These data properties selected and coded using the following selection criteria:

- *Recurrence*: frequently recurring themes, in the form of comments, requests, questions, or design decisions, which were coded and grouped.
- *Importance*: the selection criteria aided and informed by the researchers subject knowledge and the iterative nature of the inductive research process. (Miles and Huberman, 1984)

Various data analysis and concluding techniques are proposed, the most powerful being comparison (Robson, 1993). The researcher must be aware of and avoid bias in drawing conclusions. Glaser and Strauss (1967) refer to the concluding point as 'theoretical saturation', when further data is only proving and validating, rather than expanding a particular finding. Miles and Huberman (1984) suggest a variety of strategies to do draw conclusions, which this study the researchers selected: noting patterns and themes within the data collection and analysis phases – repeated and replicating themes to develop theoretical constructs; clustering – was a fundamental part of the data analysis. The conceptual clusters were also used as core themes within the conclusions; building a logical chain of evidence – involving looking up and down stream to causes and effects; Making metaphors – metaphors, analogies and symbols are a powerful means of relating findings to theory, using the language of inference which helps the reader get the link; as well as making conceptual/theoretical coherence – this involves moving from the clusters and metaphors to the constructs and theory.

## 4.8 Drawing conclusions



The findings and conclusions in the main study are based on research 'emergent' from the data collection and analysis ensuring they are grounded in reality.

*"In discovering theory, one generates conceptual categories or their properties from evidence; then the evidence from which the categories emerged is used to illustrate the concept. The evidence may not necessarily be accurate beyond a doubt, but the concept is undoubtedly a relevant theory abstraction about what is going on in the area studied." (Glaser and Strauss, 1967, p.23 )*

Yin (1989) describes two means of testing and validating qualitative research findings. The first of these uses a descriptive framework predefined from the literature. The second of these tests, confirms and validates research findings against hypotheses or questions that are either emergent from the research or pre-defined, known as 'grounded theory'.

#### **4.8.1 Grounded theory**

In contrast to the deductive analysis approach which begins without a pre-determined set of theories and descriptions, 'grounded theory' sees theory emerge from and be grounded in data and thus reality (Glaser and Strauss, 1967). Grounded theory works on the following set of principles (Saunders et al., 1997):

- Grounded theory is an inductive approach
- Theory emerges from the process of data collection and analysis
- You do not commence such a study with a defined theoretical framework
- You identify relationships between your data and develop questions and hypotheses to test these.

In this enquiry, findings and conclusions are developed using this grounded theory.

#### **4.8.2 Testing and verifying the conclusions**

Miles and Huberman (1984) describe a variety of validation techniques relevant to qualitative data. These help to verify and validate the data analysis and findings, as well in extreme cases providing a further source of data. Those selected within this study were peer-review, informant feedback and alternative explanation building. Testing and validating conclusions – by relating the findings to hypothetical propositions or research questions – will be left to the discussion chapter 7.

#### **4.8.3 Presenting the findings**

Qualitative data has the disadvantage of being difficult to represent and summarise so the reader can follow lines of enquiry. Miles and Huberman (1984) state several strategies for presenting qualitative data suggesting it be presented in a way that sufficiently portrays experiences, whilst allowing the readers judgement to rest on how the researcher concluded. Here, data will be included within each finding for illustrative purposes. These will be either dramatic or especially telling quotes, and may be from differing sources such as presentations, focus groups or interviews to triangulate and increase validity.

#### **4.9 Trustworthiness**

Several techniques are proposed to ensure the trustworthiness of the research and conclusions. Robson (1993) summarises these as:



### **4.9.1 Credibility**

The goal here is to demonstrate the research was carried out in ways that ensure accurate identification and description. Techniques to ensure this are: prolonged involvement, ensuring familiarity and iteration; persistent observation, which brings depth and triangulation; and peer debriefing, or exposure to colleagues and peers. Berg (1989) describes 4 differing types of triangulation:

- Data triangulation: time, space or person
- Investigator triangulation: consists of multiple rather than single observer of the same
- Theory triangulation: using multiple rather than single perspectives to draw conclusions
- Methodological triangulation: within and between methods

The researcher was involvement with the single case over a 2-year period and part of the success of this, identified by both parties was his similar background and familiarity with the subject and the culture of industrial 'designing'. Data collection and analysis methods via time and person, as well as investigator ensure methodological triangulation. As happened here, case studies also rely on multi-methods for their success, particularly when only a single case is involved. Also in many ways, qualitative, inductive research has inherent credibility as results are derived from the data as an on-going process (Miles and Huberman, 1984).

### **4.9.2 Transferability**

Generalisation through single or few cases is not completely necessary (Glaser and Strauss, 1964). Case studies (especially when single) relate findings to new theory, rather than to populations, so have less concern for transferability. Here the onus is on the researcher to make connections between the conclusions and the implications and their broader applications (Robson, 1992; Miles and Huberman, 1984). Transferability is through inference and it is for the researcher to point the reader in these directions. Relating to theoretical fields and propositions does this as a means of validation and verification in the discussion Chapter 7.

### **4.9.3 Dependability**

This is traditionally referred to as reliability and can be overcome through triangulation and by avoiding bias. Triangulation questions are addressed above, however bias is more difficult to avoid as decisions are almost always value laden. Salmon (1992, cited in Fletcher, 1999, p.132) therefore suggests researchers state their biases to the reader.

This researcher has perhaps two biases. The first of these is in a self-confessed interest in promoting design as the researcher is from a designer background himself. The second of these relates to ontological questions of the environment. The literature earlier (section 2.1.2) suggested various environmentalist paradigms, this could be described as a 'business as usual attitude' favouring incremental, step-by-step improvements, while the other promotes a more radical approach to environmentalism and ecodesign innovations. This research believes that only through the pursuit of more radical environmental innovation will sustainability be achieved.



#### **4.9.4 Confirmability**

This deals with questions regarding the methodical and rigorous conduct and conclusion of the research. For instance, do the findings flow from the data? Or does the data confirm what the research concludes? In this study these questions are overcome during data analysis using theoretical saturation, where no further data is needed to confirm or prove a particular category (Miles and Huberman, 1984), and in conclusions by relating the findings back to theoretical propositions developed from the ecodesign literature in Chapter 7.

#### **4.10 Summary of methodology selection**

The research methodology and strategy selected was a single case study using predominantly action research, with multi-methods of data collection would being employed. The data collection and analysis would utilise a qualitative and inductive approach, while the results will be tested and verified against the theoretical ecodesign framework developed from the literature review. Justification for this is summarised below:

##### **4.9.1 Knowledge Gaps**

The literature and previous work within the institute highlighted a number of key research methods and gaps in ecodesign knowledge for this research:

- There was very little research or practice of more radical or Innovative Ecodesign at the early stages of product development. Where there is, it tended to be conducted in an unsystematic way or focus entirely on the outcomes rather than the processes providing only anecdotal evidence.
- Ecodesign at present is largely integrated and considered at the detail stages of product design and development. There is little work and fewer enquiries into concept based/led ecodesign approaches.
- Research that does exist tends to either assess the impacts of existing products - reflective and assessment tools. There is a need for tools and methods to aid designers with idea and concept generation of ecodesign.
- There is little work considering industrial designer's role and approach to ecodesign. There is also little work that explores ecodesign integration within these design departments.
- Existing work highlights the need for Innovative Ecodesign, but does not illustrate how designers do this, or what happens when they do.

##### **4.9.2 Case Study**

A single case study research strategy was selected as it offered several research benefits:

- It allows rich and deep access to reality and, in this case access to the empirical study of 'real' processes of Innovative Ecodesign.
- This case in particular was selected due to its novelty and revelatory nature. The department is at the early design stage, thus offered potential to study the



processes of change, while the subject matter in question had not previously subject to systematic enquiry.

- A single case offers flexibility and adaptability to the changing circumstances that occur within the real world and the field.
- Multiple methods allowed the collection of data from a variety of sources using various methods, which increases research validity. They also allow a certain opportunism in the data collection as the researcher can return and reflect on subjects

#### 4.9.3 Action research

Action research was selected as the predominant, though not only method for the following reasons:

- This method was selected predominantly is most appealing to the collaborators in question, due to the culture of designing and view of research.
- The action research method ensured some element of control over the subject matter, as in this case such Innovative Ecodesign activities would not have taken place without the intervention of this researcher.

The single case study methodology using predominantly an action research strategy (with multi-methods of data collection and analysis) was selected as suitable for the research aims and objectives, and the context of this enquiry. It was this methodological framework used in the following pilot project, in which the research aims were:

- To explore and describe the integration of ecodesign at the early stages of the design and product development process.







This chapter describes the pilot study and early exploratory stages of the enquiry. It begins by introducing the project and describing its background and conception. It will then provides details of the collaborative process, highlighting the design processes followed throughout the project and the roles and approaches of the two parties. It then presents the new product concepts resulting from the project while drawing some early research conclusions and developing clusters and categories for the subsequent main study

### 5.1 Background to the Pilot

This section describes the pilot project, an enquiry based largely on data from a 'real' or 'live' ecodesign project. This was seen as the most suitable methodological approach for the research and enquiry in question. The lack of examples and practice within this subject domain, required the researcher to initiate and conduct this project within a single case and action research strategy.

#### 5.1.1 Research questions and focus within the pilot

Before doing this and presenting its findings, the research objectives and questions will be reiterated as a reminder to the reader. The literature presented 'state of the art' ecodesign literature as having specific characteristics and placed these into polarities described as the 'incremental' and 'innovative' approaches. This enquiry deals very much with the more innovative approach to and practices of ecodesign. This is visualised in figure 5.1 and is undertaken using the research questions stated below:

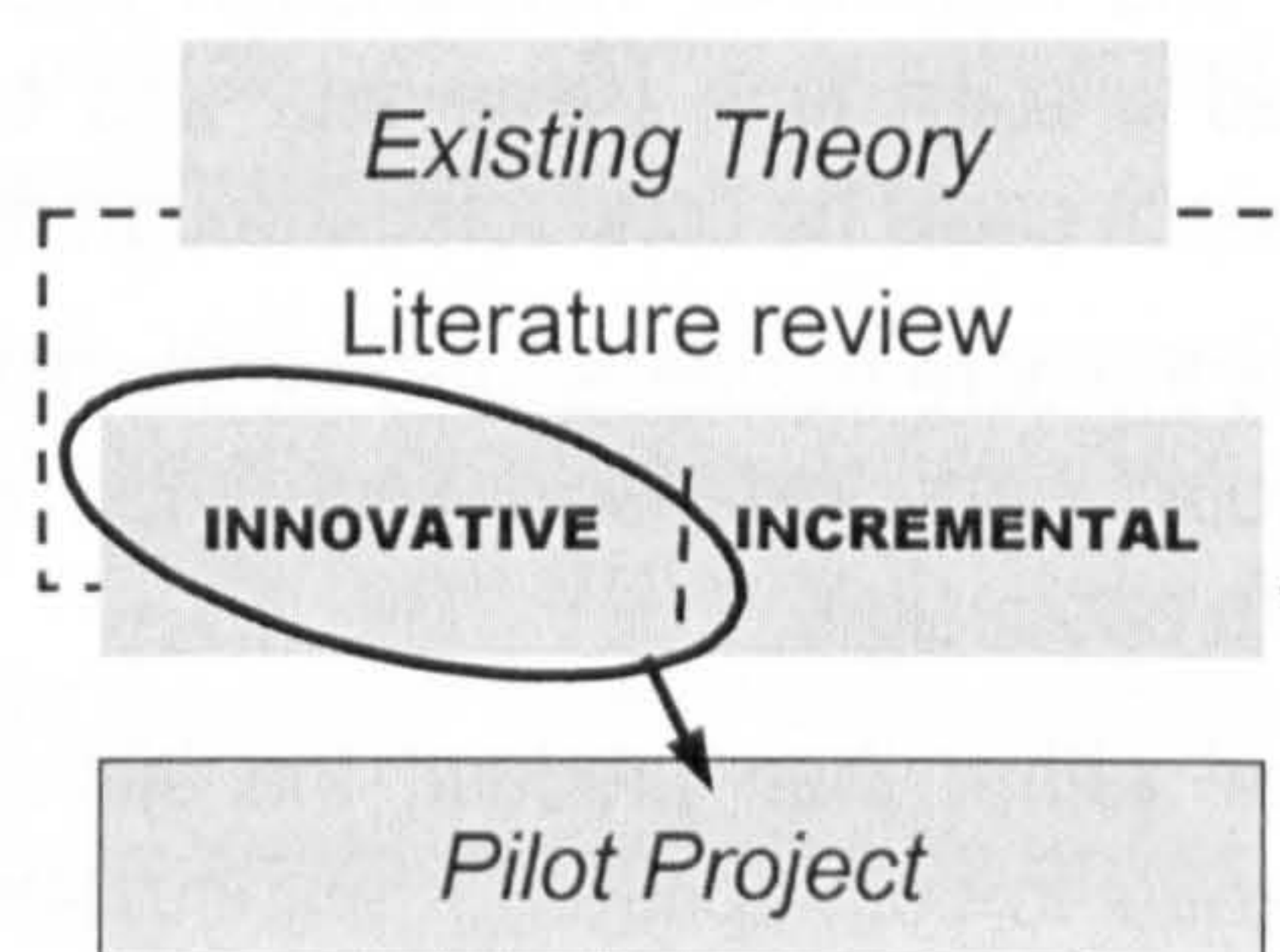


Figure 5.1: Visualisation of the research focus within the pilot study

#### 5.1.1.2 Research questions within the pilot project

- How does an early stage (industrial) design department integrate ecodesign?
- How do industrial designers conduct ecodesign?
- What are the characteristics and practice of more innovative (or early stage) ecodesign?



The early stages of product design and development were considered here to be both a stage and a department within the product development process. There is also little work dealing with ecodesign integration at a departmental level and especially into Industrial Design.

## **5.2 The 'Eco-Kitchen' Project**

The project selected was the Ecodesign Wettbewerb 98, a competition organised by the Ecodesign Foundation in Austria. (see [www.ecodesign.at/](http://www.ecodesign.at/)). This was announced in December 1997, and discovered by the researcher on an electronic mailbase. Entries were encouraged from professional designers and students, and from large or small organisations alike. The project consisted of categories A and B, the second of which was selected for use as a pilot:

B) Ideas and visions for the 'Ecodesign Kitchen of the Future', aimed at more conceptual entries.

### **5.2.1 Project aims**

Amongst the competition and judgement criteria were that 'functionality and producability' would not be the main judgement criteria indicating that ideas and entries should have a high level of novelty and priority within the competition. This was seen as ideal for early stage, Innovative Ecodesign as the focus of this enquiry. The competition explored new and future product concepts, which consider both current but also future technological and lifestyle trends and behaviours. Various issues were introduced as stimuli within the design brief, including considerations of: the use of micro-electronics or information technology; the functional requirements for the future kitchen; the social role and considerations within the kitchen; and new and cutting-edge technologies such as food delivery to astronauts in space.

This project was selected as the pilot as it had a number of relevant factors of importance for this research:

- It was open and innovative, with enough freedom for exploratory research and design. It had a short time frame and was clear and tangible. Its 'live' nature ensured research could be conducted through designing.
- The kitchen is the core business area for Electrolux (the case in question) meaning designers would bring extensive knowledge of the subject matter immediately transferable to ecodesign.
- As a 'system' rather than product, the kitchen ensures broader and systemic thinking essential to both ecodesign and sustainability, as well as the focus of this research. The kitchen also contains both supply-side issues (such as technological and material considerations), as well as demand-side issue (such as consumption and lifestyle considerations) suggested as critical to sustainability (section 2.1.1.1).

The project was proposed to Electrolux as an initial introduction to the subject and to each other, and accepted with a view to further work between the two parties dependent on its success.



## 5.2.2 Project Description

After initial discussions, the project was split into three stages. These are introduced (figure 5.2) then described below in more detail. The stages were:

- Stage 1: Project Identification and Research Phase
- Stage 2: Two-day Workshop
- Stage 3: Idea Generation and Concept Development

In total the project took 4 months to complete. As the project developed the responsibilities and emphasis shifted from one collaborator to the other with Cranfield responsible for the initiation and proposal of the project as well as to shape and steer it through the research and the introductory phases. Electrolux would conduct all design activities, including developing an appropriate design brief, idea generation and concept development as well as the preparation of the final designs and the presentation.

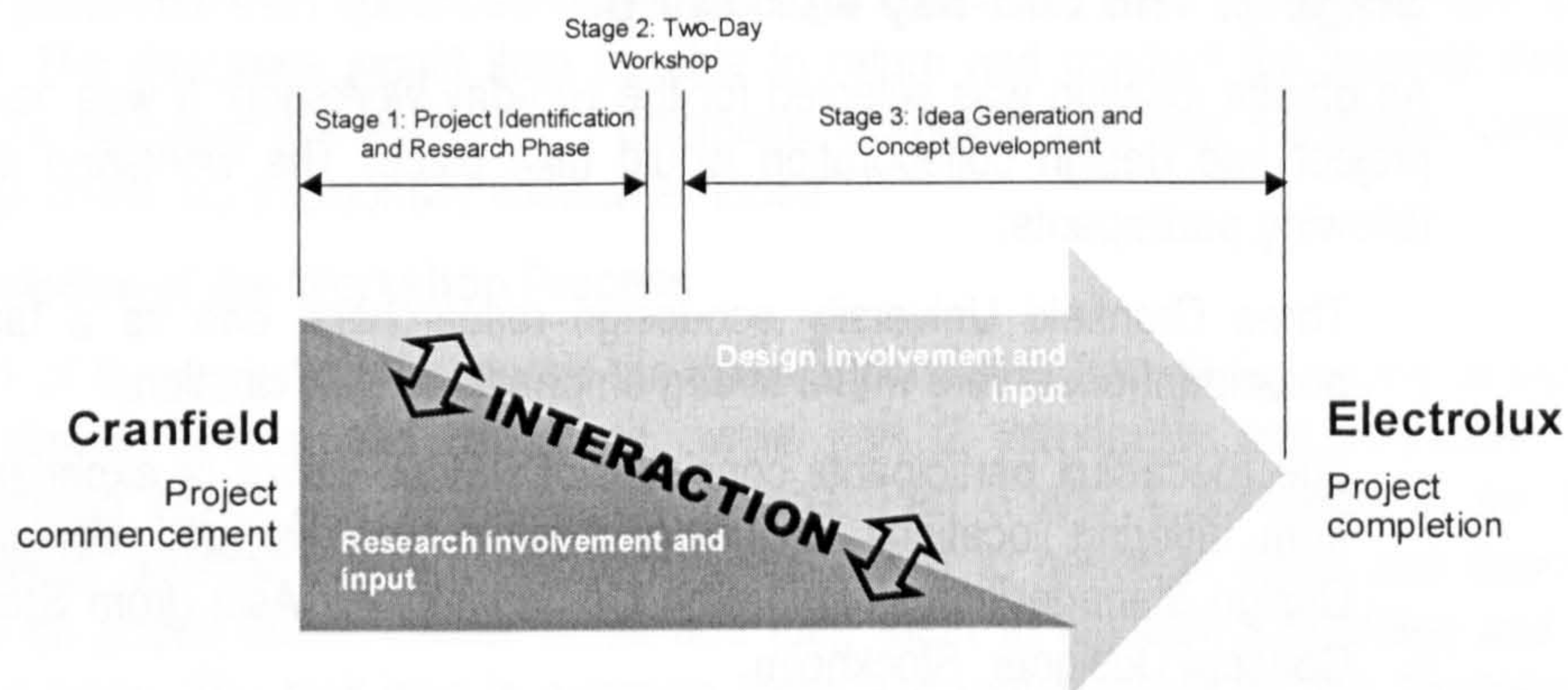


Figure 5.2: Collaborative process and responsibilities

## 5.3 Stage 1: The Project Identification and Research Stage

This stage consisted of initial meetings and discussion between the two collaborators agreeing details on the project such as the number and type of participants, the location and some early responsibilities.

Within stage 1, a 6-week research period was agreed and undertaken by the researcher as a means of steering the design project. This research task was titled a 'Kitchen Life Cycle study' and its basic aim was to define and collect relevant project information and stimulus for the design project and designers.

### 5.3.1 The Research Phase – Project Information and Stimulus

This 6-week research stage aimed to collect various and relevant information and stimulus for the project. This was collected largely via personal experiences and the intuition of the researcher, with diversity and variety being key considerations. It was felt at this stage that any form of relevant ecodesign or environment related information should be collected and utilised using an inclusive, rather than exclusive approach. The key selection criteria were that it contained information of relevance to the ecodesign of the kitchen, and would enable or facilitate ecodesign or be relevant to Industrial Design. This kitchen life cycle study consisted of the following subject areas and topics:



- Information on kitchen impacts, such as: waste; water and energy use, household purchasing.
- Specific life cycle analyses of products or aspects of specific consumer life styles in the kitchen.
- Food, health and dietary tips.
- General green lifestyle information.
- A summary of the environmental challenges and goals facing designers (reduction targets, etc).
- Examples and case studies of ecodesign products for:
  - The kitchen.
  - Industrial Design based ecodesign.
- Future trends and requirements (such as re-introduction to biological processes).

The aim was to deliver the material during stage 2: the two-day workshop.

#### **5.4 Stage 2: The two-day workshop**

An off-site location was selected for the two-day workshop. It was here that the main project and design collaboration would take place. The workshop consisted of the following participants:

- Three Cranfield University ecodesign researchers: one as a facilitator; two as participant-observers with a strong emphasis on participation.
- The Electrolux participants consisted of various senior or experienced individuals from differing locations, including: Design Manager UK; Senior Designer UK; Design Manager/Industrial Design Co-ordinator for Asia (from Stockholm); Senior Concept Designer, Stockholm.

Though a workshop agenda was defined many exacting duties and responsibilities were not yet allocated. It was acknowledged that projects of such an exploratory nature might be hindered by tight constraints, stemming the open and creative flow of ideas and the workshop development. In this case the design and collaborative processes would develop concurrently with the product concepts and ideas, aiding both exploratory design and research. Further developments beyond the workshop in stage 3 were therefore defined at the workshop itself. Figure 5.2 is a summary of the workshop agenda:



<b>Workshop Agenda:</b>	<b>Led by:</b>
1. Introduction to ecodesign.	Cranfield
2. Introduction to project and competition.	Cranfield
3. Task and Brainstorming - Generate 'Eco-Kitchen' ideas. Record and map on post-it notes.	Cranfield with Electrolux
4. Cluster brainstorming ideas into similar groups	Cranfield with Electrolux
5. Kitchen Life Cycle study presentation – data, historical developments, examples and case studies of ecodesign for the kitchen and 'food culture'.	Cranfield
6. Identify user groups and target audience.	Electrolux with Cranfield
7. Define project brief.	Electrolux with Cranfield
8. Develop design ideas and proposals.	Electrolux

Figure 5.3: Two-day pilot project workshop agenda and responsibilities

The intended outcome of the two-day workshop was a design brief. A design brief is a clear set of statements and design requirements for designers to follow. It is however, more guidelines than specifications as a design brief often does not go into extensive detail. The designers would then be able to return and conduct the 'normal' design process following the workshop. Participants acknowledged that Electrolux Concept Design briefs are traditionally somewhat 'loose'.

#### 5.4.1 Description of the Workshop Process

Part 1 of the workshop introduced the general principle of ecodesign using accepted and simple models and definitions, while part 2 introduced and expanded the competition along with its judgement criteria. Part 3 and 4 consisted of the first ecodesign exercise where participants were asked to generate ideas and describe these on post-it notes, cluster these and map them to highlight similarities and the overall focus. The task was to generate ideas and requirements for the 'Sustainable Kitchen', aiming to generate group dynamics and empower designers. Part 5 saw the results of the initial research phase presented, aimed as project stimulation and to present the possibilities of ecodesign via various tangible and transferable case studies and examples. Part 6 to 8 of the workshop aimed more towards the development of the design brief. Here the ecodesign stimulus and existing design skills would be synthesised and attention turned to the project. A target audience would be described along with a clearer idea of their lifestyle requirements and kitchen requirements. The overall design focus would emerge and some early stage design ideas were to emerge and described within the resultant design brief.

Researchers noted that within these later workshop stages (6-8) a distinct change occurred within the workshop where the designers took control of its direction and development. After understanding the basics of ecodesign and the project and competition requirements, the project moved to the task clarification stages of the product development process (section 2.5). A clear series of themes and requirements began to emerge, including the overall project aims and focus, the target audience as well as the design brief. The following sections describe these key concepts that would shape and steer the design processes to follow. This will be done largely using illustrations from the final presentation developed after the two-day workshop. However, all the material represented within these illustrations was defined within the confines of a two-day workshop and made more presentable at later dates:



## 5.4.2 Project Focus

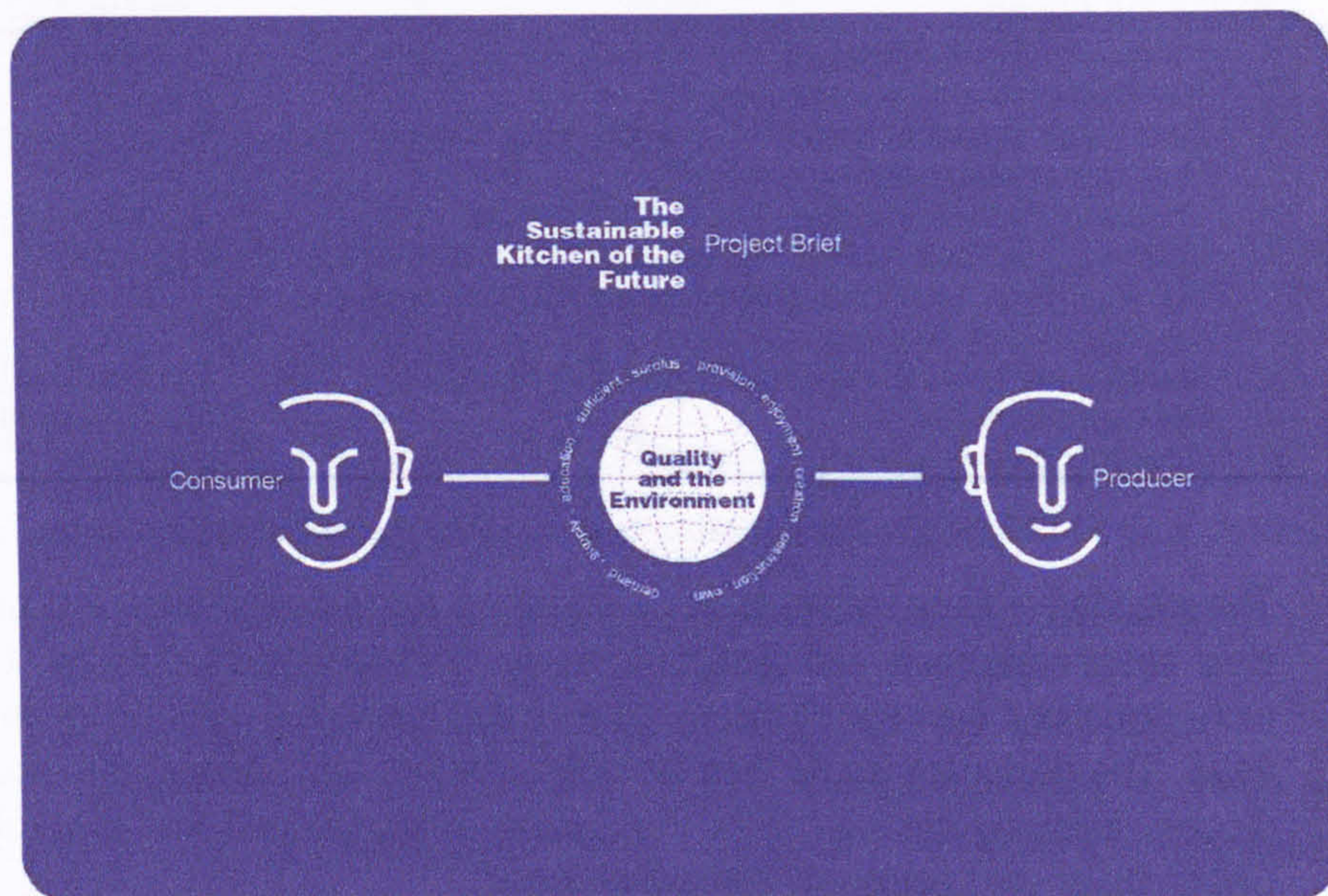


Figure 5.4: The Project Introduction

This section presents the overall project emphasis and focus as illustrated by figure 5.4 above. Designers viewed and described the project as a 'Partnership of Awareness', dealing with and representing the interests of both consumers and producers. Figure 5.5 below, illustrates some of the values represented within this project as: responsibility and ethics by the consumer, in proactively influencing and educating consumers, whilst directing and creating markets. The designers defined this as raising the 'Awareness' of both consumers and producers, by providing 'Appealing and Adaptable Alternatives'. Indeed designers later titled the project 'Awareness' summarising their overall intentions



### 5.4.3 Consumer Clusters and Profiles

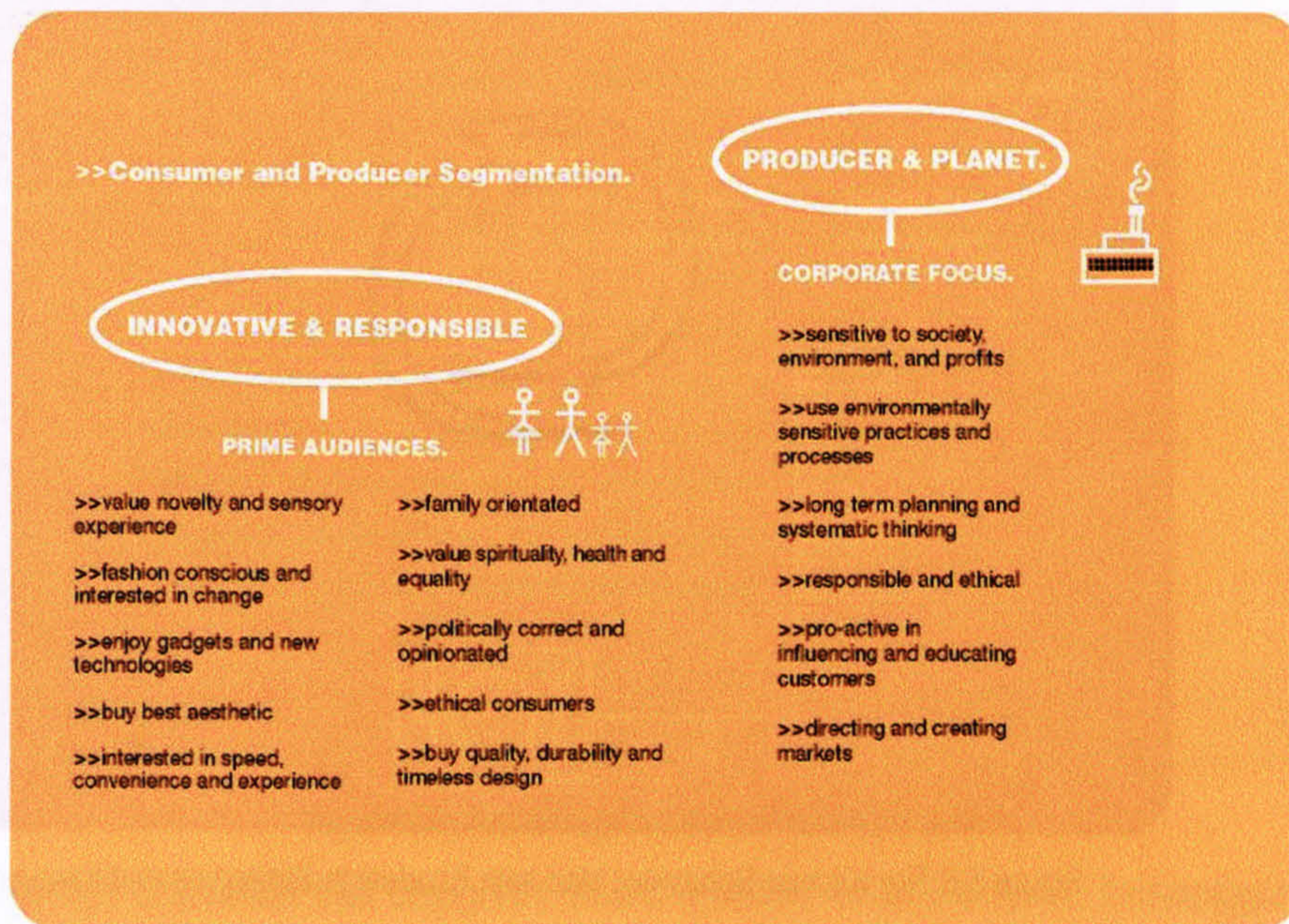


Figure 5.5: Consumer Clusters and Corporate Values

Another important project stage was to define a target audience in the form of consumer clusters. Consumer clusters are groups of consumers that have similar characteristic, buying or behavioural patterns and values. They are most often used in marketing and sales contexts. As consumers are increasingly diverse and have differing requirements and living patterns, it is increasingly important for designers to know and understand their customers. The consumer clusters used here were from existing Electrolux information in the form of a 'European Consumer of the Future' study (a series of predefined consumer groups). Those selected here were seen to be the consumer groups most sympathetic and suitable to an ecodesign project. The 'Innovative' and 'Responsible' consumer clusters with a summary of their profile values are also illustrated in figure 5.5.

#### 5.4.4 Kitchen Behaviour Map

After the target audience was defined, design discussion turned to consumer behaviour and functional requirements, as well as current lifestyle patterns within the kitchen. Using existing knowledge the group defined a series of universal kitchen behaviours that western consumers generally follow in the kitchen. These consist of steps such as: buying; storing; preparing/cooking; eating; then washing and disposing. Within each of these stages various ecodesign interventions were highlighted and listed. The Kitchen Behaviour Map, as well as the ecodesign strategy and key environmental interventions in each one of these behaviours is illustrated in figure 5.6.



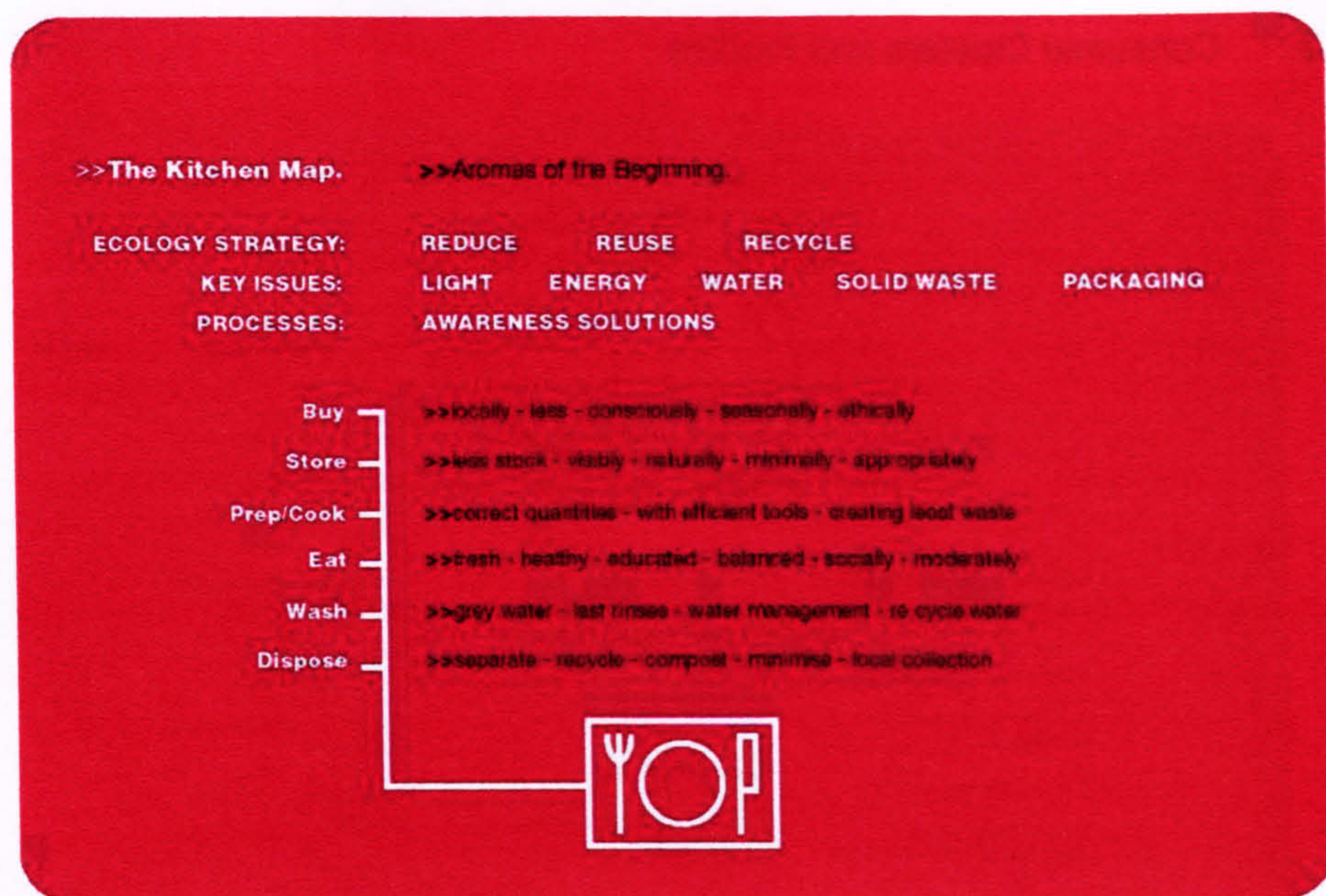


Figure 5.6: The Kitchen Behaviour Map with Ecodesign Strategies and Interventions.

#### 5.4.5 Design Brief

The next step was the definition of the design brief, which set out a series of basic directions to follow during the design stages. Encapsulated within this was the overall focus of the design project as well as various ecodesign requirements. Here the brief is summarised below, and then described further in figure 5.7.

- Balancing desire and the environment.
- Use current market clusters and social trends.
- Use near future support systems: home delivery; Internet shopping; separated waste collection.
- Use real, not ideal behaviour.
- Support not force consumers.



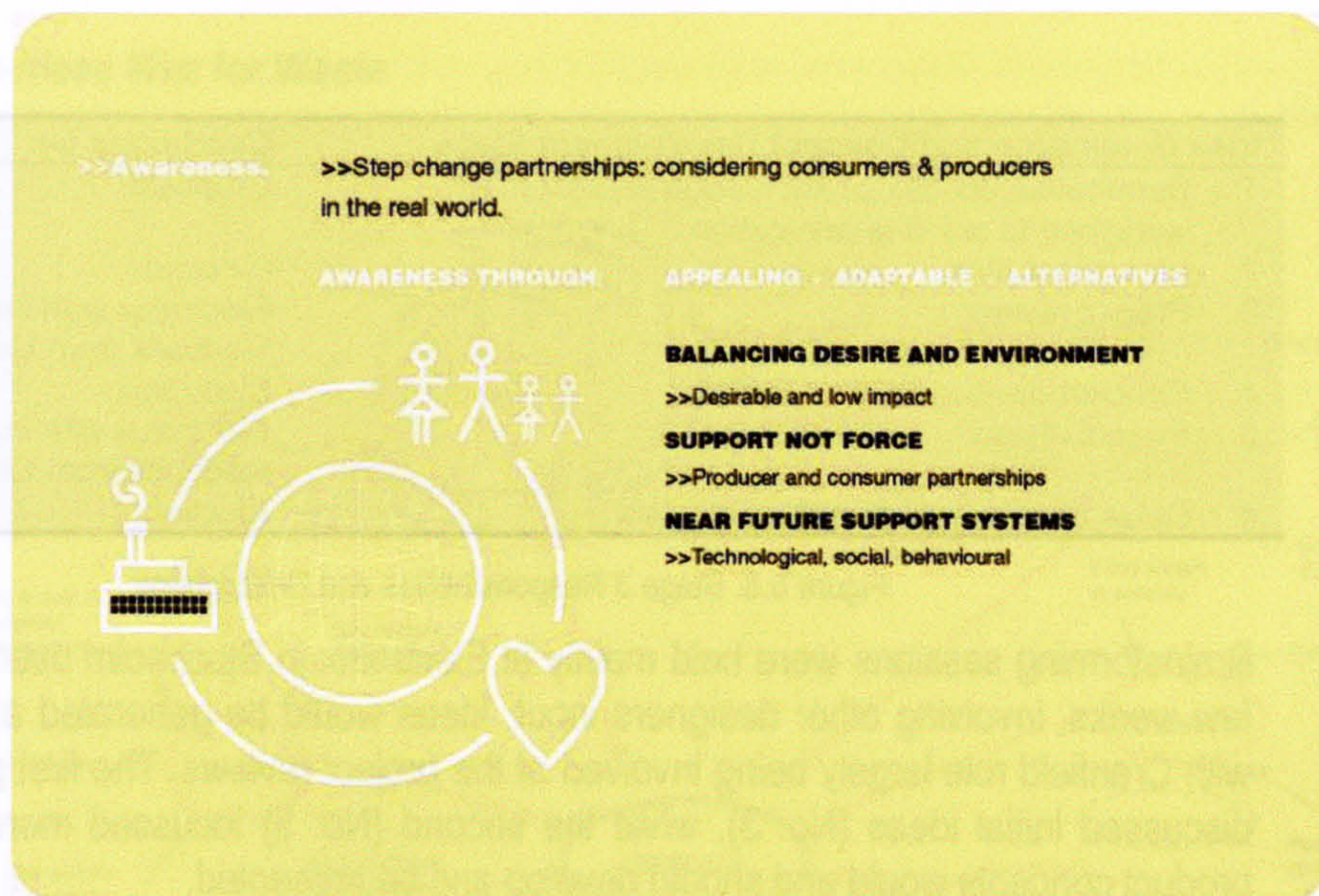


Figure 5.7: The Design Brief and Project Approach

The design brief state that designers would consider new and future technologies and lifestyles, but these should be probable or foreseeable and very much lead from current trends. There was also a clear emphasis on representing the interests and raising the awareness of both producers and consumers encapsulated in the title a 'Partnership of Awareness'. Designers were keen to state their aims in offering 'alternatives' to consumers enabling them to choose and select rather than attempting to enforce change. This final point is of importance as a critical part of the design brief was in stating the appeal or desirability of these offered ecodesign alternatives, expressed as 'Balancing Desire and Environment' (figure 5.7). The overall approach in the design brief was summarised later as follows, *"the messages are: AWARENESS through; education; partnerships between producer and consumer; the responsible manufacturer; the aided consumer; .. (and) ecology can be sexy"* (ref)

### 5.5 Phase 3: Idea generation and concept development

During the workshop a list of duties and responsibilities were also devised for stage 3 - Idea Generation and Concept Development. During this stage the design brief and results of the workshop would be developed into product ideas and new concepts as the competition entry. This would be conducted largely by Electrolux designers, with support and input along with some technical and environmental validation from Cranfield. The specific tasks are illustrated below:



Idea Generation and Concept Development Stage	Conducted by:
1. Summarise ecodesign knowledge presented at workshop to aid idea generation	Cranfield
2. Idea generation	Electrolux
3. Project review	Electrolux with input and feedback from Cranfield
4. Concept development and design	Electrolux
5. Project review	Electrolux with input and feedback from Cranfield
6. Detail concepts and produce models	Electrolux

Figure 5.8: Stage 3 Responsibilities and Descriptions

Brainstorming sessions were held mainly at Electrolux in Stockholm over the following few weeks, involving other designers input. Ideas would be generated and developed with Cranfield role largely being involved at the project reviews. The first project review discussed initial ideas (No. 3), while the second (No. 5) focussed more on how the product concepts would and should develop and be presented.

The first task after the workshop, as a request by Electrolux was for Cranfield to summarise and communicate the information from the research phase and delivered in the workshop presentation. The workshop emphasis was as an introduction to ecodesign and each other. The designers now had few reference points on which to base ideas and develop concepts in isolation from the researchers. They requested the research information and stimulus, summarised in a manageable and stimulating format for use during stage 3 (from section 5.3.1).

### 5.5.1 The Eco-Ideas Maps

In effect the designers had requested a specific ecodesign tool to aid idea and concept generation, for which there were no clear guidelines or models previously. This task was done by summarising the ecodesign examples and case studies, along with a series of ecodesign strategies presented as 'maps', and split into: Water, Energy, Light, Packaging and Waste. These environmental factors had emerged as of importance during the research phase and each map was then divided into the ecodesign strategies of Reduce, Reuse or Recycle, and in turn sub-divided into the areas defined by the Kitchen Behaviour Map (buy, store, prepare/cook, eat, etc). These 'Eco-ideas Maps' were produced for each of the environmental resource areas as a design aid during stage 3. The Eco-Ideas map for 'Energy' is shown in figure 5.9.



### 5.5.1.1 Eco-Ideas Map for Waste

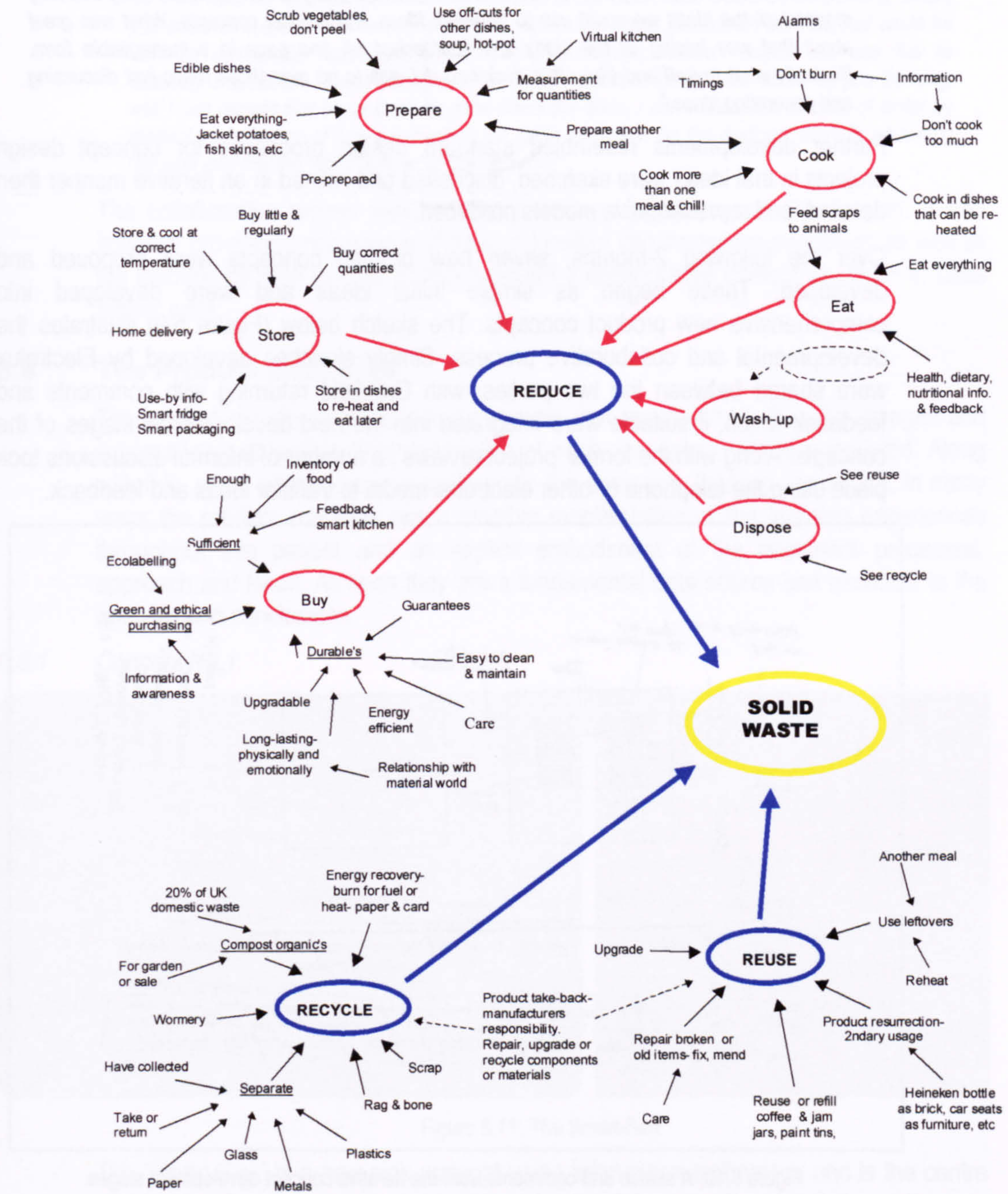


Figure 5.9: The Eco-Ideas Map for Solid Waste



The Eco-ideas Maps were well received by the designers and used extensively as design references throughout stage 3.

"I also think another turning point was the ecodesign maps that you sent up to us. They basically mapped all the ideas we could use to generate ideas and product concepts. What was great about that was having all the ideas and approaches on one page in a manageable form. Basically what myself and (the other designer) did was to go over those maps just discussing and generating ideas."

Further developments resembled standard design processes for concept design projects in that ideas were sketched, discussed and refined in an iterative manner then detailed, and representative models produced.

Over the following 2-months, seven new product concepts were proposed and developed. These began as simple initial ideas and were developed into comprehensive new product concepts. The sketch below (Figure 5.9) illustrates the developmental and collaborative process. Simply sketches developed by Electrolux were shared between the two parties, with Cranfield returning with comments and feedback which, if suitable were integrated into the next developmental stages of the concepts. Along with the formal 'project reviews', a number of informal discussions took place using the telephone or other electronic media to transfer ideas and feedback.

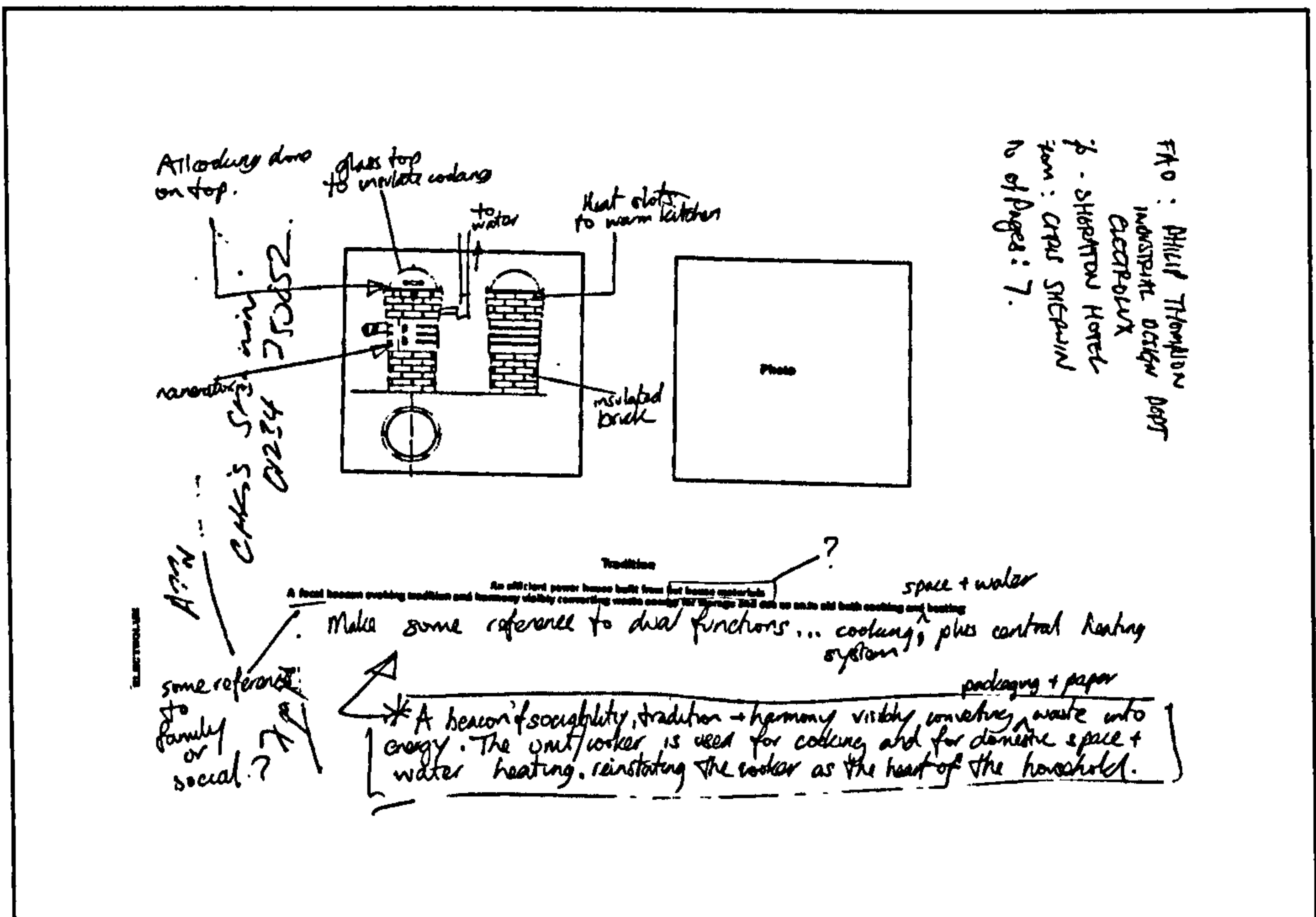


Figure 5.10: A sketch and comments from the iterative concept development stages.

The concepts were developed into concept models to expressing ideas and communicating ecodesign principles. These were then developed into a project booklet, which explained not only the outcomes, but the designers approach to the project. Overall the project was complex, exploratory and novel, but reflections on the processes and developments help illustrate its nature. One designer stated:



*"The Sustainable Kitchen was an opportunity to show how an appreciation of the environmental issues, and the intent to increase consumers 'awareness' of those issues would drive design ideas.*

*So if we look, for example at something like the 'Smart Sink', taps would be left running, where you could fill a basin to do a very small job. Where the water goes down the sink that could be used for some other operation. So if we look at Reduce, Reuse, Recycle and use that as basically 3 questions to ask throughout the design process, ideas come about by you thinking, well I can recycle that water once its gone down the drain. I can reduce the amount of water by making an indication of how much water I'm using each day. So the designer there is educating the user and making them 'Aware' of their actions."*

The collaborative project was entered into the competition but did not win. It had however provided a rich source of data and insight into innovative ecodesign as well as the learning by both parties. It also provided a collaborative context on which to base further work.

## 5.6 The Product Concepts

This section introduces the product concepts that resulted from the pilot. Images and explanations, as well as brief description of each concept principles is included. Along with this, some brief comments to illustrate the designers thinking are added. In many ways the product concepts are a tangible manifestation of the learning experiences throughout this project and an explicit embodiment of the designers processes, approach and focus. As such they are a fundamental data source and essential to the analysis and conclusions.

### 5.6.1 Concept No.1

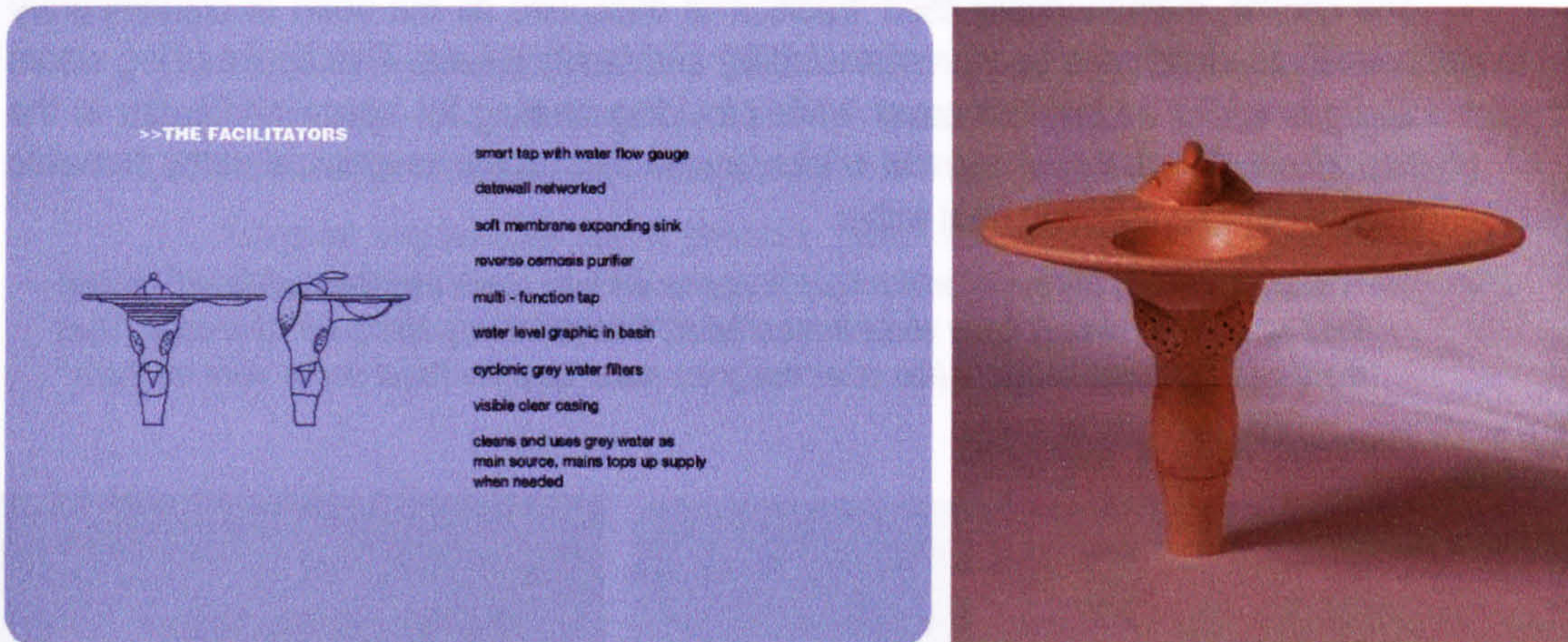


Figure 5.11: The Smart-Sink

The 'Smart Sink' is a new sink concept using information technology and is the centre of household water management. A membrane sink expands to minimise water use while the smart tap switches from jet to spray to mist to suit consumer needs. A consumption meter on the pedestal and a water-level indicator in the main basin give feedback on rates and level of water usage. Such features inform and empower consumers to make educated choices to change their behaviour, satisfying the design brief considerations of supporting and enhancing peoples use. Grey water is managed visibly using an osmosis purifier (purifies water) and a cyclone filter (removes impurities) located in the pedestal, both are linked to household grey-water storage.



“... there was a comment on there (Eco-Ideas Map) about using less water and we just said ‘well wouldn’t it be good if you could just have a sink that you could change the size of..., like having a bag on a string so that you could just change the size so that it would always seem full!’. And that led to the membrane sink. We also like the idea of giving feedback on usage, empowering people and giving them the choice to change their behaviour, so we put the water volume marks on the bottom of the water basin and also the consumption meters on the taps to show water flow.”

### 5.6.2 Concept No.2

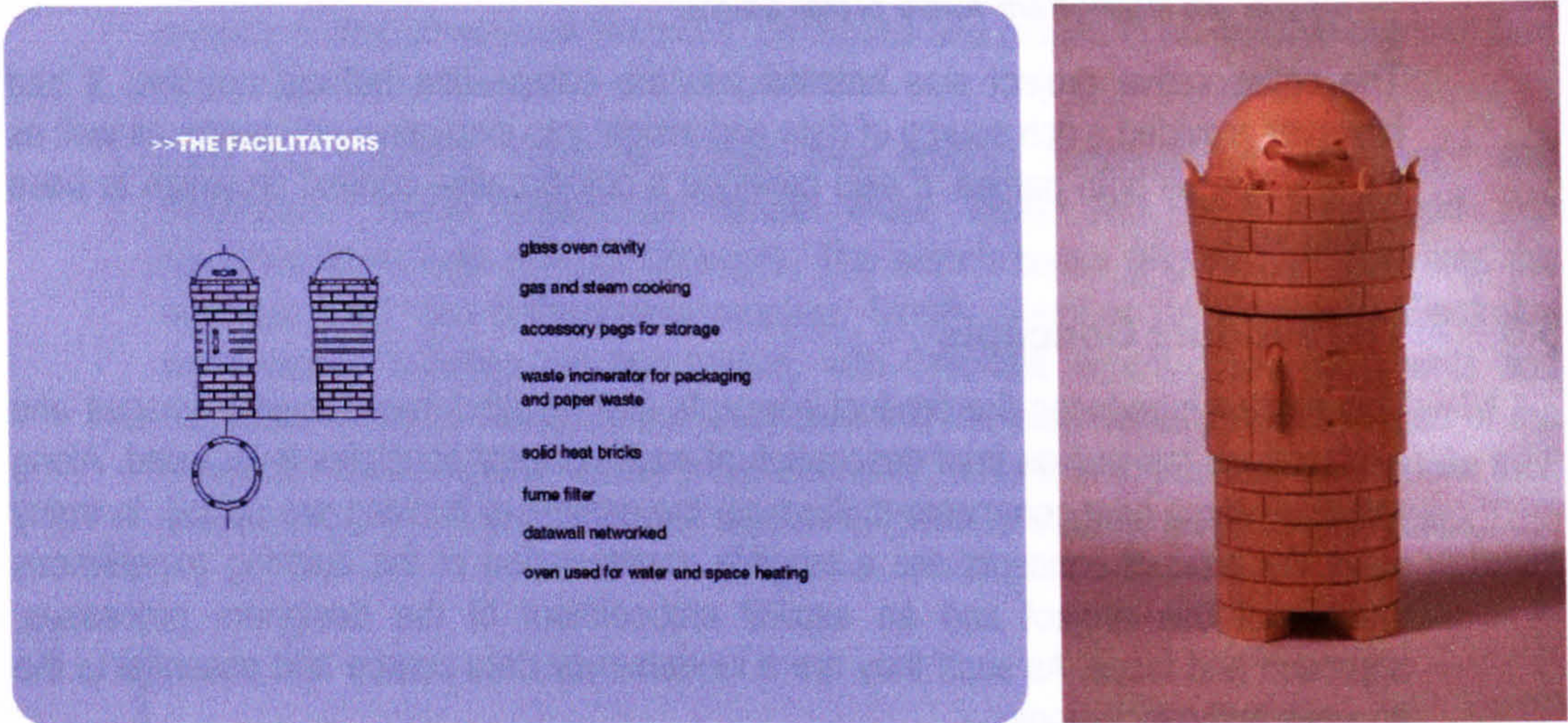
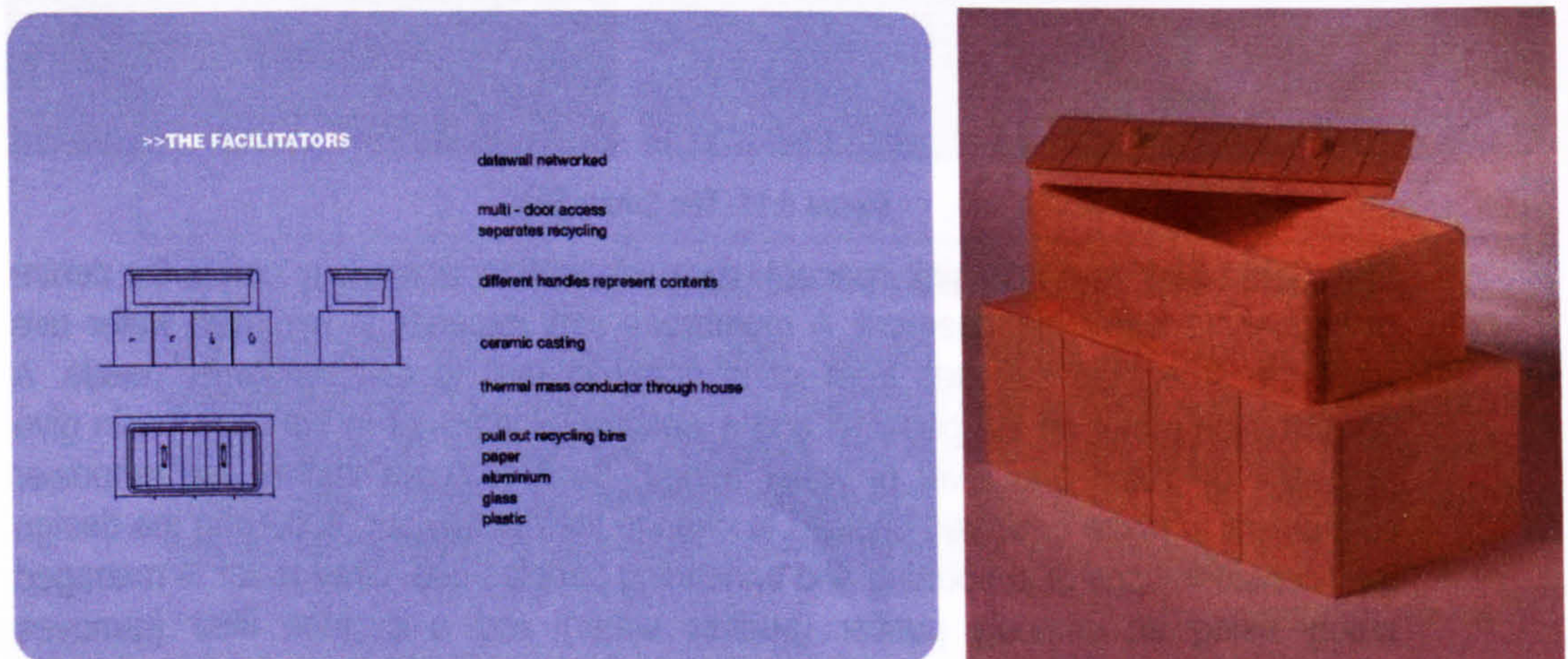


Figure 5.12: The cooker

The cooker, metaphorically titled ‘tradition’ is described as the heart of contemporary households, and as a beacon of sociability and family values. This cooks using steam and gas under an insulated cover while providing heating for space and water in the household. The base of thermal bricks, incinerates waste to provide extra domestic heat whilst also retaining heat within.

*“The cooker was really based on the Aga., that it would heat space and water while still cooking food as well. We already know about thermal bricks from previous projects we have done. Then there was the towel hooks.... (the other designer) made sure the towel hooks were on there.”*

### 5.6.3 Concept No.3





The Chest Freezer, titled 'basics' is based on simplicity and elegance. As cold air falls, it is not efficient to have front door access to freezers as cold air literally falls out. The 'chest freezer' operates on the principles that it is much more efficient to have access from above. The body is ceramic to increase thermal mass and raises the top as a work-surface. In doing this, the lower section is then utilised as a domestic recycling unit.

*"The freezer idea came from the in-efficiency of existing products. We know that cold air falls out of freezers and that it's a bad way to design. Its far better to have upright freezers.....!"*

#### 5.6.4 Concept No.4

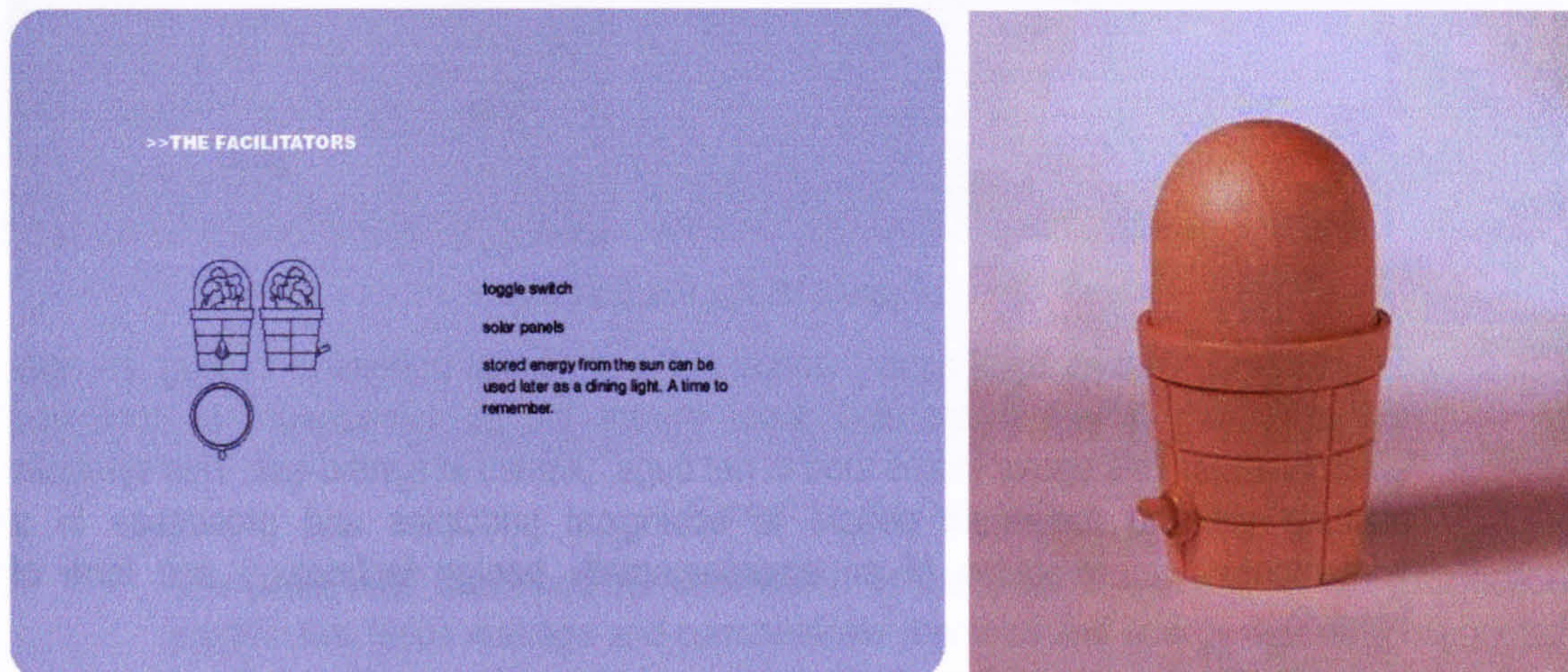


Figure 5.14: The Light-Plant

The 'Light-Plant', metaphorically titled 'Awaken' is a communicator of environmental principles, and as a functional reminder of resource use. Left on a windowsill it collects and store solar energy, and when placed on the table emits stored energy as light.

*"Lite-plant was basically just a gimmicky, quirky little thing that was about environmental awareness and delight... I think we got the idea because that technology to store solar energy and create light does actually exist at the moment."*



5.6.5 Concept No.5

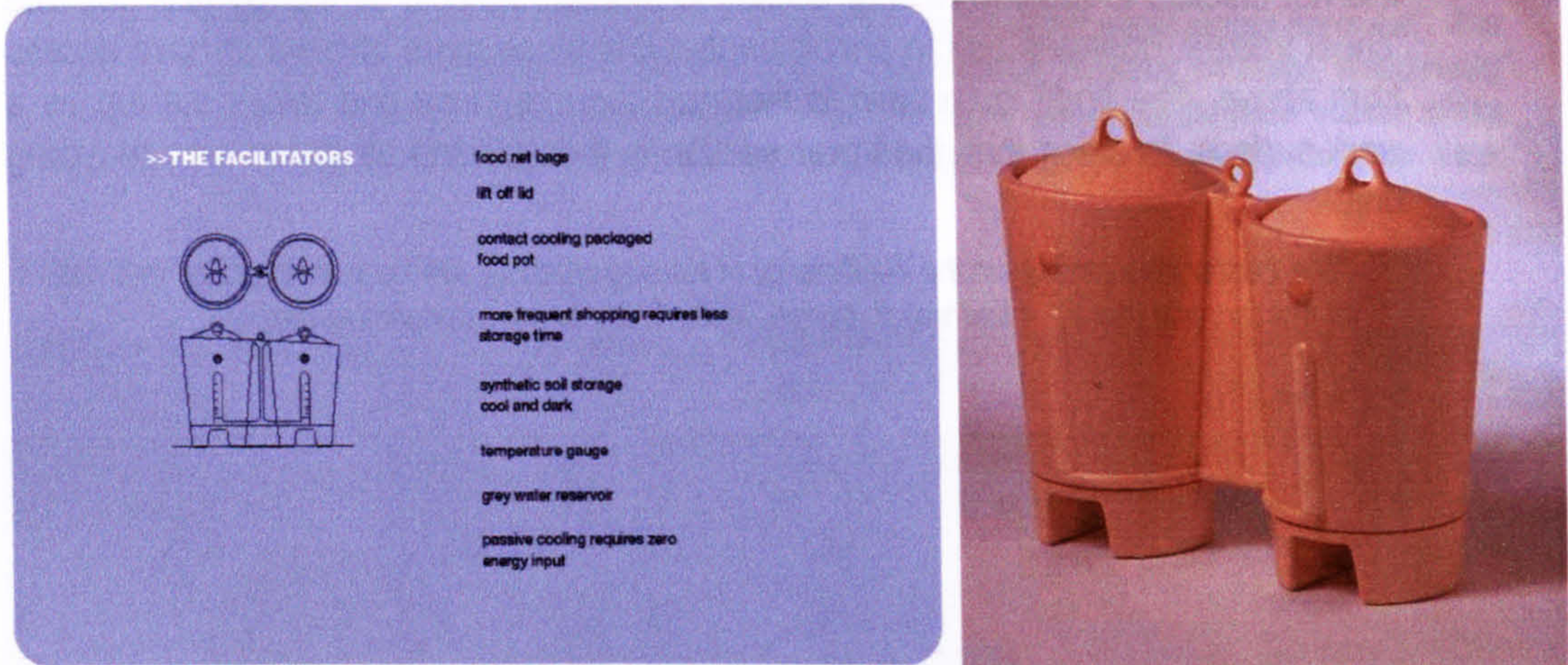


Figure 5.15: The Passive Cooler

The fridge (known as 'symbolism') works on the principles of passive cooling, an age-old technology where evaporated water lowers the air temperature of controlled environments. This cooler stores food in net bags, planted in syntho-soil. This symbolic planting aims to reconnect people to ecological principles and processes in a contemporary interpretation of an environmentally benign technology and form of behaviour.

*"In Sweden people actually do plant things to keep them cool... They put food into bags and bury them...!"*

5.6.6 Concept No.6

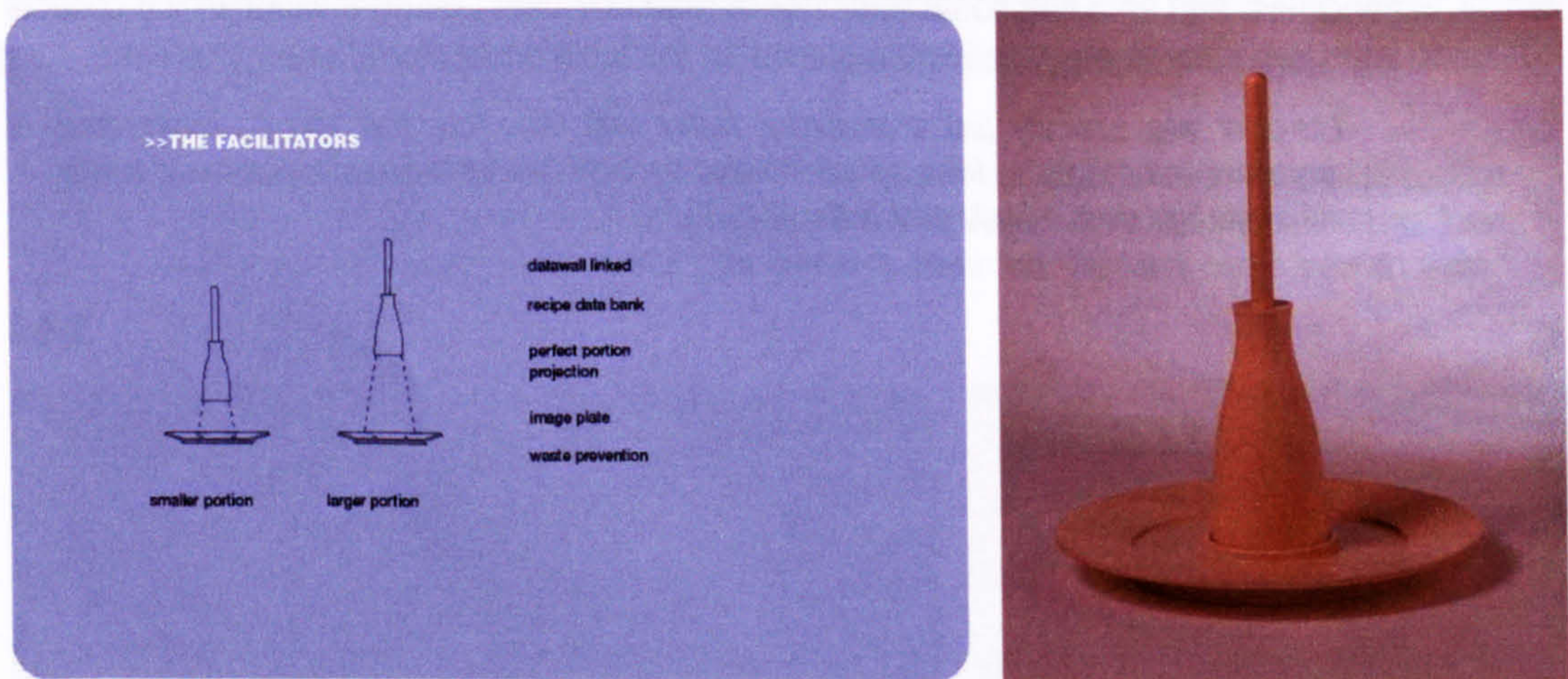


Figure 5.16: The Portion Projector

The 'Portion-Projector', subtitled 'measure' eliminates excessive or wasteful preparation and cooking. Connected to the 'Data-Wall' information network, meals can be dialled up and the correct quantities projected on the under-plate. This reduces waste and ensures enough food is prepared and cooked for all.



*"There was also a point on there (Eco-Ideas maps) about not cooking to much and that you should prepare and cook the correct quantities, and not be wasteful in preparation. So I came up with the idea of a product that would project the image of your food onto the plate and show you how much you should be preparing."*

### 5.6.7 Concept No.7

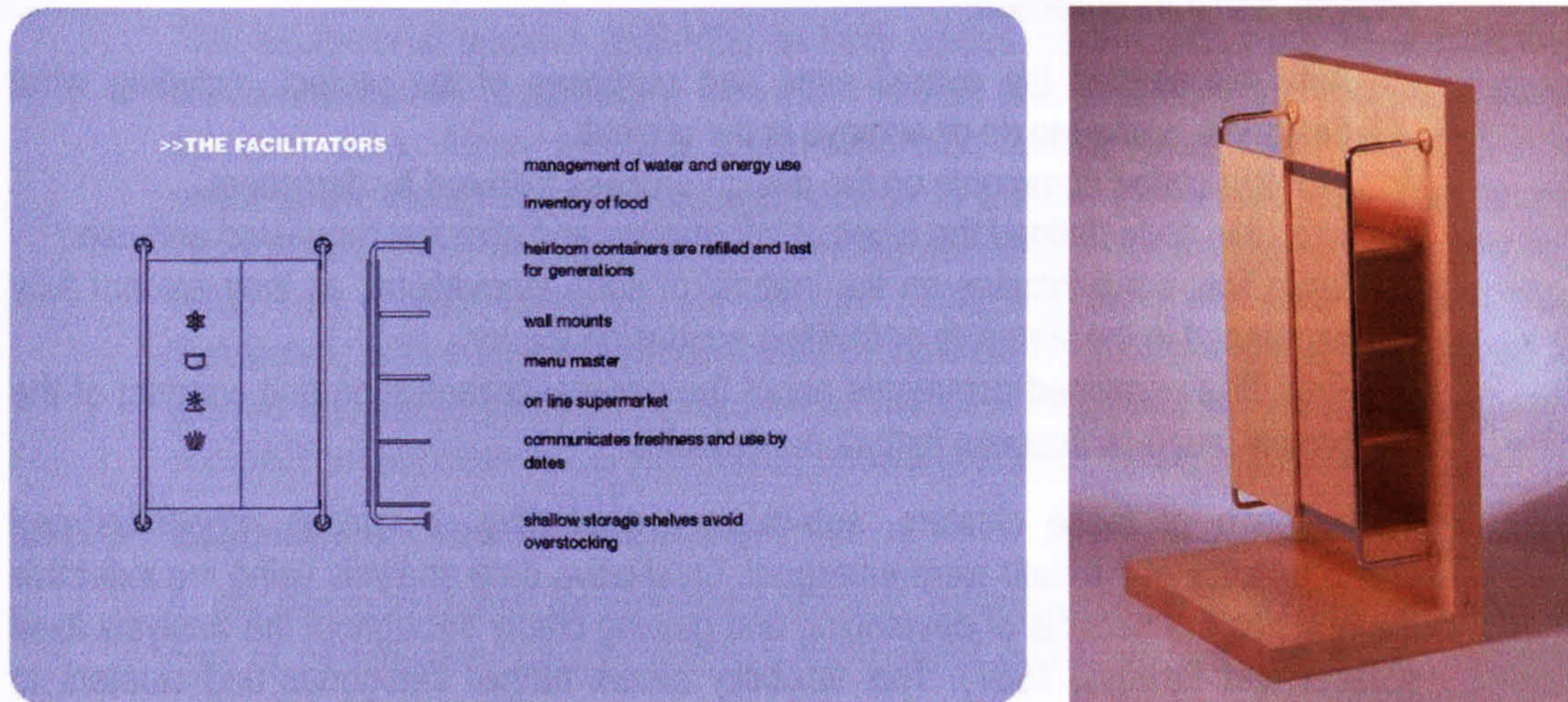


Figure 5.17: The Data-Wall

The 'Data-Wall' described as 'information' is the brain of the kitchen, an information product that helps manage and communicate resource and energy use. It is connected to other kitchen and household products (such as lighting) giving feedback on levels of overall domestic resource usage. Along with this it holds an inventory of food stock, whilst communicating quantities, freshness and use-by dates. It is a link to the supermarket via the Internet for home-shopping and delivery service and contains the 'menu-master' giving advice on recipes, cooking techniques and health and dietary issues. Behind this information interface is kitchen storage, refillable and reusable containers that have jewellery like, cherishable quality.

*"The Data-Wall basically came from the idea of information access being the key to sustainability and technology being an enabler. This thing was like the Smart Fridge we are currently developing in conjunction with Sainsbury's (see figure 3.11). We had to put some extra features on it to make it more 'eco'.... like dietary and health issues, as well as making it have resource data... The jewellery containers basically came from the Eternally Yours idea of preciousness and care."*

## 5.7 Data Analysis

This section begins the task of data analysis and concluding from the pilot study. Available data in the form of interviews and observational notes, written and email contact as well as the product concepts themselves were all data sources of use to the analysis. This was conducted by coding and clustering the data to extract common 'themes' and draw some general subject areas on which to make early inferences, and steer the data collection and analysis for the main study. At this stage, the themes were deliberately broad aiming to only to give initial direction from the pilot project, being only a single case. After initial observations and discussion among the three participant-observers, as well as further conceptualisation by the researcher alone, a number of research and data analysis themes were identified. This took place after stage 2 of the



pilot, to help data collection during and throughout stage 3 (idea generation and concept development) of the pilot and in the later main study.

### **5.7.1 Coding and clustering the data**

The coding systems consisted of the following conceptual categories used during analysis and data collection:

- *Aim*: this studied the overall aims and purposes of the project, including what designers wished to do or achieve in the project.
- *Pro*: this coded comments on the design process followed by designers.
- *Info*: this code defined the types of information and stimulus requested and used.
- *Inno*: This code focuses on the 'nature' of such innovations, as they are not fully expressed in the literature or existing ecodesign theory.
- *Proj*: This contained comments about the general organisation and conduct of the project, such as success factors or obstacles.

Within each of these clusters, sub-clusters consisting of various properties and characteristics of the data were emergent. Qualitative data analysis using the inductive method has the benefits of developing and gaining clarity throughout the analysis itself (Glaser and Strauss, 1967). This flexibility allows further categories and clusters to emerge throughout the process of collecting and analysing data, while previous clusters can expand, contract or merge. The resultant conclusions and generalisations are therefore 'grounded' in reality (Glaser and Strauss, 1967, Miles and Huberman, 1984), as they emerge from the data itself rather than from a series of proven (or not) pre-defined hypotheses (Glaser and Strauss, 1967). In this case, though the original codes and clusters were identified though, not all were continued from the pilot through to theory building in the main study. The following section describes the main pilot study conclusions and the key research themes extracted and used within the main study.

## **5.8 Findings and Key Research Themes**

This section describes the key research conclusions under each of the 'coded' headings defined above. The reader will note the overlap between several of these themes, categories and conclusions. Glaser and Strauss (1967) suggest that clusters in themselves are not the data or findings, rather a framework for analysis. As such the overlap between themes is less relevant than the conclusions drawn from them. An example of this is the clear overlap between the PRO (design process) and the INNO (nature of innovation) categories as, in many ways the design process is an innovation process.

### **5.8.1 Aims**

This category explores the overall aims and purposes of the project. Rather than a single series of aims, there in fact emerged several and various. These are introduced and described in detail below:

#### **5.8.1.1 Education and Learning**

In many ways the pilot and competition were simply a 'means', as an introduction to and education for ecodesign. As the competition summary, written by designers indicated:



In many ways the pilot and competition were simply a 'means', as an introduction to and education for ecodesign. As the competition summary, written by designers indicated:

*This entire project has been a collaboration between Electrolux Industrial Design and Cranfield University. A learning mix of the industrial and academic worlds.*

This educational purpose extended to both parties as the designers were exploring uncharted territory (ecodesign), whereas this was also a highly exploratory and novel research area. Along with this there were also further goals of empowering and enabling the designers to conduct ecodesign in a more systematic way. The design team stated at the beginning of the two-day workshop "We want to know... how to? What can it (ecodesign) do for design?" indicating the clear wish to familiarise themselves with ecodesign practice and processes. It was therefore a clear aim to explore and define paths and directions for industrial designers by entering an external competition, with less risk or not directly answerable to company constraints.

### 5.8.1.2 Empowerment and Transferability

In the mid to long-term departmental aim was for ecodesign to be a more fundamental part of all Industrial Design practice and part of every product and project passing within the department:

*The intention is that this initial exercise will lead on to future collaborations and most importantly the assurance that sustainability will always be central to product/systems development.*

Thus the project had more formal goals of transferring methods and approaches to everyday Industrial Design practice.

### 5.8.1.3 Promotion

A project also aimed to champion the department as a more strategic resource within the company, and also as an internal 'eco-champion'. Designer indicated that the project was a means of promoting its profile as both a place to turn for more strategic thinking and insight and to also build its profile as having unique skills and insight into ecodesign. The department was stated to have a small profile and input into more senior and high level decision making and this as well as the current departmental inactivity meant that ecodesign was a cause for Industrial Design to champion .

*"We want to go back to the business and say 'Here..., Look....!' This is what we can do! And to show them something they didn't know they wanted"*

### 5.8.1.4 Aims Category Summary

<b>Category</b>
<b>AIMS:</b> The pilot project had various aims of importance to designers and to innovative ecodesign. These include:
<i>Properties</i>
- <b>Education:</b> to learn about and be introduced to ecodesign.
- <b>Empowerment:</b> to empower designers to do ecodesign.
- <b>Transferability:</b> to transfer appropriate techniques and methods to Industrial Design practice.
- <b>Promotion:</b> to promote the department as a strategic resource and an eco-champion.

## 5.8.2 Design process



This section provides insight into the design and ecodesign processes used in the pilot project. It should be noted that there are a number of ways to understand and describe the design process (Evbuomvan, Sivaloganathan and Jebb, 1996; Cooper and Press, 1996). The aim here is to define and describe unique characteristics of the 'Innovative Ecodesign' or Industrial Design based process. As these are early conclusions drawn from a single (though comprehensive) case, the descriptions will be more indicative than definitive.

#### **5.8.2.1 Open and Innovative**

As highlighted previously, existing ecodesign conducted by the company and in practice more generally were not seen as especially relevant or transferable to Industrial Design. This was described as 'eco-engineering', which *"(f)or Industrial Design the subject seems technical and requiring a lot of statistical information"*. A fundamental part of the process was for designers to define their own direction and approach, with a project allowing the freedom to do so. As a participant-observer noted:

*"What was really interesting was that the workshop was so non-prescriptive."*

An uncritical, free and open project approach was also identified as an important factor within the design process. This is characteristic of most Concept Design projects.

*"The key tool was freedom and the chance to broaden the design space. There were really no 'tools' to help design team..... The other thing was, how do you win a competition and what will look good in a magazine."*

#### **5.8.2.2 Constraints and Clarity**

In sharp contrast to this open and innovative nature the project also required clear limits to innovation and creativity. Here the balance within this project was between innovation and appropriateness, where certain ideas would 'breach' the project and design requirements while a 'sensible' balance of design innovation was sought. For example the groups were conscious of real design constraints, summarised in the competition entry as:

*By not ignoring the real world issues we believe that our working process has been realistically constrained and that the resulting innovations will have a strong understanding from future generations.*

Further examples of this was the groups insistence on designing new product concepts as the outcome, to make them recognisable and tangible, whilst remaining within existing Industrial Design capabilities that of (product design):

*Our approach has been to take the lead with the production of 'one-off' innovative products, which facilitate awareness.*

#### **5.8.2.3 Link ecodesign to existing practices**

Another characteristic of the design process was that designers appeared to fit the task to their existing practices of Industrial Design. At a certain stage within the two day pilot workshop, the researchers noted that Electrolux designers took control of the workshop and moved into, what was described as the 'comfort zone', or their traditional design territory. One designer later noted at a particular stage of the project, *"Then we just got on with it and did what we normally do which is ideas, I mean new product concepts."*



#### **5.8.2.4 Ends-driven**

The project, though containing various other design considerations always retained a clear picture of the outcomes. In many ways the outcomes or goals – products – were decided even before the approach, with the design processes being very much ends-driven. Design specific goals were to design and produce results and outcomes in the form of products and models, as: *“(m)odels were built as a visual reminder to demonstrate the transition from theory to practice and from vision to reality”*. A clear picture of the ‘ends’, in this case as products seems important to the design process.

#### **5.8.2.5 Consumer orientation and user focus**

The pilot project also highlighted various ecodesign characteristics unique to Industrial Design practice as well as ecodesign. The first of these is that the Industrial Design process is characterised by its focus on the consumer. The Electrolux design process *“always starts with the consumer!....., the consumer, the consumer, the user!”* Within every project (Concept, Core or Continuous Improvement) the first step is the identification of the customer profile and needs. Within the pilot these ‘consumer focused’ design processes were evident in a number of ways, including:

*Definition of the target consumer - Developed from accepted clusters of ‘Innovative and Responsible’.*

Here, Electrolux information from the European ‘Consumer of the Future’ (containing consumer clusters and lifestyle patterns was used to define the pilot projects target audience. The ‘Kitchen Behaviour Map’ (figure 5.6) was also used to define types of behaviour within the kitchen, along with some potential environmental interventions within these.

*Use the kitchen functions map as a checklist of functional needs and spiritual desires. Order – prepare – eat – dispose – digest.*

This consumer focus is also evident within the products themselves. For example, the flexible tap on the ‘Smart Sink’ (figure 5.11), which changed from jet, to spray to mist is an example of this consumer considerations in design, using ecodesign interventions during the ‘use’ of products, when washing crockery or food. Similarly, the access to information so prevalent in many products, such as the ‘Data-Wall’ (figure 5.17) and the very purpose of the ‘Portion-Projector’ (as means to communicate food quantities and reduce waste (figure 5.16), are other examples of design processes considering consumer behaviour and awareness. The most explicit example of this consumer orientated is in the overall project title as ‘Awareness’.

#### **5.6.2.6 The ‘eco’ in ecodesign**

Environmental issues played a rather ambiguous, often periphery role within the pilot project. Though they were the aims and purpose of the project, they were often side lined or shelved within the driven for innovative ideas, new thinking and approaches. Environmental issues seem only to be used as a reference or start point, while the main aims were innovative and creative thinking and designing resulting in new products. At one stage within the workshop, designers realised that environmental goals were being ignored, and one participant questioned, *“where’s the eco?”* as the subject matter had been lost in pursuing existing design process and goals. Successful ecodesign was measured within the project not in environmental improvements, but on



the simple existence of these products and on the designer's ability to generate and develop them. When environmental issues were considered, no environmental quantification was requested throughout or after the project. Designers had little concern as to whether these products are actually environmentally beneficial as the design ability to generate them was the apparent judgement criteria. The 'eco' in ecodesign is often lost, or shelved in service of the free-flow of ideas, creativity and innovativeness.

### 5.8.2.7 Design Process Category Summary

<p><b>Category</b></p> <p><b>DESIGN PROCESS:</b> Innovative Ecodesign processes followed by designers have a number of unique characteristics, including</p>
<p><b>Properties</b></p> <ul style="list-style-type: none"> <li>- <b>Open, broad and innovative:</b> allowing designers freedom to explore and define their own path.</li> <li>- <b>Constraints and clarity:</b> Some clear guidelines and boundaries in which to wander.</li> <li>- <b>Linked to existing practice:</b> Ecodesign was 'fit' to existing Industrial Design processes.</li> <li>- <b>Ends-driven:</b> the project had a clear 'vision' of the goals or outcomes even before the design process began.</li> <li>- <b>Consumer focus:</b> consumer and user centred design considerations .</li> <li>- <b>Eco-ambiguity:</b> environmental issues play an ambiguous nature, often not being the primary design objective.</li> </ul>

## 5.8.3 Information

The information cluster deals with the types of information and stimulus required and used within the pilot project. Ultimately, it was Cranfields' responsibility for steering the design process by 'feeding in' various information and stimulus. At these stages the definition of the correct or most useful types of information was done very much on an ad-hoc, 'hit or miss' basis. The emphasis was on variety and diversity at these initial exploratory research stages. However industrial designers and projects of this nature appear to require particular types of information.

### 5.8.3.1 Demand side Information

The first of these connects to the consumer focused design processes highlighted earlier. Designers require some technological, material and supply-side information (that more traditionally expected), as well as consumer focused or demand-side information. In the workshop this was soon to emerge frequently, as one designer stated, "*What about consumers...? Because the user is as confused about environmental acts as we are!*" and was to emerge in design developments constantly. This was also notable in the use of consumer clusters and profiles:

*Use the 'Consumer of the Future life-styles (see section 5.3.3) of innovative/responsible as a design decision focus.*

Consumer focussed information not only appear through consumer clusters, but also in an emphasis on consumer behaviour. Using existing knowledge, designers "*noted that modern users have different lifestyle patterns that dictate differing requirements from the kitchen, at different times of the week*". Current kitchen lifestyle patterns were described as "*80% convenience; 20% slow food*". These requests for, interest in and



use of consumer focus information types was a constantly recurring theme and frame of reference throughout the pilot project.

### **5.8.3.2 General Ecodesign Principles**

Information also needed to be simple, consisting mostly of general ecodesign strategies, definition or principles. The relative inexperience of the designers and the introductory nature of the project could explain this. However, as the project developed requests for simple forms of information and simple ways to describe ecodesign or relevant environmental information remained. Such simple information type were recognised as a key to successful ecodesign, for example one designer reflected after the workshop, "...then when we went away and went over what you had said about it... *Ecodesign is system not product, ecodesign is good design, etc, it all fitted into place and made sense.*"

Various general principles or models became design references throughout this and subsequent projects. The most prevalent of these was Charters 4-step model of ecodesign innovation (section 2.3.2.2), "*(t)he hierarchy of repair, refine, redesign and rethink takes time to adjust to but is a strong model*", later becoming the reference for all ecodesign activities. Also, the 3-R's model of ecodesign (Reduce, Reuse, Recycle, see section 2.3.2.1), became the overall ecodesign strategy for the entire pilot project (see figure 5.6 and the reference below):

*Applied ecological strategy - Reduce, Reuse and Recycle.*

### **5.8.3.3 Visually Presented**

A further findings is that information needs to visually and simply presented. There was little interest in quantitative data, and for information not represented in a stimulating manner. Information was requested in a visual format or summary form, on one-page. An example of this is the information on consumer behaviour within the kitchen presented as the "*(c)reation of kitchen function map- as a checklist of functional needs and spiritual desires: buy-store-prep/cook-eat-wash-dispose*" (see Figure 5.5). Similarly, during stage 3, the company requested the 'Eco-Ideas Map' (figure 5.8). These presented various strategies, examples and approaches in a visual format on a single sheet, and were highly successful and of critical importance within concept development.

### **5.8.3.4 Applied information**

Ecodesign and the resultant information also needs to be substantiated with examples and illustrations, as designers felt that, "*(a)ll of this stuff only makes sense when supported by examples*". In this sense case studies and examples of other design projects and designers approaches seemed most relevant, as they immediately apply and transfer to design.



### 5.8.3.5 Information Category Summary

<b>Category</b>
<b>INFORMATION:</b> The information and stimulus requested and used by designers in the pilot study had specific properties:
<b>Properties</b>
<ul style="list-style-type: none"><li>- <b>Demand-side:</b> contained consumer, user and lifestyle information in a variety of forms.</li><li>- <b>Simple:</b> consisting mostly of general ecodesign principles and strategies.</li><li>- <b>Visual:</b> needs to be visually presented in a stimulating manner.</li><li>- <b>Substantiated:</b> extensively applied using case studies and examples transferable to design.</li></ul>

## 5.8.4 Innovation

The pilot project suggested some unique characteristics of ecodesign innovation itself. Many of these are not explicit in the literature and existing theory. This category describes the 'nature' of ecodesign innovation as undertaken within the pilot project.

### 5.8.4.1 Consumer focus and demand-side orientation (social innovations)

Following from the conclusions for the design process and information requirements, the design innovations conducted here were clearly and distinctly 'consumer focussed' and 'user centred'. This became apparent not only in the design discussions throughout, but also through the product concepts themselves. For instance, in describing concept no. 6, one designers stated, "(s)o we said 'ah yes, we need to get people not to cook to much... what about a portion projector..!' etc. it was all about awareness...., consumer awareness!". The competition entry summarised this consumer design focus:

*Market up-take, social attitudes and credibility were also key to our approach.*

### 5.8.4.2 Education, Communication, Awareness

Central to this consumer-orientation were ideas of education, communication and awareness. Within the project approach, designers felt they could influence consumers and behaviour via the products themselves, rather than via the provision of explicit information such as leaflets, booklets or handbooks. Such notions of products as communication devices, having visual cues to elicit certain use patterns or forms of behaviour is often referred to in design literature as product semantics (see for example (Krippendorf, 1995; du Gay et al., 1997). It is extensively used by designers to contexts such a signage or graphic communication, product safety and usability, but is distinctly absent within the ecodesign literature. In a sense, the products themselves are 'containers' of information and meaning able to implicitly educate and communicate, which here is "... produced by systems, which outwardly communicate their efficient resource use and in parallel actively distribute information about their benefits."

### 5.8.4.3 Desirability

Further conclusions relate to 'desire' and 'desirability'. Designer felt a key role for themselves was in designing and promoting new products and forms of behaviour, that are more environmentally favourable and preferable to consumers, thus encouraging people to 'buy-in'. Within the project this was described as 'Appealing – Adaptable - Alternative' (see figure 5.7). Design desirability is strikingly absent from ecodesign literature also, whilst being a central and recurring theme in design literature. It is also



strikingly different from the technical, material and detailed design emphasis of much ecodesign literature and practice to date. This theme of increasing the desirability of certain alternative was termed “eco – erotica”, and also stated as “ecology can be sexy!” within the project, and became a factor in which designers felt they could play a central part.

#### 5.8.4.4 Innovation Category Summary

<b>Category</b>	<b>INNOVATION:</b> The nature of the ecodesign innovations within the pilot has various unique characteristics also.
<i>Properties</i>	<ul style="list-style-type: none"> <li>- <b>Social Innovations:</b> The focus of much design innovation was on consumers, rather than materials, production processes or technologies.</li> <li>- <b>Education, communication, awareness:</b> designers could raise awareness and educate consumers via the product itself.</li> <li>- <b>Desirability:</b> increasing the desirability of new 'eco-options'.</li> </ul>

#### 5.8.5 Project

Within the pilot, various findings can also be drawn regarding the success factors and the barrier within the project. These may highlight consideration factors for other similar projects.

##### 5.8.5.1 Manageable and Achievable

The key to this is ensuring designers set targets and conduct design activities that are achievable in terms of the skills they possess; their role within the company and society; and to some extent for the time and experiences they have. In the pilot, this was aided by a clear ‘vision’ of the goals or outcomes as products. This helped ‘bound’ the project. The identification of the kitchen boundaries (fig. 5.6) and the kitchen as a system was also of critical importance. Often defined as a systems focus, this broadening of the project was kept manageable and achievable by defining the aims as the design of ‘product solutions’ within this redefined ‘kitchen boundary’.

##### 5.8.5.2 Time constraints, competition and location

Having a time limit and clear competition guidelines also helped frame the project whilst directing design decisions.

*“Well we think its was a very successful project. I think that one of the key factors was the competition. Having this project as a competition to enter, with a tight deadline and clear deliverables was really useful. It meant that we didn’t wander around, not making any decisions or not go anywhere.”*

The off-site location played an important part as it “dissolves the customer / client relationship” whilst the “non-contractual side also makes a more even playing field etc.”

##### 5.8.5.3 Defining a process and approach

Designers also highlighted the importance of introducing ecodesign as a process or approach within the project. This clearly aided comprehension of ecodesign, empowering designers and enabling the resultant design processes and ideas to be generated. Amongst this was the definition of “(e)codesign is system not product, ecodesign is good design, etc..”



“... you see this was what worked at Loosehill because you stood up and talked about the idea of reuse, recycle..., you know design. And then from that its like, here’s the turning point for me because we’ve got the right facilities and skills..., we’d have never come and said ‘think of that as a process!’. Well we may have done, but just by saying ‘there’s stuff there’, ‘there’s stuff here’, ‘there’s stuff there’..., that’s what worked.”

#### 5.8.5.4 External change agent

Designers highlighted the importance of an external stimulant, noting that the project would not have succeeded, without the external driving force, direction and knowledge of Cranfield. It is important that this contact is external, bringing impartiality and objectivity. “External ecodesign specialist is important to success. It’s also important they are impartial.”

#### 5.8.5.5 Project Factors Category Summary

<b>Category</b>	<b>PROJECT:</b> The project itself had various issues identified as important success factors or obstacles.
<i>Properties</i>	<ul style="list-style-type: none"> <li>- <b>Manageable and achievable:</b> not be too difficult, challenging or complex.</li> <li>- <b>Time constraints, a competition and the location:</b> have clear and pre-set guidelines aided the success as did an off-site location.</li> <li>- <b>Defining a process and approach:</b> Introducing ecodesign as a process.</li> <li>- <b>External change agent:</b> input and guidance from an external party.</li> </ul>

### 5.9 Summary of Pilot Conclusions

The pilot project highlighted a number of key findings, whilst developing several conceptual categories around which to collect and analyse data. These included:

- *Project aims:* there were various design and project aims expressed within the pilot project, which include: education; empowerment; transferability and promotion.
- *Design process:* the design processes followed have characteristic specific to ecodesign, some properties of which can be described as: open and innovative; constrained and clear; ‘fit’ to existing practice; end-driven; consumer focussed; and eco-ambiguous.
- *Information and Stimulus:* the information requirements of designers conducting ecodesign consist of the following characteristics: demand-side orientated; simple; visual; and substantiated
- *Nature of Innovation:* the nature of innovation undertaken within the pilot were highly novel and unique in the following ways: focus on social innovation; they education, communication and raise awareness; deal with desire and desirability.
- *Factors with the Project:* there were a number of generic factors highlighted as key to success or as potential obstacles. These include: manageability and achieveability; time constraints, a competition and location; defining an ecodesign process; an external change agent.

These themes and initial conclusions were drawn within the original research framework, aims and objectives prior to the pilot study.

### 5.10 Change to Research Design



As highlighted in chapter 4 (section 4.5.2), the pilot project led to a change in the research design, and some alteration to the research questions. Prior to the pilot, this enquiry focused on the following research questions:

- How does an early stage (industrial) design department integrate ecodesign?
- How do industrial designers conduct ecodesign?
- What are the characteristics and practice of more innovative (or early stage) ecodesign?

The pilot was conducted with the Concept Design team, as part of Primary Development activity (see section 3.4.2). The original enquiry focused on the early stages of the product development process, whereas in actual fact, Primary Development consist of research and development phases not directly linked to product development.

The main study was also conducted entirely with the Concept Design team from the single case within this Primary Development context. In many ways this might be described as the 'earliest' of the early design stages, but represents an area of enquiry of uniqueness and novelty. This uniqueness and 'revelatory' nature only emerged within the pilot itself and was unclear to the researcher prior to the pilot. As industrial designers are, in many ways, the early stage designers, the research aims and objectives had not been lost, rather developed throughout the research process. The study now began to explore a novel design phenomenon and context, rather than strictly an integration process

#### **5.10.1 New Enquiry Questions and Focus**

Therefore whilst still satisfying the research requirements, the research design and subsequent questions were required to change. Rather than studying processes of departmental ecodesign integration, the enquiry now looked to:

- The characteristics of Innovative Ecodesign
- Practices of Industrial design based innovative ecodesign

The subsequent research questions were changed for the main enquiry, to:

- What is the nature and characteristics of Innovative Ecodesign?
- How do industrial designers conduct ecodesign?

This is important to acknowledge as several conclusions from the pilot study though satisfying the objectives and research questions for the original enquiry (pre-pilot) were no longer relevant for this new research context. For example various conclusions for the project aims, though providing insight into processes of ecodesign integration, shed little light on the nature of this pre-product development based ecodesign.

Data Collection and analysis within main study therefore begin with these pre-defined conceptual research themes, though these developed and matured throughout the enquiry to suit this research change. The main study aims are as follows:

- *Verification:* To verify and validate the emerging conclusions drawn from the pilot study.



- *Expansion:* To broaden and expand the themes and conclusions drawn from the pilot study, via further cases and enquiry.

The goals of this are in providing a series of research findings on which to build theory and contribute ecodesign knowledge.



# Chapter 6

## MAIN STUDY: PRESENTING THE FINDINGS & MODELS

*This chapter presents the findings from the main study within this enquiry. Its aims are to verify and expand the emergent research themes from the pilot project. It begins by discussing the collaborative and methodological procedures, then goes on to present data under the two key research themes identified at the pilot completion. Findings are presented and discussed via the conceptual analysis cluster and properties developed throughout the main study, to inform verification, confirmation and discussion in the following chapter.*

### 6.1 Moving from the Pilot to the Main study

This section presents the key research findings from the main study. It will begin with the transition from the pilot to the main study, as the pilot study findings were used as the basis and starting point within the main study. This aimed to identify data collection and analysis categories and properties on which to base findings and draw conclusions for the two research areas highlighted earlier. *"A category stands by itself as a conceptual element of the theory. A property, in turn, is a conceptual aspect or element of a category"* [Glaser and Strauss, 1967, p.36]. Findings and conclusions will be drawn from these conceptual analysis categories and properties.

#### 6.1.1 The research focus after the pilot

Section 5.10, presented a change in the research design on completion of the pilot project. Whereas previously the enquiry had focussed on:

- Early stage ecodesign integrate into the product development process?
- How industrial designers conduct ecodesign?
- The characteristics and practice of more innovative (or early stage) ecodesign?

Now the study had moved to earlier stages of product development or Primary Development (in Concept Design). This led to a funnelling of the research objectives into two distinct research themes, which can be summarised as:

- The nature and characteristics of Industrial Design based ecodesign
- Practices of more Innovative Ecodesign.

These two research themes (visualised in figure 6.1) were used as a data collection and analysis framework analysis within the main study, and based around the followed research questions:



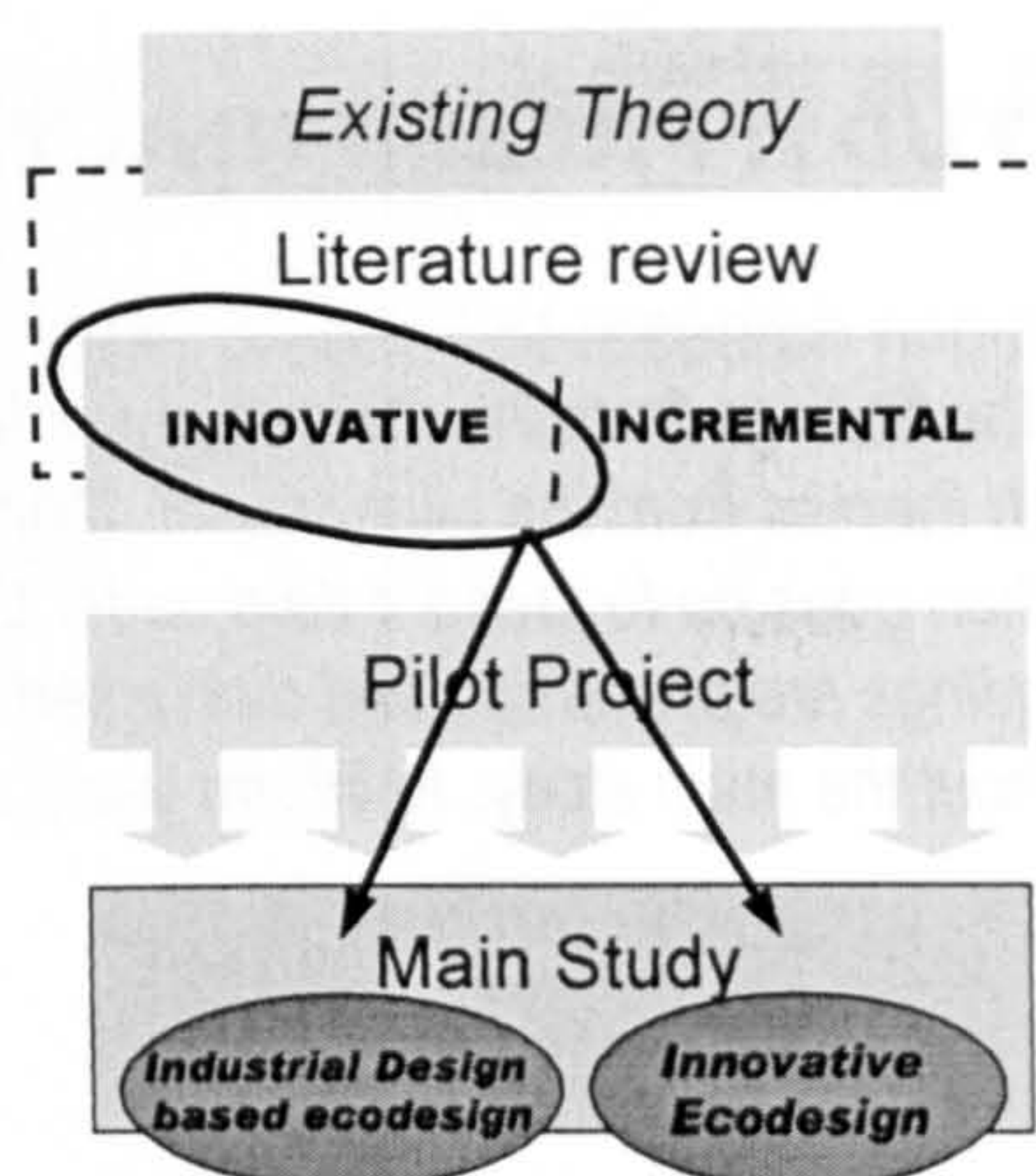


Figure 6.1: Visualisation of the research focus within the main study

### 6.1.2 *Research questions within the main study*

- What is the nature and characteristics of Innovative Ecodesign?
- How do industrial designers conduct ecodesign?

## 6.2 **The collaborative process throughout the main study**

After the pilot project, the company requested further collaborative proposals from the researcher, with similar aims and processes to the pilot. This tied in closely to the research requirements and was seen as an ideal way to continue the research, but did result in an adjustment to the research design described in sections 4.6.3.1 and 5.8. After some thought and reflection, the researcher devised 8 potential projects, of which the company decided to select one, the Service Design project based around ecodesign themes described in section 2.10.5 This project took place from February to October 1999, with various other design activities arising and projects 'spinning off' as a result or sideline from this.

From approximately August 1998 to February 2000 the key collaborative period of the main study was undertaken. It was during this period that the researcher had the greatest access to the company, gaining their trust and confidence. The data collection and analysis within this context was a simultaneous and concurrent processes, allowing the research an opportunity to develop, pursue and confirm core themes within the enquiry. The researcher's access allowed key themes to be revisited, questioned and conducted over time.

### 6.2.1 *Pilot Conclusions*

The core conclusions from the pilot project were 'bought forward' and used as the commencing themes within the main study. As is the nature of qualitative research using the inductive method, the research clusters on which the core themes and resultant conclusions were based were emergent and developed even throughout the main study (in the same sense as the findings themselves). Analysis clusters on which findings and conclusions were based were therefore moved, merged or simply discarded throughout. The following findings were brought forward from the pilot study to the main study:



<b>Aim</b>	<b>Design process</b>	<b>Information</b>	<b>Innovation</b>	<b>Project</b>
<i>Education</i>	<i>Open, broad and innovative</i>	<i>Demand-side</i>	<i>Social Innovation</i>	<i>Manageable and achievable</i>
<i>Empowerment</i>	<i>Constrained and clear</i>	<i>Simple</i>	<i>Education, communication, awareness</i>	<i>Time constraints, a competition and location</i>
<i>Transferability</i>	<i>Fit to existing practice</i>	<i>Visual</i>	<i>Desirability</i>	<i>Defining a process and approach</i>
<i>Promotion</i>	<i>Ends driven</i>	<i>Substantiated</i>		<i>External change agent</i>
	<i>Consumer focus</i>			
	<i>Eco-ambiguous</i>			

Figure 6.2: Pilot study conclusions

However, these data collection and analysis clusters still aimed to relate to the two research themes and questiona described above. This will become evident when the findings and analysis procedure are presented later in this chapter.

### 6.2.2 **Data sources within the main study**

The main study uses data from a variety of projects and data sources taking place during the research. A number of projects were either initiated, conducted or planned as part of Concept Design activities in which the researcher had varying levels of participation, as: an action-researcher; or a participant-observer. Though the subject matter on which these were based differed, the core themes and aims are strikingly similar. All these innovative ecodesign projects had a strong concept design emphasis, thus qualifying them for this study. A table of the data sources and projects, is presented belo



DATA SOURCES FOR THE MAIN STUDY	
Project title	Summary and description
<i>Researcher in action research capacity</i>	
Eco-Kitchen Project	Concept based ecodesign project undertaken as pilot project (see chapter 5). Further data and reflection was used in the main study.
Service Design project	Aimed to study and develop methods to design eco-efficient services, whilst challenging designers to vision the organisation as a service provider (see section 2.10.5). This project was conducted in the same manner as the pilot project.
Shades of Green Consumer	This report aimed to build and describe European green consumer clusters and profiles, while also describing lifestyles and behavioural patterns. This did not directly result in designs or concepts, but did filter in to various projects in other ways.
<i>Researcher as participant-observer</i>	
Donor Products	An Electrolux sponsored college project organised and run by this researcher. Its aims were to find creative uses for second-hand or discarded Electrolux products, parts or components at the end of their 'useful' life. Relevant data here was from the initiation and generation, rather than the design phases themselves.
HICS project	An EU funded project to commence Oct, 2000, involving the research institutes and single case in question. This project extended many parts of Service Design stated above, aiming to design and develop methodology for sustainable product-service-systems (see section 2.?). This provided valuable data during intensive early discussions and the identification of the company's requirements, etc.
Viridian Energy Meter	A design competition for an energy meter to express and communicate energy usage and encourage behaviour change and awareness of energy use. Though the project did not materialised it did provide data.
Extreme Green and Basics	These two projects aimed to 'flip-down' certain ecodesign issues to core design projects (especially green consumers study and the Service Design project). These again did not materialise, but provided data concerning the contrast between primary and product development projects and how ideas are transferred between the two.
Other researchers work	Though the other researchers work was on a different enquiry, it was a data source for comparative purposes, while also significantly increasing triangulation of data from multiple researchers and collection and analysis methods.
Other data sources (some not project 'related')	These include: <ul style="list-style-type: none"> <li>• Advise and feedback about overall departmental ecodesign strategy and presentations</li> <li>• Advice on general project and departmental ecodesign issues</li> </ul>

Figure 6.3: Data source within the main study

The main study used data from multiple sources, using multi-methods of collection and analysis as well as a number of researchers, all aiding triangulation, construct and internal validity.

### 6.3 Analysing the Data

Throughout the main and pilot study coding and clustering data analysis techniques were used to find commonalities, emergent themes and conclusions. The coding and clustering procedures are described in section 4.7.1.

#### A note on visual data analysis

Along with the predominantly word and text based data, designers work in more visual ways using visual means. Designers for example, tend to conduct design using both verbal (spoken) and visual (sketched) methods. Electrolux designers also communicate



with each other and other departments or organisations in a visual manner using pictorially based PowerPoint presentations. These visual materials are a rich data source, and in themselves are illustrative of key ecodesign processes and findings. In this enquiry, these visual forms of data are used as a form of research verification, to confirm and validate theoretical findings drawn from the verbal coding system within the main study.

### **6.3.1 The clustering procedure**

The coding system helped cluster data into manageable and meaningful groups. Throughout the main study, these clusters developed as illustrated in Figure 6.4 which presents a schematic representation of the clustering process from the pilot, through the main study to the conclusions. It illustrates a 'funnelling' of the data analysis to three final clusters on which conclusions were predominantly based. It also presents the properties of these three final clusters, visually illustrating the conclusions from which these were drawn, by relating them to the two key research areas.



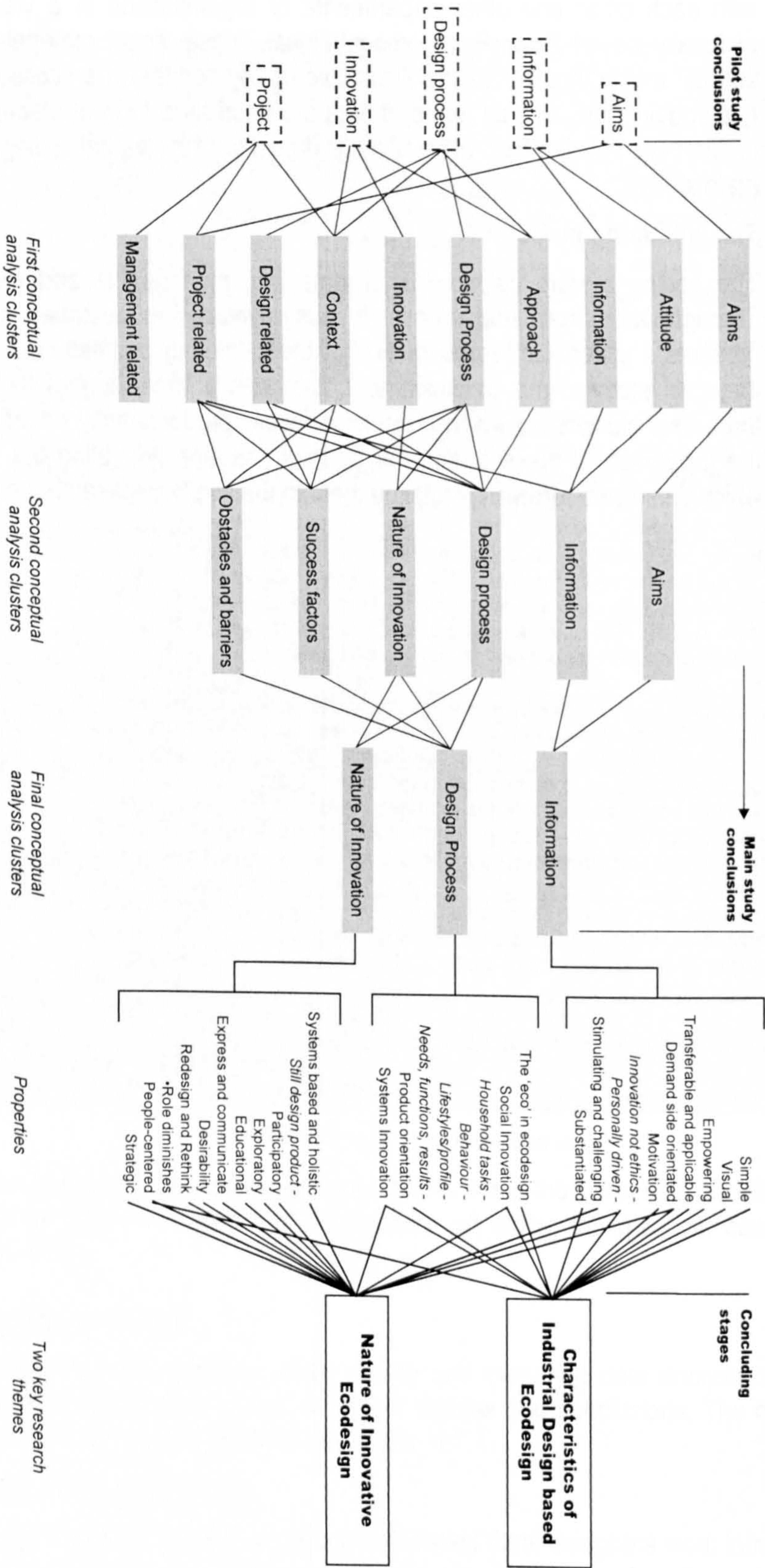


Figure 6.4: Schematic representation of the clustering process



## 6.4 Presenting the Research Findings

The following section presents the main study findings. The data will be presented relating to and under the headings of the two key research themes stated in section 5.8, on:

- Practices of Industrial Designers based ecodesign
- The nature and characteristics of Innovative Ecodesign

## 6.5 Practices of Industrial Design based ecodesign

This section presents findings from the first of these key research themes – Industrial Design based ecodesign. The pilot project suggested industrial designers conduct ecodesign in their own unique ways, not completely represented within the literature and existing theory. This part of the research stream aims to begin to fill these knowledge gaps. Though most of the projects providing data were practices of Innovative Ecodesign (or radical) projects, the findings from this section are more generalisable to other forms, practices and contexts of Industrial Design based ecodesign.

### 6.5.1 Information and Stimulus

Industrial designers have specific information requirements and are stimulated by specific things. Information and input is a fundamental part of the success of ecodesign projects (Bakker, 1995) and design projects more broadly (Snoek and Hekkert, 1998). The latter of these two studies suggested that information provided at the commencement of design projects (in the design brief) can significantly direct designers towards innovative solutions. This broadens the 'design space' increasing the opportunity for more creative and innovative thinking. Some properties of these specific Industrial Design requirements for information and stimulus are presented below:

#### 6.5.1.1 General

Within all projects and design activities there was a general requirement for 'general' forms of information in the shape of general ecodesign principles and strategies. Designers need only to understand some key principles to conduct ecodesign, helping inform, educate and guide overall design decisions and the generation of ideas.

*"I also really like the way Edwin is defining ecodesign (section 2.3.3.5). He's saying that ecodesign needs to be Solar, Safe, Cyclical and Efficient., and that's it. That's all it needs to be for me... So our designers just say 'Ok! Solar, Safe, Cyclical, and Efficient, that's all I need to think about and if I've done one of them then that's OK!' I think having 4 simple factors is an excellent idea to understand ecodesign on this really simple level."*

Towards the end of the enquiry, the current Environmental Design Co-ordinator began to refer to these as 'nuggets' of information i.e. small pieces of manageable information to feed into design. Not only should general principles be provided, but these should be articulated using simple, almost simplistic language. When discussing the linguistic style of ecodesign information, a senior designer suggested, *"its almost like... a secondary school language... Not, not patronising, but very much clear chapters and you can go as deep as you want..... but if you only throw long balls then everyone will sort of, lose it"*



### 6.5.1.2 Visual

Similarly information and stimulus needs to be presented and represented in ways appropriate to Industrial Design. Designers use visually presented material as their sources of inspiration and stimulus. If information is not presented in similar ways it is not likely to be successful and relevant to designers, as illustrated in the comments on ecodesign information presented by other internal environmental specialists:

*"This looks like the sort of general presentation that he (internal environmental specialist) gives out to everyone... the overview! He came in to do this to design. What you've got to realise that by the time it gets to this point everyone in design has like... gone (to sleep!). They've all gone! And by this one they've definitely gone! And they are saying, 'what am I looking at here? Is there a picture coming on the next one?"*

A clear example of this occurs in that designers source and collect material within the department by keeping and using a 'scrapbook' of relevant or interesting projects, products, images or materials.

*"Concept designer - What we want is like a scrap-book, or a database of ecodesign examples for inspiration*

*Researcher - Should this be on the internal intranet?*

*Concept designer - Well our designers don't really work like that, with electronic material all the time. We use scrapbooks and cutting and bits out of magazines and competitors catalogues. These are really the drivers for innovations. I mean my scrap-book is my life and soul"*

#### 6.5.1.2.1 Existing ecodesign information

Much existing company based ecodesign information is deemed to fail in that, not only was it not the right form of information for industrial designers, but it was not presented in a format or style relevant to their needs (Sherwin and Evans, 2000). The comments below regarding an Internet based information tool illustrate this well:

*"Senior Designer - Also have you seen the (ecodesign information) tool?*

*Researcher - No*

*Senior Designer - Well I'll show it to you. Basically its in-house environmental training, its to train up all the staff on every site. And basically anyone anywhere can have access to this on the Intranet. We've won awards for this...*

*Ask a designer if they use it, and its like 'No! Oh, and well why is that? Well, because it's pig ugly, and it's a pig! I mean look at, how long have we had to wait for this to download. It's like, designers would be off by now... They'd be bored, and go check out, I don't know the Alessi website... or the new, I don't know Philips products, or try and get a job or something.... Or even the weather!"*

#### 6.5.1.3 Empowering and transferable

The information provided needs also to be transferable and applicable to industrial designers. There was a general feeling that much ecodesign information, tools and methods were simply not developed in sympathy with designers and not immediately transferable to their own design process. The perceived role of the present Environmental Design Co-ordinator illustrates this well, "my role now is like a fitter.., I have to beat the ecodesign stuff into the department and make it fit what we do already and work within the exiting work patterns.... To fit industrial designers needs."

The appropriateness and applicability of ecodesign related material to Industrial Design was a constantly questioned and scrutinised. Again the Environmental Design Co-ordinator states:



“... my thoughts and the point of all discussion are always... how can I turn this information into a design brief? How can I make a decent brief out of it? And then if I can't see a decent brief in it. If its not something industrial designers can get to grips with, then I'll happily pass it on to other departments. I mean, I want to find out about the research, but it has to be design-focussed research.”

#### 6.5.1.4 Substantiated

Information and stimulus is better received and most useful when substantiated with case studies and examples. Indeed this application of often abstract design principles seems the most relevant format for industrial design based information and stimulus. In many ways examples are seen as a valuable source of 'off the shelf' models or design approaches immediately transferable to Electrolux, as articulated within a discussion from a design based workshop:

*“Designer 1 - Or maybe we look to other industries of who has done this before. And when you find one that's doing it better and you copy it. So I was just thinking again of banks, insurance.*

*Participant researcher - Phones, what the telephone companies are doing regarding service is really advanced*

*Designer 1 - For me where we are failing here is that we haven't got a wall full of good examples of where other people are doing it elsewhere. And we look at them and say that's so bloody good. Because most things in white good is.., you copy somebody else whose actually innovating.”*

The most explicit illustration of this occurs within the SEEDS projects (Fig. 6.5) intended as a kind of Sustainable Innovation database containing examples of ecodesign and other environmental or sustainability related matters. This aimed to begin a dialogue and provoke designers into action using a means and language they understood – examples accessible via the Electrolux Intranet.

*“So what I want to do is develop a gallery or notice-board of sustainable innovation. Something that you and we can pool and both have the same examples... Then give it a sexy name and everyone will use it!”*

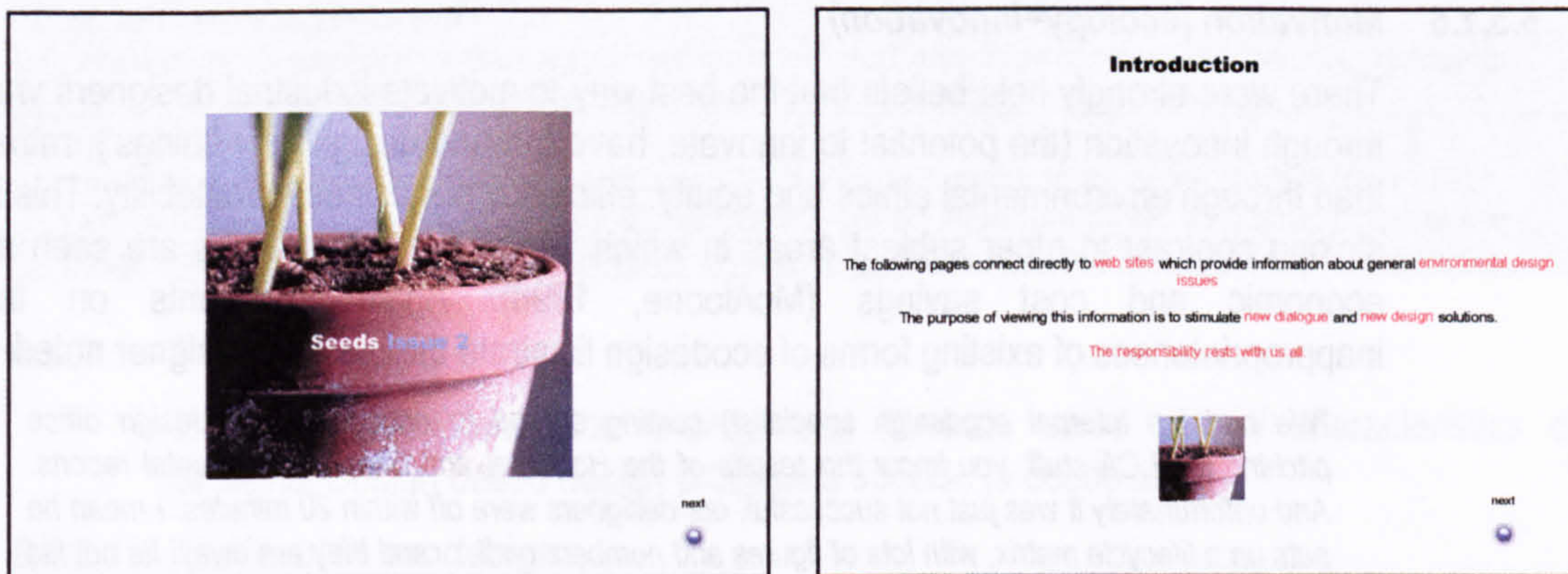


Figure 6.5: Images from the SEEDS database

#### 6.5.1.5 Demand-side orientated

A commonly recurring information theme within this research was the request for and use of consumer orientated and user-centred information and data. This occurred in a number of ways, but was common to all project in some way or other. For instance, as a designer requested in the Service Design project, *“what I really want is some scenarios..., and some consumer profiles for a variety of eco-strategies like service,*



consumption change, etc... We need scenarios and situations that help us understand what sustainable consumption and sustainable lifestyles need on a micro scale."

The most explicit of these requests for consumer related research was the Shades of Green Consumer report. This aimed to describe profiles, clusters and lifestyle patterns for European green consumers, whilst describing their lives largely through visual, material and product means. The sample profile and quote below from the study illustrates the aims and interest of the study:

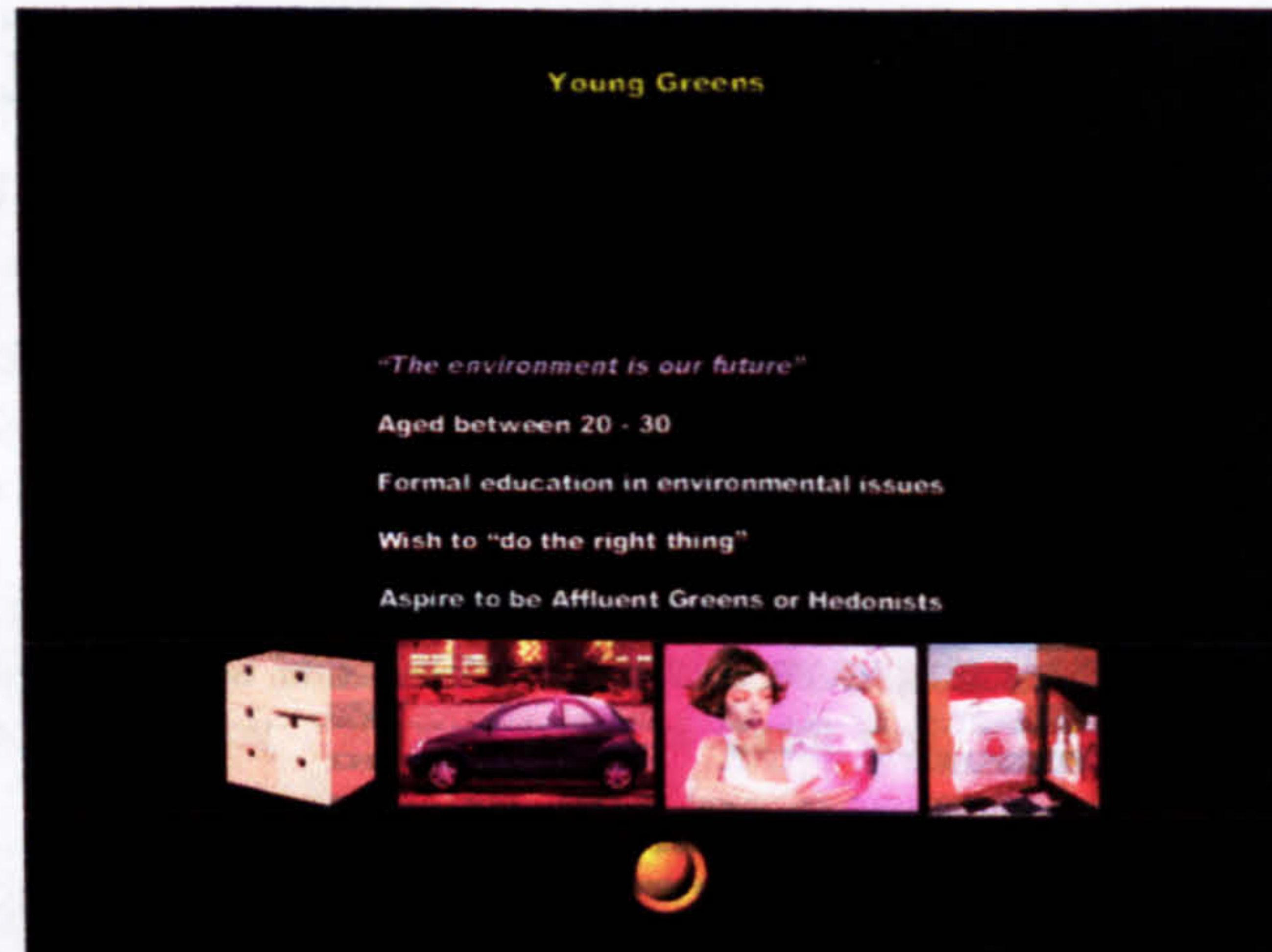


Figure 6.6: Sample of one consumer cluster from the Shades of Green Consumer study

*Environmental design co-ordinator - We want profiles and lifestyle descriptions of Green Consumers, they have to be specific... we want to know the similarities and differences between green and service consumers*

*Researcher - And do you want anything on green consumerism?*

*Environmental design co-ordinator - Well, yes general stuff on Green Consumerism is useful but not essential..."*

#### 6.5.1.6 Motivation (ecology=innovation)

There were strongly held beliefs that the best way to motivate industrial designers was through innovation (the potential to innovate, have fun and design new 'things'), rather than through environmental ethics and equity, efficiency or business profitability. This is striking contrast to other subject areas in which the primary motivations are seen as economic and cost savings (McAloone, 1998). Again comments on the inappropriateness of existing forms of ecodesign illustrate this, as one designer noted:

*"We had (an internal ecodesign specialist) coming around to each industrial design office pitching the LCA stuff, you know the results of the Hot, Wet and Cold environmental reports. And unfortunately it was just not successful, our designers were off within 20 minutes. I mean he puts up a lifecycle matrix, with lots of figures and numbers on it.... and they are away! Its not his fault, its an inherent problem with designers.. The farthest you can get them to read is Design Week and then they turn straight to the back for the job page. So they walk away from their magic markers to this presentation, and say "this is just not what we do!" They are interested in innovations and things and he shows figures and graphs."*



### 6.5.1.6.1 Personally driven

There was a strong feeling that ecodesign and environmental issues more generally need to be driven initially by designers themselves. Design is very much self-initiated and non-prescriptive with design achievements measured on the outcomes. Designers often do not receive a clear set of specifications or design requirements and the onus is left to the individual.

*“You have to understand how the design briefs are written at Electrolux. You see we don't have a formal design brief as such, I mean we get information from marketing and through our design managers and then we rewrite it and fax it back to them..., Its not really a design brief as such”*

Driving ecodesign therefore will very much “be left up to the individual designer, as no one else will do it”. In the long-term however there was increasing recognition that this was a design management issue and needed such senior commitment to ensure its success in the mid to long-term. *“Ultimately this will be driven by design management and I'm not sure how to motivate and engage design management”*, a question still unresolved at the research completion.

### 6.5.1.7 Summary of findings on Information for industrial designers

<b>Information and Stimulus</b>
<b>General</b> General ecodesign principles and strategies, rather than exacting or quantifiable data.
<b>Visual</b> visually presented and represented
<b>Substantiated</b> with examples and case studies and applied to design contexts
<b>Empowering</b> Information and stimulus needs to be transferable and applicable to the working practices of industrial designers. Many existing methods and techniques are not seen to do this
<b>Demand-side orientated</b> Designers require and requested consumer orientated and user-centred information, including: behaviour; Lifestyles; consumer profiles; needs; and functional requirements.
<b>Motivation (ecology=innovation)</b> Industrial designers are seen as motivated by the opportunities to innovate, rather than ethics, efficiency or cost reductions. Personal motivations are an important driver as design projects are largely led and driven by the individual.

## 6.5.2 Design process

This section presents the findings that illustrate some unique characteristics of Industrial Design based design processes specific to ecodesign.

### 6.5.2.1 The 'eco' in ecodesign

Environmental factors appear to play a rather ambiguous role within Industrial Design based ecodesign. Though they are often a key consideration, they are often not the 'primary generator' or motivator within the design process. The concept of a primary generator (Drake, 1979 described in Cross, 1992, Roy, 1993) describes the primary motivation for design development, which may range from a usability problem with an existing product, through to an identified need within the developing world. A *“primary generator, (is an) essential generating idea, behind the invention or new design. This (arises) at the beginning ...in the project, and provided the guiding concept for all the design and development work that followed”* (Roy, 1993, p.439). For industrial



designers the primary generator appears not to be environmental problems or the design and proposals of environmentally preferable alternatives only. Rather it was frequently the opportunity to innovate and design new 'things'. Within a variety of projects this was evident, particularly the Viridian Design competition (see figure 6.3) planned as a collaboration with a leading design college for which the Environmental Design Co-ordinator stated, *"I don't really even want to put ecodesign in the title, I don't really want to push or sell the 'eco-stuff'. This is about people, not products or technology."*

As well as playing this 'covert' role, as an almost hidden agenda, environmental issues and priorities are often subordinate to other innovation drivers and seen to 'piggy-back' on other design factors. This was particularly obvious when the Service Design project priorities were listed:

*We shouldn't push this into inappropriate territories.... Our questions should be:*

*-How can services improve eco-efficiency?*

*-Cost vs less to produce*

*-Satisfy customer needs*

*-Make life easier, more convenience for consumers*

*-Eco-efficiency (saving the planet)... this is of no interest to consumers. This is a hidden agenda*

### **6.5.2.2 The role of the product**

The 'product' plays a similarly ambiguous, often contradictory role within Industrial Design based ecodesign. The product seems to be both a 'means' and a 'goal'. The product is a means in the sense that design processes are played out largely through 'products' i.e. the product is the 'solution' to specifically identified 'problems', (product-orientation) and is also an examples of the departments 'culture of designing'. When commenting on future ecodesign developments at the beginning of the research, the ecodesign co-ordinator at the time noted, *"basically the next thing we are going to do is an eco-audit of an existing product. We want to focus on the outcomes... on product outcomes. What does it mean for design?"*

There is a strong sense that designers will design the material, the 'hard' or the product dimensions of any ecodesign based innovation even when its considerations extend beyond the product into other production and consumption stages. When commenting on feedback given on this product orientation of much design thinking, the Environmental Design Co-ordinator replied:

*"I was struck by your comments on product-orientated thinking. We didn't imagine the whole system! We need to think about the total service... then pick out products that make this up! The service needs to be the satisfier, then we'll design the products for this."*

#### **6.5.2.2.1 The product as a help and a hindrance**

This product orientation appears to be both a help and a hindrance. Product orientation can aid designers in the sense that it ensures design projects are manageable and tangible, and 'fit' existing Industrial Design based practice. A comment from a Service Design workshop noted:

*"So our role is not going to be to design the service. Well we are going to conceive the service and then design the tools to carry out that service, so it will link back from that need back through. So we are like designing taxi's..., well there's the service and we are going to have to design the*



*design the taxi, but that taxi will not be a car. No one drives a taxi as a normal car.... It will be designing products that provide services rather than designing products that are just products...  
....Because otherwise I just think we are going to end up being physically sick because we don't quite know where we are going!"*

This can also be a hindrance however in that the product may not be the only or even most appropriate output for projects, especially in ecodesign which is broadly aimed at diminishing the role and presence of materials and products. Again this was evident within the Service Design project overstating this dematerialization and aimed to explore and design completely non-material and eco-efficient services:

*"Designer 1 -The idea is to understand a consumer's life, across everyday living in the home, that's the brief, and to demonstrate the potential advantages of services to improve that life.*

*Designer 2 - Hopefully through a product relationship!*

*Designer 1 - But that's a product relationship where relevant and positive.."*

#### **6.5.2.2.2 'Fit' to existing ecodesign practices and processes**

There was a strong sense that existing practices and processes of ecodesign do not completely fit those of Industrial Design and that designers need to define their own working practices and methods. In a summary of the types of ecodesign activities undertaken more generally within the company, the ecodesign co-ordinator at the time stated:

*Electrolux has a leading reputation in the field of environmental affairs. However the area of design which is praised in this existing work leans towards the hard – product efficiency. Industrial designers do not get down to that level of detail in the design process.*

#### **6.5.5.3 Consumer orientated (social innovations or user centred)**

Along with the requirement for consumer orientated information, there is strong evidence of a consumer orientated design focus. This was again a recurring theme within design discussion, with Industrial Design viewed as the consumer orientated design discipline responsible for among other things the visual appearance and appeal of products, and their usability.

*"We've pretty much figured out that production processes and toxic materials, etc are the responsibility of production managers and environmental affairs. These have an internal factory focus – the way something is produced. Basically what we can help with is consumption patterns and users.. the behavioural stuff...!"*

This user-centred dimension to Industrial Design, especially within Electrolux is confirmed by Larson's (1997) description of their role as responsibility as 'user interface' aspects of design (section 3.5). The potential for industrial designers to consider consumer related ecodesign considerations appeared in a variety of ways and through various projects, and is illustrated in the Viridian Competition discussed below:

*"I want to set a project at the RCA (Royal College of Art), with like the best students in the country, that's about consumption, about reducing consumption. To get designers to think about some of the softer issues of ecodesign. Not just the technological and material issues, but like how can we change people?"*

It was also evident in the departmental ecodesign presentation developed by the Environmental Design Co-ordinator and illustrated below. Here ecodesign was presented as both 'Eco-production' (product efficiency or hard issues) and 'Eco-



consumption' (use efficiency of softer issues). The accompanying comment represents designer's view on these issues:



Figure 6.7: Consumer orientation in departmental ecodesign presentation

*"We also realise that there are the hard issues of 'eco-production', and the soft issues of 'eco-consumption'. Well it is basically the soft issues..., the 'eco-consumption' that industrial designers can best contribute to."*

Such consumer-orientated design considerations manifest themselves in various ways:

#### 6.5.2.3.1 Behaviour and use of products

Behavioural issues were frequent considerations in design, as illustrated in a design discussion within the Service Design project, *"I just want something to tell me your milk is going bad if you don't use it today. I suppose bar-coding could do that and we as design could highlight the fridge fears of the user ie... you have something rotting in the back.... I think whichever way we go if we focus on the fears of the user we could get somewhere."*

#### 6.5.2.3.2 Lifestyle considerations and patterns

It was also essential to know how consumers live and what their values and ideals were illustrated in discussions from a design workshop, *"so we take a family... and er.. I'll stick these other things up here - food, washing, clothes, or whatever. And it's just their life, throughout the day."*

#### 6.5.2.3.3 Needs, functions, results

There was also a strong sense of returning to, identifying or satisfying 'needs' within the design process. This was articulated in several differing ways, that were often interchangeable though had fundamentally the same aims and purpose. This is represented again from design discussions.

*"Designer 2 - So why don't we start with needs? Look at needs?"*

*Designers 1 - OK well yes, look at needs? And look at needs for the categories we've just defined, we could take young people..."*



#### 6.5.2.3.4 A note of consumer orientation in design

It is important however not to misread this consumer orientation in design. This is not to imply that designers can design behaviour, consumption, lifestyles or needs. In fact what was happening was the designing of the product or the material means to influence or affect these factors. The 'Eco-kitchen' project highlights this well, as the Environmental Design Co-ordinator later describing it as "*not product design, but consumption design*", though clearly this 'consumption design' emphasis was expressed through material and product means as new product concepts (see figures 5.11 to 5.17).

#### 6.4.2.5 Summary of findings the Design Process followed by industrial designers.

<b>Design process</b>
<b>The 'eco' in ecodesign</b> Environmental issues are not always the primary goal, driver or outcome of ecodesign projects. Environmental issues are often sub-ordinate or 'piggy-backed' onto other design drivers/factors
<b>Product orientation</b> Designers 'design' via the product. It both the goal and the means of the design process, therefore products are seen as the key outcome of ecodesign.
<b>Consumer orientated (Social Innovation or User centred)</b> Industrial Design considerations orientated more towards the consumer and user. Design considerations in relation to environmental issues include: behaviour, lifestyles, needs and consumption factors. (However designers again, design the material means to influence these factors).

### 6.5.3 Role

There are specific roles for Industrial Design within Ecodesign, representations of which are presented below.

#### 6.5.3.1 Ideas (creative and strategic thinking)

There was a strong sense that the creativity of industrial designers, such as the generation of ideas, new and innovative ways to satisfy needs and alternative design proposals was their greatest contribution. The view of their role within ecodesign developments was, "*the idea is for designers to add value with their creativity*". A specific requirement of industrial designers is the design and proposal of a variety of alternative new concepts and ideas (see section 2.6.1), rather than any specific environmental expertise or knowledge. This is fundamentally about new ideas, creativity and strategic thinking. It is well expressed by a senior designer, in discussing the nature of the Industrial Design – ecodesign relationship:

*"So, like first it was manufacturing that was king, then everyone could do that. Then marketing was king and now everyone could do that. But now we are back to ideas, its ideas that matter. With manufacturing you don't have to be concerned with the quality of ideas. With ideas you don't have to be good at manufacturing or marketing. I almost wanna write down that the 'eco' question refocuses on the quality of ideas."*

#### 6.5.3.2 Redesign and Rethink

It was felt that the most significant contribution industrial designers could make to ecodesign was up towards the 're-design' and 're-think', or more strategic phases of Charter's ecodesign innovation models highlighted earlier (section 2.6). This means of visualising and understanding their role was interpreted by the department itself, and



though somewhat simplistic, clearly articulates the view that industrial designers can engage more with the design and provision of new product concepts (innovative approach) than with existing product redesign (incremental approach) characterising most current ecodesign practice. A slide from the department's ecodesign presentation indicates this:

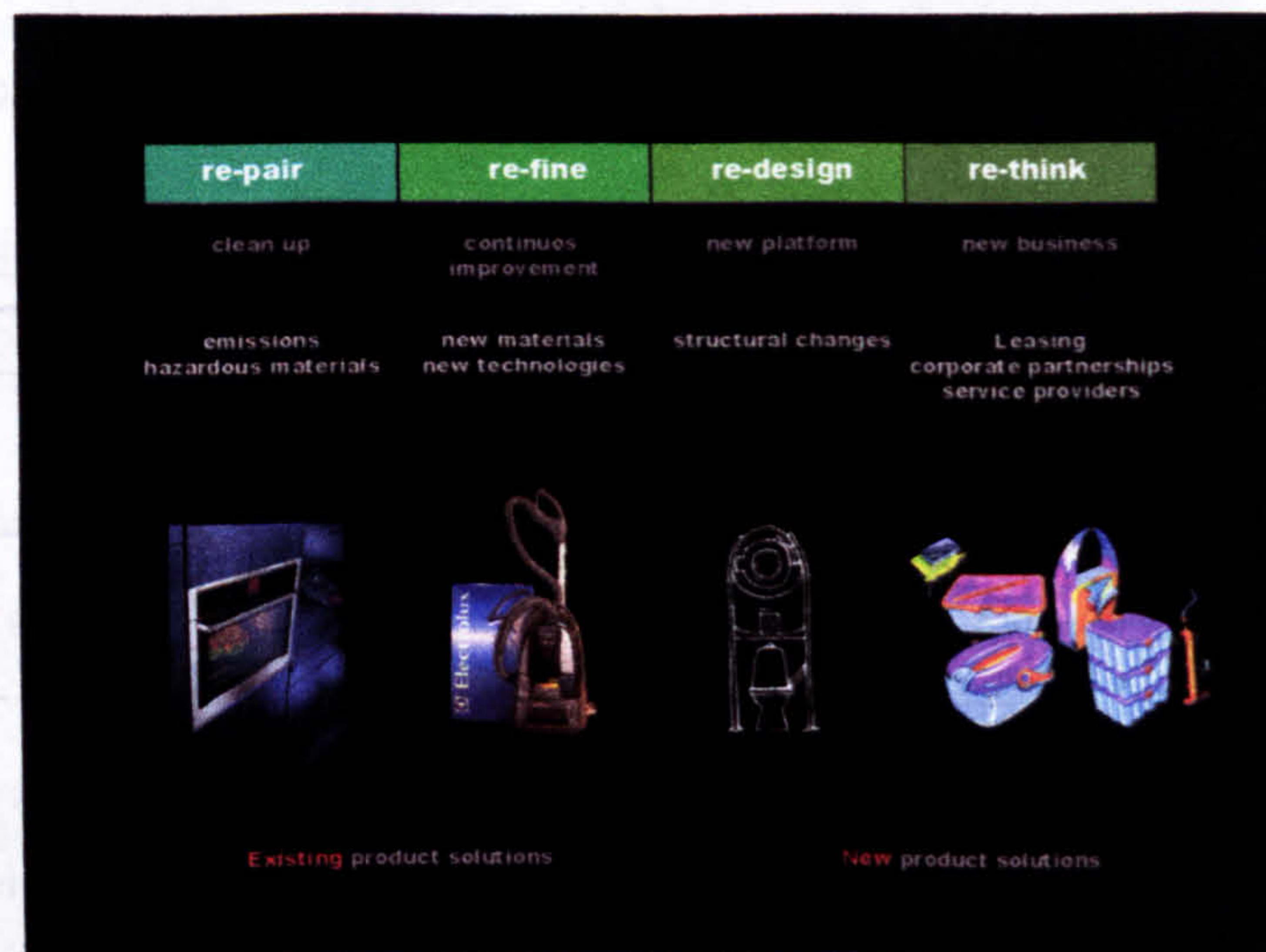


Figure 6.8: Industrial Designer's role visualised

This was accompanied by comments such as, "if you take the model of re-pair, re-fine, re-design, re-think as a blueprint for innovation, we've pretty much realised that is up towards the 're-design' and 're-think' stages that industrial designers can best contribute." It was generally felt that designers do not get down to the levels of detail considered at the 're-pair' and 're-think' stages. Of the 4 stages presented above, designers could and did the 're-design' and 're-think' activities presented in the image, but had little involvement in those from the 're-pair and re-fine' stages.

#### 6.5.3.2.1 The role diminishes towards the operational level

This 4-step model of ecodesign was also seen to align closely to the three forms of Industrial Design practice – Concept, Core and Continuous Improvement (section 3.4). So primary or Concept Design matches the kind of design issues and approaches considered towards the 're-design' and 're-think' stages of the ecodesign model, the more strategic design context. While core and continuous improvement, the more operational roles, more answerable directly to product developments connect to 're-pair' and re-fine'. Many of the more Innovative Ecodesign project undertaken as part of this enquiry, were Concept Design and Primary Development. As the senior designer in Spennymoor commented on the HICS project, "I'm going to take it to concept. It sits naturally in concept, because it's newer than core. I think that if it was in core it would on a time sheet and billed to a direct category."

Whilst 're-think' and 're-design' are viewed as the most appropriate forms of ecodesign, industrial designers ability to 'do' ecodesign were seen to diminish progressively towards the more operational design levels, such as Core Design and Continuous



Improvement. Their ability to conduct 're-pair' and re-fine' type ecodesign was seen as small, these being design considerations for other departments and types of designer.

*“Researcher - What if you find that ecodesign innovation at Core and Continuous Improvements, only design engineers can do?”*

*Environmental design co-ordinator - When you get down to continuous improvement, well, we'll take out all the red in the model because it contains cadmium and that might be an environmental re-pair, but might be a designers decision that's driven through legislation. When you go into core where they want to have thicker insulation in the canopy, when we want to do, erm, err! I think in core you should still be able to..., that's really (the other researcher), I think (she's) really working with us on core and that's really where environmental affairs and designers relate within the IPD process. But obviously the biggest area is in the re-design and re-think, right at the front end. If you say, well everyone shares their cooker, Wow! Major impact!”*

### 6.5.3.3 Summary of role of industrial designers

<b>Role</b>
<b>Ideas (creative and strategic thinking)</b> Among the most significant contribution by Industrial designers is the proposal of new and alternative ideas and ways of satisfying needs.
<b>Desirability</b> Industrial designers can influence the desirability of new products or lifestyle options.
<b>Redesign and Rethink</b> The greatest contribution to be made by industrial designers is towards the more strategic stages of ecodesign innovation, proposing new product concepts (innovative) rather than the redesign of existing products (incremental). This contribution diminishes towards the more operational role.

### 6.5.4 **Summary of Industrial Design based ecodesign**

This section presented findings and draws conclusions on Industrial Design based Ecodesign illustrating some unique characteristics of the ways in industrial designer's practice not previously articulated in the literature. The following matrix (figure 6.9) compares the research findings for Industrial Design based ecodesign against the data source projects described in section 6.1.3. It illustrates the various sources from which conclusions emerged helping triangulate the data and validate the research finding.



Figure 6.9: Matrix of Industrial Design based Ecodesign - Data sources against findings

	ECO-KITCHEN PROJECT	SERVICE DESIGN	SHADES OF GREEN	DONOR PRODUCTS	HICS PROJECT	VIRIDIAN ENERGY METER	EXTREME GREEN & BASICS	OTHER ACTIVITIES
Information								
General	Models and introductory descriptions of ecodesign	Definitions of service and relationship to design/ecodesign	Information on green consumerism, clusters and profiles	N/A	Simple descriptions of HICS introduction			All information requested 'on one page'. Biothinking simple principles
Visual	Eco-ideas maps, visual models of ecodesign processes and principles	'Eco-efficient' services model	Green lifestyle continuum, with lifestyle cluster mapped over. Lifestyles explained via products	Examples of other design approaches	'Comic strip' of HICS project concept	Outcomes as visual examples of eco-principles	PowerPoint presentations as design briefs	SEEDs database of eco-examples
Substantiated	Examples of other Industrial Design practice (e.g. Kambrook Kettle)	Case studies and examples of Service Design.	story lives and consumption patterns told via products.	Examples and case studies of other Donor products	N/A		Aspects from eco-concepts 'filter-down' to Core Design	Extensive use and collection of case studies and examples
Empowering	To enable Industrial designers 'to do' ecodesign	To enable designers to design 'Service'	To enable designers to transfer ecodesign to Industrial Design.	Transferable via examples, visually explaining the concept	Develop HICS methodology	Transferable and understandable to Industrial Design		SEEDs - to explain design contribution
Demand-side	Kitchen behaviour, product in use, needs.	Needs, wants, functional requirements	How people live. What people want	N/A	Defining needs for global/local contexts	Behaviour, attitudes lifestyle, consumption info for energy usage	Shades of Green work 'filters-down'	Departmental presentation softer, eco-consumption
Motivation								
Ecology=innovation	New product concepts and examples	New design themes, concepts, role and company context	N/A	A means to design some new and nice 'things'	Interest because of projects novelty			
Personally driven	Successful because of designers motivation	Driven by Industrial Design into new areas		Driven by individual designer, aimed to motivate designers in dept		Driven by individual designer, aimed to motivate designers in dept		SEEDs database - to motivate the individual
Design Process								
Not driven by 'eco'	'Consumption' not 'eco' or 'product' design	Driven by novelty/innovative and new business/market potential	N/A	No interest in eco-improvements, just making 'eco' visible	Driven by design novelty/innovation. Not eco-potential	Driven by novelty/innovation	N/A	
Product-orientation	7 product concepts	Designing 'the products of service'	Understanding green consumers via products and purchasing patterns	Project manifest as product examples	Interest in product outcomes	Aimed at product outputs	Aimed at Core product development	
Ideas	Project success in novelty of ideas as concept demonstrators	Interest just in new ideas			N/A			
Desirability	No detailed knowledge							
	'Eco-erotic', 'appealing-adaptable-alternatives'	Tailoring product/services to meet peoples needs	N/A	Making reuse/recycling desirable to designers and consumers	N/A	Making energy saving desirable and 'cool'		
Re-design and Re-think	Redesign and new design. New product concepts	Focus on new business Not product design	N/A		New business, design and market opportunities	Aimed at new product concepts		Departmental strategy and presentation

Blank cell = No evidence, N/A = Not Applicable



## 6.6 The nature and characteristic of Innovative Ecodesign

This section presents findings from the second research theme. The aim of this research stream is to describe unique characteristics of innovative ecodesign (innovative, radical approach), not previously considered in the literature. These findings are generalisable to other forms of Innovative Ecodesign, but only when undertaken by industrial designers. Such designers, as the previous section highlighted, conduct ecodesign in their own way. In this case it is impossible to separate the research phenomenon from the subject and context. The pilot study shifted the emphasis from early product development stages to pre-product development (section 5.8), a novel research context and area. Innovative Ecodesign is considered to operate and be integrated in this research context, i.e. pre-product development with a strong conceptual weighting. The following section describes some of its characteristics and properties:

### 6.6.1 Exploratory

Innovative Ecodesign is an exploratory form of design requiring freedom, openness and an innovative and creative design context. A critical ingredient is the opportunity to pursue and 'push around' ideas in an unquestioning manner, with design requirements that do not constrain creativity and innovation. An open enough 'design space' that has large 'degrees of freedom' allowing truly innovative ideas to emerge without being stifled is necessary here.

*"Researcher - So why was the Eco-Kitchen project successful?"*

*Environmental Design Co-ordinator - That was successful because of the personal motivations of the individual designers and the team, and also in that there was so much freedom there. Basically because it was a concept project and because we were allowed to push it around for some time... just understand what the subject was and define how we could best do it..... All projects can't push the boundaries of what design does!"*

#### 6.6.1.1 Not directly linked to product development

Of critical importance to this is that these kind of ecodesign activities are not directly related and answerable to product development, i.e. their primary purpose was not to feed directly into the development of products. Concept Design offers the ideal context for this. Therefore, a key aspect of Innovative Ecodesign is that it *does not* always result in new products or innovations, and is not directly accountable to the development of products.

*"I mean the whole idea of doing this in isolation from the business is that we come up with something neat, some... opportunities that they may not think of. Because the business will be very driven by business, driven by business initiative and making certain amounts of money here and there. Whereas we have the opportunity of coming up with innovative ideas without letting the overall profitability of the idea limit us."*

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#### **Exploratory**

Requiring freedom and openness for creativity and innovative thinking. Not directly linked of answerable to product development.

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### 6.6.2 Educate, Communicate and Embody

There is also a strong sense that Innovative Ecodesign is for educate, express and communicate certain core environmental or sustainability principle, as illustrated by



discussion in a design workshop, "OK, this is basically to demonstrate a concept, so we could take one consumer profile, and we follow it through, lets say the elderly...." In a similar sense the Service Design project conceptualised this through the idea of a 'Hero' service, i.e., the most obvious examples or application of the concept (or the 'killer' application):

*"Designer 2 - And I want to make time to go through this Hero Service, because ideally..*

*Designer 1 - Hero service is just a clearer idea of what we want to get out of it isn't it? I mean ideally, that's a description of the end result. I mean I don't really just want to design a fancy gadget...*

*Designer 2 - No, the reason I like Hero Service is because its going to somehow illustrate, I don't know on a piece of paper or a product our thinking and how our thinking developed.*

*Designer 1 - That's what I was saying we need some examples*

*Designer 2 - But also I think that we are also going to be dragged into this product solution, somehow. We have to start somewhere."*

The 'Eco-kitchen' pilot project similarly embodied the principles of raising consumer 'Awareness' through models of product concepts, which "express eco-ideas of resource efficiency and responsible behaviour in a format that consumers and designers will understand." This type of design project is often termed a 'concept demonstrator', and has some history and use in companies integrating ecodesign (Simon et al., 2000). These educational and communicative purposes extend to a variety of stakeholders, including:

#### 6.6.2.1 Designers

The exploratory nature of the project aim to educate those designers conducting them, but also to communicate to and educate other designers within the department. For example, within the pilot project a key aim was "to produce nice little models we can put on the Intranet so that designers will get it! So they will understand ecodesign!"

#### 6.6.2.2 Consumers

Designer felt that a key aim of these projects was to educate consumers as to the possibilities of new lifestyle options and environmental possibilities, "you see the nice things about this project is that's its got some legs... there are things to see things!... which is where I want to see this one going. I want to see things built so that people can say 'Ah yeah! I get it!' And I give you how much money and, OK, it's that obvious at the end of the day."

#### 6.6.2.3 The company

There is a clear feeling that potential for Industrial Design to contribute to overall environmental excellence was not completely understood. Other departments "don't get it!", in that they do not fully comprehend what the department can do and ways they may contribute. Part of the aims of these projects were therefore to educate the company as to the potentiality of both Industrial Design and ecodesign:

*Well yes, they (Environmental Affairs) have a fairly traditional view on this, you can imagine their view. They are not necessarily championing new product development. They're not looking for new ideas, they are looking for compliance. But having said that I've been there and showed them the last months work, and they've been like 'Wow!' Can you show this again!' We can do things they hadn't imagined and they want us to do things because it makes it more glamorous.... I should be like a constant monitor like..... keep bringing it back to (Environmental Affairs) and let*



Affairs) and let them use it for promotional purposes and let them use it for educational purposes. I can see them making use out of what I've given them..."

### **Educate, communicate and embody**

A strong emphasis on educating and communicating to various stakeholders (designers, company, consumers), as well as to embody certain key ecodesign or sustainability principles.

## **6.6.3 Design process (core business and consumer needs)**

Innovative Ecodesign processes have various unique characteristics important to identify within this research. Two important factors appeared of critical importance to be identified early within the design process. These are 'the identification of core business' and the 'identification of consumer needs'.

### **6.6.3.1 Core business**

Of critical importance to Innovative Ecodesign was the identification, acknowledgement and use of core business as a central theme or starting point of the design process (ideas of what do the company do? What business they are in?). Design developments would then be based on this identified core business, often as core competencies or existing categories (hot, wet or cold). In design, core business was viewed in a variety of ways, though generally around certain 'household tasks' and articulated as "serving people in their everyday household tasks". One concept designers comments illustrates this well in saying, "this is not about a fundamental shift! It's about looking at our existing business and the design and development process from an 'eco' perspective. We will still fit these ideas into core competence... our core business."

### **6.6.3.2 Consumer needs**

Of equal importance to processes of Innovative Ecodesign is the identification of consumer needs (what do people want or need?). This return to perceived needs or first principles, attempting to strip away the reliance on existing products was evident in a variety of forms, and ties strongly in with conclusions on the 'consumer orientation' of Industrial Design processes from the previous section (6.5.5.3). The quote below from the Service Design project helps illustrate this concern for consumer needs, through an emphasis on tasks as part of the companies core business:

*"Well the project was task led... rather than product led which is what we normally do!. We designed and had tasks and loads of consumer profiles. We don't know our consumers well enough in this project, so it had to be tasks. When we sat through this and generated some ideas, we just kept saying 'Who are these consumers?' We know more about household tasks, as this is basically our core business, so it had to be tasks."*

The identification of consumer needs extended to a variety of demand-side orientation previously mentioned (section 6.5.1.5) including: consumer behaviour, consumers lifestyles and profiles, needs, results and the 'service' requirement.

### **6.6.3.3 Core business and consumer needs**

These two themes of core business (what business are we in?) and consumer needs (what do customers want?) appear central to Innovative Ecodesign processes and are clearly articulated in the illustrative design brief from the Service Design project below.



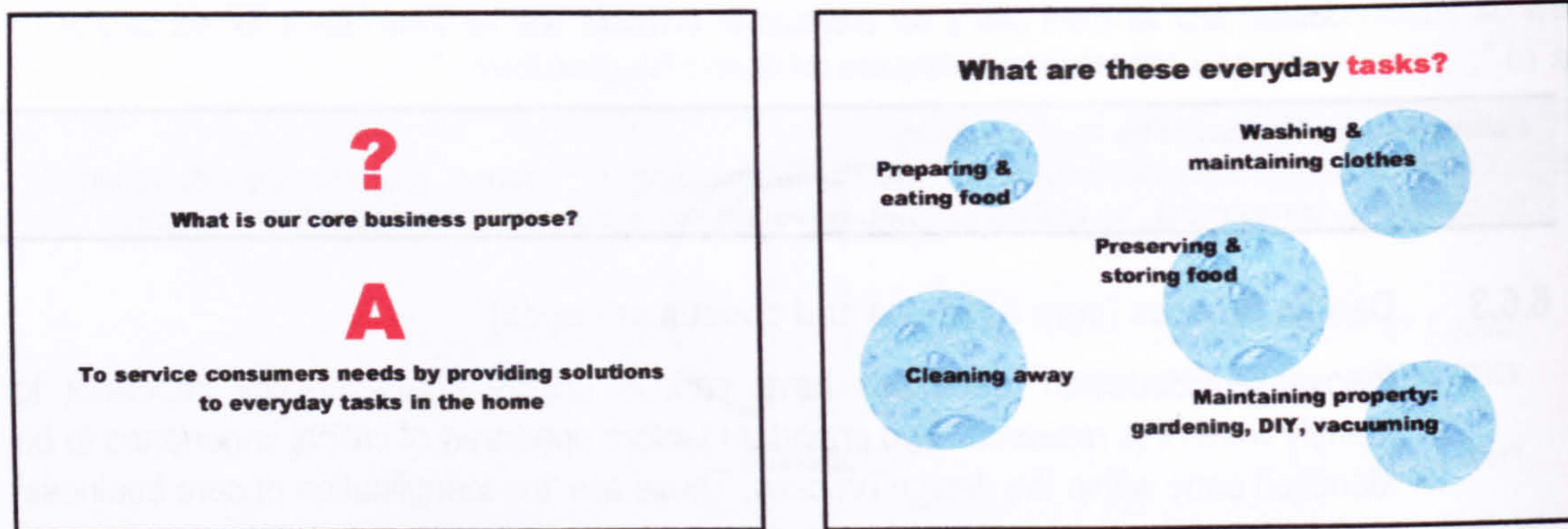


Figure 6.10: Core business and consumer needs from the Service Design brief

**Uses core business and consumer needs**

Essential aspects of the design process are the identification of the company's core business and the consumers needs at the start of the design process.

**6.6.4 Prioritising environmental issues (via the design brief)**

Also of important is placing environmental issues as of high importance at the projects conception and commencement. Environmental factors need to be afforded a high priority within these projects, and stated as a key innovation driver (even though not always used as the primary generator in the actual design process, as in section 6.5.2.1). Within the 'Eco-kitchen' pilot project, of importance was to "write a brief that stated environment clearly in the title. Because if you don't put environment in the title its always the first thing to go". Clearly such environment priorities require a high priority as design briefs are written and driven by designers themselves. This is done by ensuring environmental issues are included in the design brief. A good design brief, with clearly articulates environmental priorities was seen as crucial to successful Innovative Ecodesign:

*"Researcher - So you see the answer in the brief?"*

*Ecodesign co-ordinator - Yes..., from that you get a good brief. And then you come back and you apply everyday common or garden design techniques to it. But before, without a good brief you are just swinging in the trees!"*

**Prioritising environmental issues (via the design brief)**

Place a strong emphasis on environmental issues by ensuring they are an essential (even prevalent) part of the design brief, seen as the success to such projects.

**6.6.5 Innovative Ecodesign is Strategic**

There was widespread acceptance that Innovative Ecodesign asks important and challenging questions of design and the organisation in which it operates. As such it tends to deal with issues of a strategic nature, sometimes termed 'strategic' design (Manzini, 1998) or 'business redefinition' (Ottman, 1999b). This form of design challenges many preconceived notions of design, products and business, as illustrated by the comment below:

*"(The IPDP) work is quite easy for us to understand as it does not question the status quo.. its like helping us to redesign products.... and products will still be the outcome. But what you are asking are strategic questions about company outputs. It fundamentally questions what we are doing. I've asked these kinds of questions before, about design outputs and people have come*



*back to me and said 'We'll if you don't know what you are doing and why you are doing it, then you shouldn't be doing it in the first place'.*

Several barriers and obstacles were identified as hindering these types of more strategic design developments. Among the first of these are internal obstacles within the mentality of designers themselves, *"Ecodesign begs some important questions about how we work and what we do.... about the company outputs, that are uncomfortable to ask to a product-orientated manufacturer. If they see that we haven't got a pen in our hand and that we aren't designing things, management begins to twitch."* Similarly the value of designers is measured by the 'culture of designing', i.e. designers should be seen to be doing design and producing products (models, sketches, etc) as their outputs (section 3.4.3).

*".. the other day I was saying I was doing some thinking... and our design manager said, 'was that 2D or 3D thinking?'. There's this boxing of it all. I think what we get paid for and what's visible is like you say, the models and illustrations and the brand co ordination."*

Other obstacles appear in that designers don't have such a strategic profile within the company and rarely, if ever tackle such strategic issues, outside of Concept Design.

*"At the moment we are making white boxes. (The IPDP work) is helping us to design maybe grey boxes with green curved corners, but they are still boxes... its not a giant leap! Bigger questions about innovation, design for services and about the new role and context of designer's are uncomfortably received here."*

#### 6.6.5.1 New business

Evidence of this strategic nature of Innovative Ecodesign, and that designers need to consider such design activities appeared most notably within description of it being the design of 'new business'. In many of these projects there was strong sense of design projects working more towards new and future business proposals (innovative, radical), more than product design (incremental, improvement) as is the case with most operational ecodesign. This notion of 'new business' though working from core competencies might extend or expand these into new business areas. This is well illustrated by the following explanation of the Service Selector, the main design concept to emerge from the Service Design project:

*"I decided to ask, not what products go with service, that seems to me to be just a maintenance man. But I decided to push the importance of information products. The future is likely to be information based, I mean that's what all the guru's like Manzini and whoever are talking about. So I tied this idea in with the new economy and sustainability... It allows you to reduce resource use and waste, etc. And so what I'm saying is that I miss out shops. We completely leapfrog the retailer and sell directly to consumers. We sell knowledge, and experience, and our brands and identity.*

*The first part is called Electrolux Household Products – which is what we do at the moment. This is our core business areas. So what I've done on this presentation is to introduce the Service Design idea as Electrolux Domestic services – Home care. This is really a new business concept and a future direction for the company. I'd love to go round and say – 'Here.. This is your new department!'"*



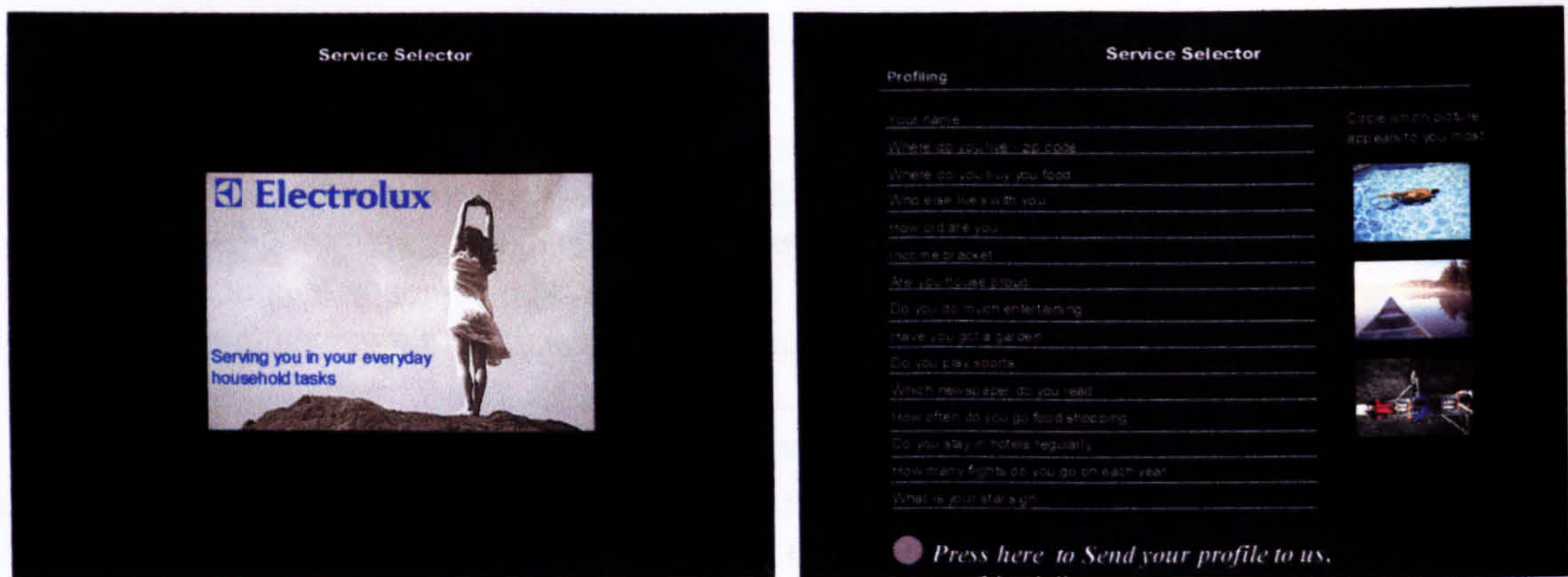


Figure 6.11: The Service Selector

The following description explains the Service Selector concept, which embodies many of the conclusions, presented above, including: the identification of core business and consumer needs; as well as the visual orientation of industrial designers and the focus on strategic issues as 'new business'.

#### 6.6.5.2 The Service Selector concept description

The Service Selector is an information product, tailoring services and the product/service mix to specific consumer needs. The Service Selector is an Internet tool allowing service providers to interact with and sell directly to consumers. By accessing personal and specific information, the company is not only allowed to tailor services to consumers specific needs, but also to anticipating future needs and provide services with flexibility and future considerations incorporated (Sherwin and Bhamra, 2000).

Consumers provide information to define their profile and lifestyle options – including age, interests, income, beliefs, employment plus their tasks and service requirements. The Service Selector then devises the 'best' (environmental and economic) solutions to the consumer's needs and context, taking into consideration present needs as well as pre-empting future ones.

The consumer receives a tailored and specific service that is flexible and will change with their lives. The company maintains closer control over the whole product lifecycle, and is more able to take-back, recycle, service or repair. The scenario is eco-efficient as 'products' cease to become the primary objective of economic activity – profit is no longer linked to product output and usage, rather service delivery (section 2.10.5). The retail 'hard-sell' (plus all the logistic, sales and resources that go into this) is 'leap-frogged' in the Service Selector scenario – therefore selling is dematerialised also. The central importance of the product (plus all the materials and energy that go into this) is therefore diminished.

#### **Strategic**

Are strategic in their nature asking searching questions of designer's and companies. The notion of designing 'new business' (extending existing, but creating new business opportunities) articulates this.



### 6.6.6 Systems based and holistic

Innovative Ecodesign processes followed are systems based with considerations of other factors than 'the product', within production and consumption chains. In the 'Eco-kitchen' pilot project this holistic view was articulated as in figure 6.13. The project was visualised and conducted by considering the kitchen as a system with clearly defined boundaries and considering resource flows such as energy, food and behaviour. The design emphasis on the 'Product Solutions' illustrates also the 'product orientation' of Industrial Design processes indicated earlier (section 6.5.2.2).

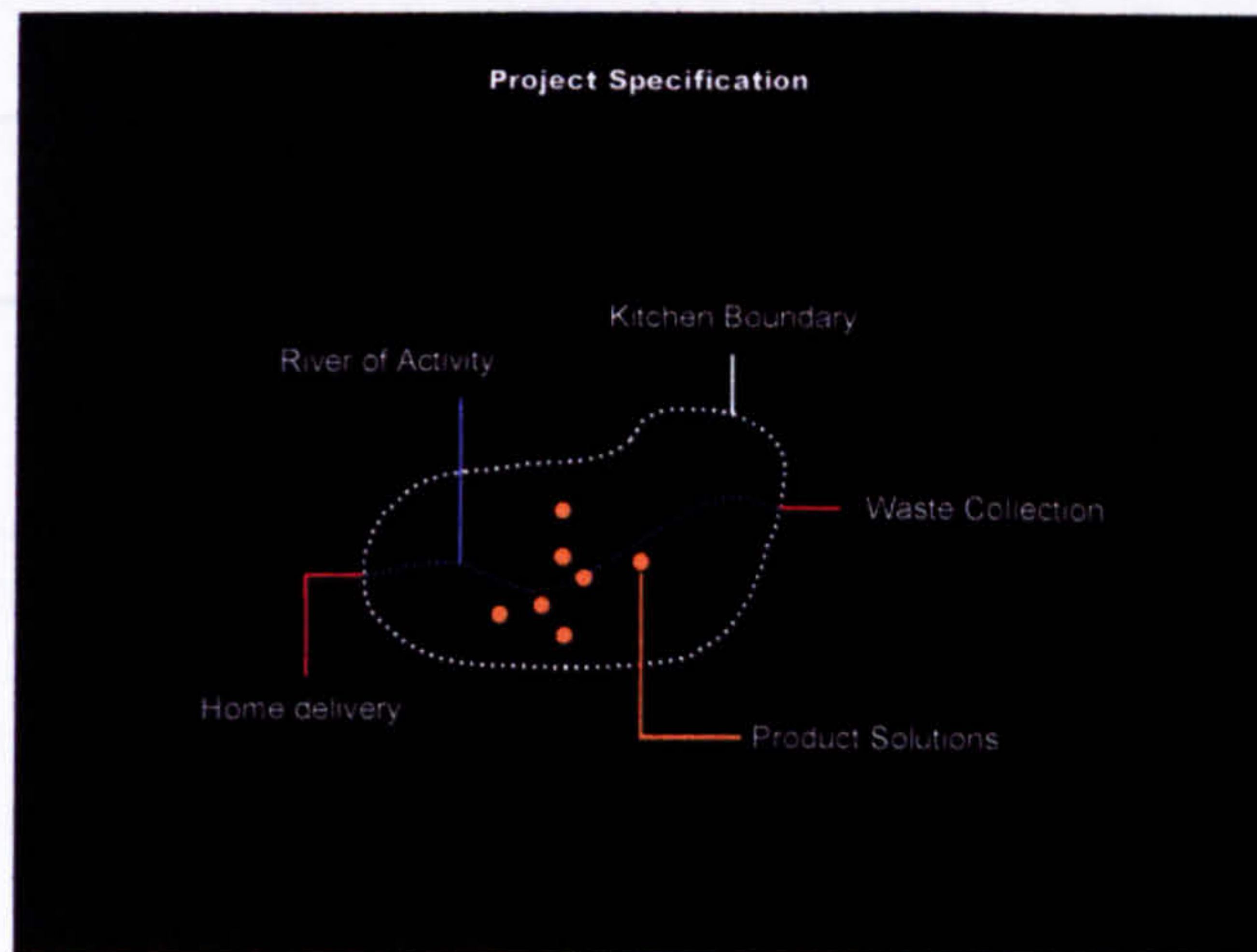


Figure 6.12: The Kitchen System and Boundaries

In a similar sense the Service Design project illustrates systems considerations, manifesting themselves in design considerations of consumption and service delivery.

*“So what we are actually understanding now is that when people buy an artefact, they are actually wanting a process and a service, so therefore you are selling the entire package, rather than a door, then a window, then a roof. Scenario planning of how people will live there lives in this way and then we just sort of extracted one little thread from that whole woven image and designed a product for that thread.”*

#### **Systems based and holistic**

Considers broader systems of production and consumption at the start of the design process, whilst still 'designing' the material dimensions.

### 6.6.7 Participatory

Key to the long-term success of Innovative Ecodesign is seen as partnerships, links and networking. It was clear that although the department can initiate and conduct many dimensions of Innovative Ecodesign, the subject requires integration within and across companies to develop successfully. Internally for example projects and design activities of this nature require increasing amounts of departmental and organisational integration to, transfer innovative ideas and concepts into innovations. The department, for example *“tend(s) not to take on concept projects without the backing and connection to another internal department or function. These kinds of projects tend to be a bit aimless and direction-less if we do them alone. We are always looking to do projects in conjunction with other departments,”*



External links also were seen to provide good business models and examples to borrow and 'fit' to the department and organisation, whilst being essential to embrace multi-disciplinary and inter-sectoral nature of most environmental issues.

*"Whenever you ring up Nike or whatever, they say, well we haven't really got anything to talk about. They don't really have anything to show you and neither can we. So why don't we just get together anyway. So everybody is really in the same boat. But through the conversations, you now I have various conversations and it just gets my head ticking and I can start to form some Electrolux opinions, circulate them internally within the group, get a consensus and then it almost becomes the external put-out. A year ago we didn't have this focus on links and relationships, well we did, but it wasn't so clear who were the partners and why we should do it. Now, even a year down the line, that's the major project."*

**Participatory**

Requires partnerships, links and integration, within and between organisations for its long-term success.

**6.6.8 Summary of Innovative Ecodesign findings**

Innovative Ecodesign as a form of ecodesign practice has some unique characteristic and a nature, not fully expressed within the literature or existing theory. Figure 6.13 presents a matrix comparing the research findings for Innovative Ecodesign against the data source projects described in section 6.1.3. It illustrates the various sources from which conclusions emerged helping triangulate the data and validate the research findings



Figure 6.13: Matrix of Innovative Ecodesign – Data sources against research findings

	ECO-KITCHEN PROJECT	SERVICE DESIGN	SHADES OF GREEN	DONOR PRODUCTS	HICS PROJECT	VIROIDIAN ENERGY METER	EXTREME GREEN & BASICS	OTHER ACTIVITIES
	Exploring new and novel design concepts - ecodesign	Exploring new and novel design concepts - services			Exploring new and novel design concepts - global/local product/systems	Exploring new design, product and semantic possibilities	N/A	Most project undertaken as part of Concept Design context
Education, communication, embodiment	Project educates designers & embody ecodesign, products educate/communicate to stakeholders	Project educates designers. Outcome embody Service Design principles & educate stakeholders	Aimed to educate and empower designers as to green consumers and lifestyles	Products to embody recycling/reuse principles and stimulate thinking and designing	Aimed as concept demonstrator, taken only to concept stages	Aimed a demonstration of Industrial Design principles, embodied in new product concepts	N/A	SEEDS database aimed stimulate debate and embody complexity and diversity of discourse
Strategic	New product concepts and business opportunities New product categories (Smart Sink)	Designers involved in New Business concept for first time. Future direction for the organisation			New and future business New approach and context for design and company		N/A	Interest in searching, more strategic questions of sustainability
Systems based and holistic	Products as part of 'kitchen system. Partnership of Awareness Systems of production and use	Systems of product/service delivery.		Concepts of take-back, material, product and component reuse and recycling.	Global/local systems of production and consumption. Embodied as product/systems	Systems of energy consumption and use, domestic behaviour and lifestyle, etc	N/A	
Participatory	Demands consumer input and interaction	Producer and consumer partnership to provide 'tailored' solutions		Demands producers and consumer responsibility, and take-back systems	Requires engagement of producer and consumer, in global and local context	Demands consumer participation	N/A	
'Eco' in the design brief.	Driven by environmental factors as core of innovation		Focuses extensively on 'green' dimensions of lifestyles	Driven by eco-benefits reuse and recycling factors	Environmental consideration as central criteria of project	Design brief aimed at energy reduction and conserving behaviour	N/A	Success factor – ensuring you get a good brief, with environment in it
<b>Identification of:</b>								
Consumer needs	Behaviour, lifestyle and consumption factors in the kitchen	Service Selector provides exact definition of specific consumer needs	Definitions of lifestyle patterns, behaviour, purchasing patterns, needs, values and beliefs, etc	N/A	Specification of consumer needs in local context	Identification of attitudes and behaviour for energy use and motivations for conserving behaviour	N/A	
Core business	Product categories as core business – Hot, Wet and Cold	Definition of core business as 'Serving your everyday household needs'	Behaviour and values based around core business – food, kitchen, etc	N/A	Based around core company business - foodcare		N/A	



## 6.7 Conceptual model for Industrial Design based Ecodesign

This section presents a conceptual model of Industrial Design based ecodesign, for descriptive and explanatory purposes. Its aims are in describing the Industrial Design – ecodesign relationship and to portray the role, approach and to some extent ecodesign processes followed by industrial designers.

The model (figure 6.14) is in two stages, with the first relating Industrial Design based ecodesign to a generic model of product development from the Ecodesign Navigator (Simon et al., 1998) stating the recognised stages in product development. The specific stages of the Electrolux IPDP (figure 3.4) are mapped over, with P1 to CP2 illustrating product development in the case on which the research was based. Below this is mapped Charter's 4-step model of Ecodesign Innovation illustrating how product development was seen to relate to general ecodesign principles (fig. 2.4). Above product development, industrial designer's role is presented, relating to the product development stages in which they generally participate (P1 to CP1). These are presented as the types of design project, such as Concept Design, Core and Continuous Improvement (fig. 3.6). These map the types of design projects in which industrial designers participate, presented as a tapering triangle which visually represents diminishing role and ability to contribute at later product development stages as the design develops. The most significant contribution to be made is towards the 'early stages of product development particularly in Concept Design (which is in fact pre-product development). This clearly illustrates that the greatest environmental improvements and the most significant role to be played by industrial designers is towards these early stages, largely via conceptual rather than detail design input. The ideal context for this is Primary or Concept Design.

The second part of this describes the design process followed by industrial designers in more detail, by presenting various characteristics and design factors against a generic model of the design process. This presents the three recognised stages in design (pre-design, design process and post-design, fig. 4.3) interpreted as information and input into design, followed by characteristics of the design process itself. This enquiry did not extend to post design or the outputs of the design process so this was missed out. The information stages clearly illustrate that industrial designers clearly require specific types of ecodesign information to facilitate design innovation, and that importantly it must be presented in an appropriate manner and fit their working practices. It also highlights the importance of personal motivations as well as the type of motivation designers may follow (innovation and novelty, etc). Following this, the design process is presented with special reference to the role environmental issues and the product play within the design process. It illustrates also the predominant demand-side orientation of projects conducted by Industrial Design. The overall nature and role of designers is presented to the left of the design process, stating designers' most significant contribution as creative and strategic thinking (ideas). This has a strong emphasis on desirability, as well as the more radical types of innovation (redesign and rethink) in which design can engage.



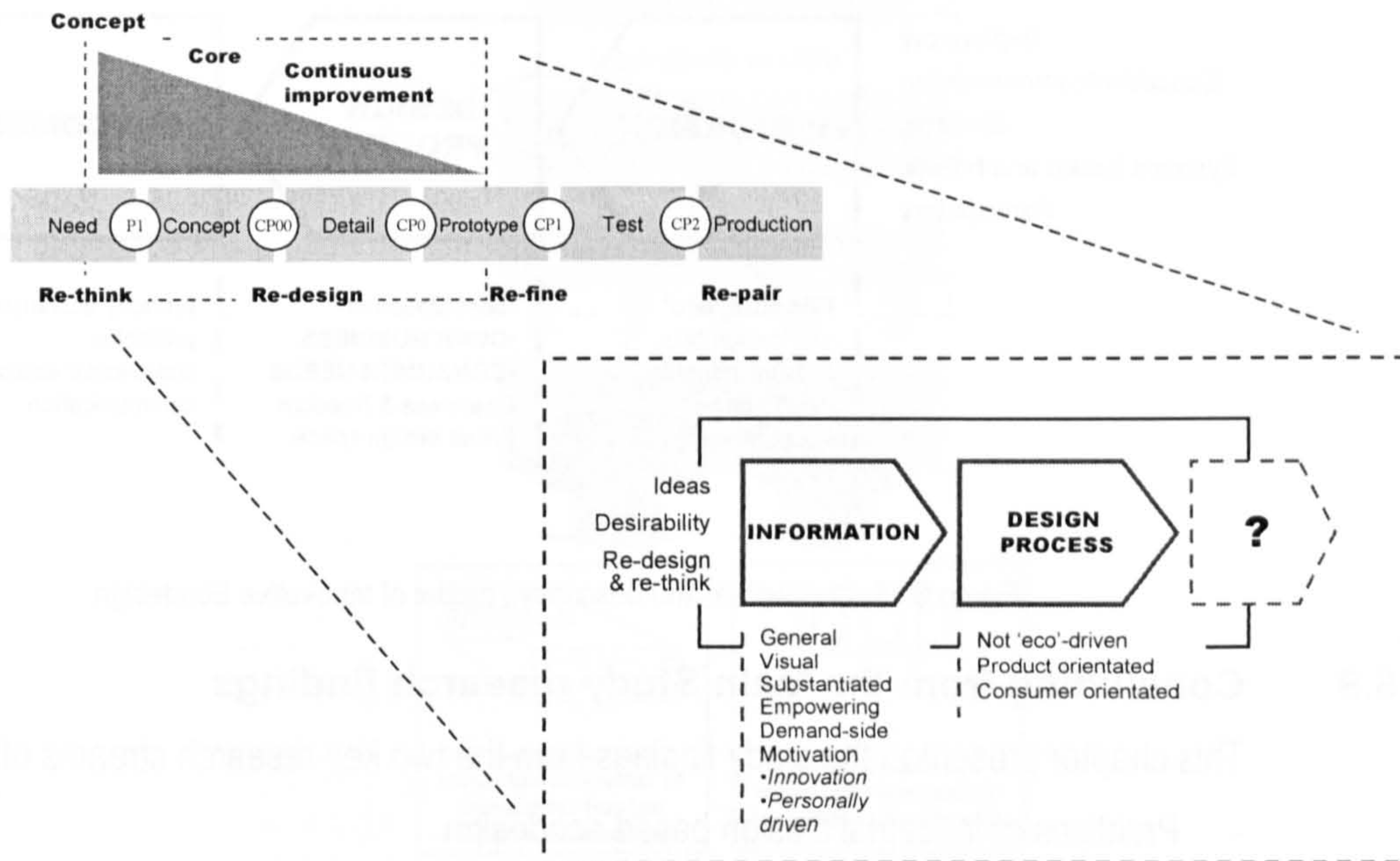


Figure 6.14: Conceptual and descriptive model of Industrial Design based ecodesign

## 6.8 Conceptual model for Innovative Ecodesign

This section presents a conceptual and descriptive model of Innovative Ecodesign (figure 6.15). The nature and characteristics of this are presented using a schematic representation of the design process with categories and properties located at the appropriate stages. Within this model, the overall nature and aims are presented at the left side as: exploratory; to educate and communicate, as strategic; systems based; as well as participatory and show clearly many aims and purposes of these forms of ecodesign. The 'Pre-Design' part of the Innovative Ecodesign model representing information and input into design. These types of design activity are significantly shaped by prioritising environmental issues at the projects commencement, particularly within the design brief, while the other information and stimulus factors apply to industrial designers more generally illustrated above (figure 6.18). The 'Design Process' or actual aspects of design are characterised by the identification of core business and consumer needs, seen as the key to the project's comprehension and success. These require openness and freedom to explore possibilities in an innovative and creative manner with a broad 'design space'. The outcomes are in part aimed to embody and express key ecodesign or sustainability principles emphasised within the brief, whilst also aiming to educate and communicate to various stakeholders (other designers, consumers, the company). The model clearly illustrates the unique nature and characteristics of such Innovative Ecodesign.



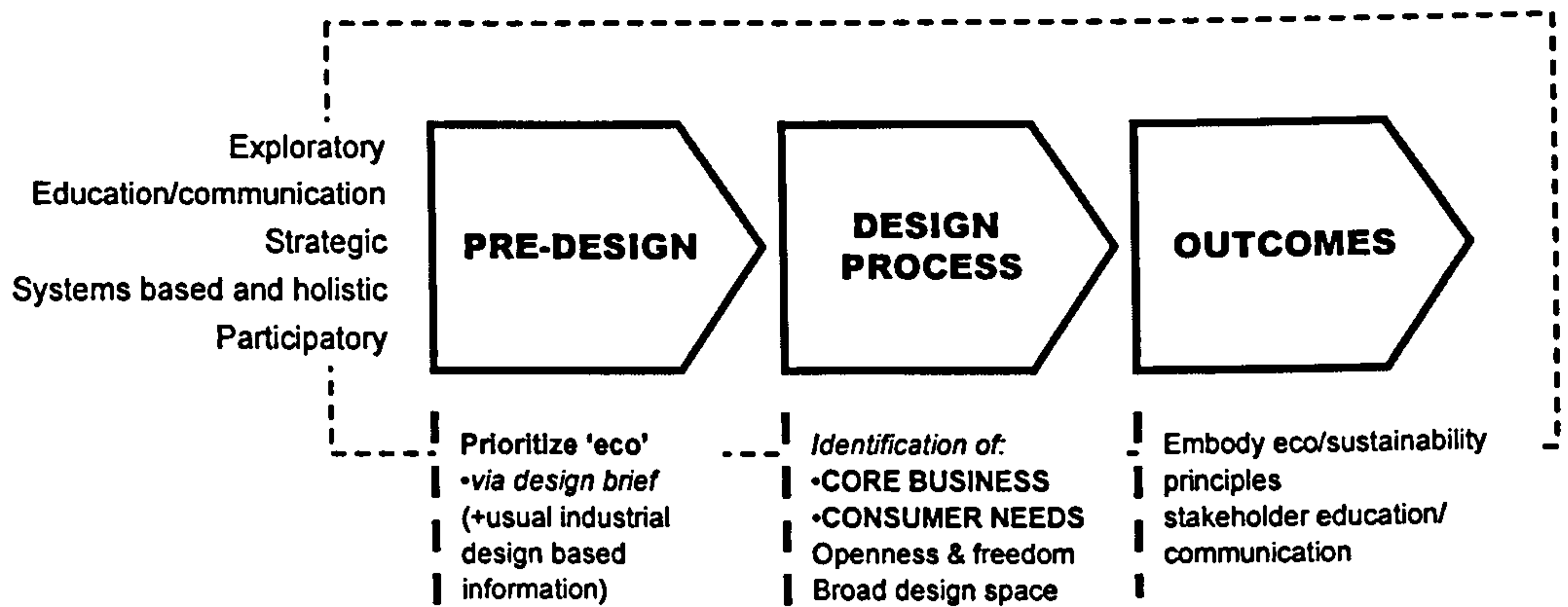


Figure 6.15: Conceptual and descriptive model of Innovative Ecodesign

## 6.9 Concluding from the Main Study research findings

This chapter presented the study findings from the two key research streams of:

- Practices of Industrial Design based ecodesign
- The nature and characteristics of Innovative Ecodesign

This is done using some early findings drawn from the pilot project to the main study with the aims of confirmation and expansion. Findings from these research streams were then developed, summarised and presented as two conceptual or descriptive models as illustrated above. The models and the findings on which they are based will now be related back to existing theory and epistemology of ecodesign previously reviewed in the literature, for the purposes of validation and verification. This final research exercise aims at theory building and represents the research contribution to knowledge.

### 6.9.1 Visualisation of Main Study conclusions

This section presents a visual representation of the research process and focus throughout the literature, the pilot and main study and illustrates the research development. It presents the results of the literature review of state of the art ecodesign, as well as the change to the research design resulting from the pilot project. It then presents how via the two identified research themes, the research questions were answered thus satisfying the objectives in the form of the two conceptual and descriptive models presented above.



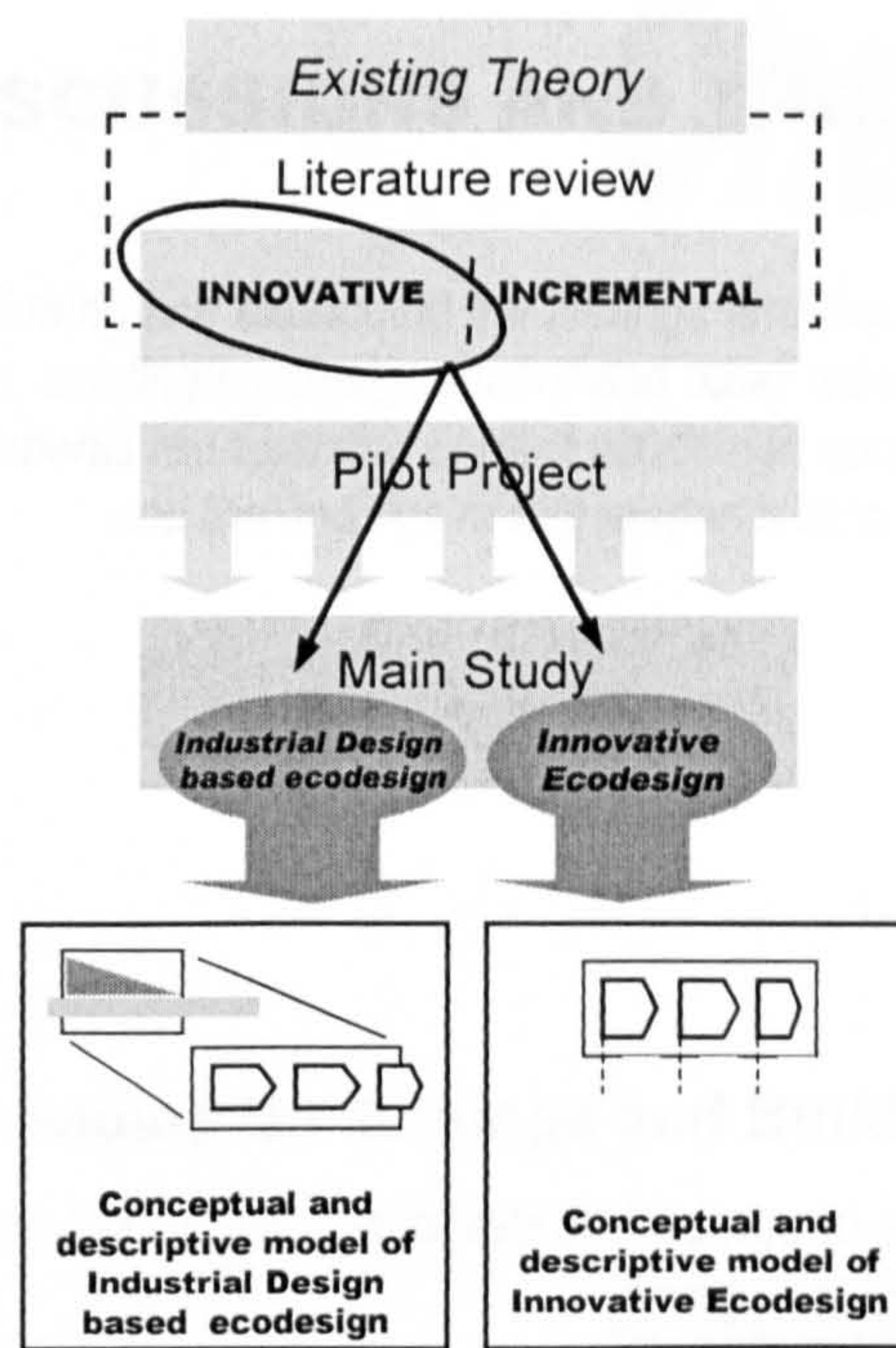


Figure 6.16: Visualisation of the research focus and process throughout the main study

These two conceptual and descriptive models, derived from the two research themes within the main study, as well as being a specific research objective help satisfy the other research objectives also. For the reader's references, these are summarised below:

- To critically review ecodesign literature and summarize into "state of the art" theory.
- To identify the nature of early stage ecodesign integration.
- To describe the characteristics of Industrial Design based ecodesign.
- To explain how industrial designers conduct innovative ecodesign by building a descriptive model.





The diagram illustrates a process flow involving several stages and components. The central oval represents a core element, with arrows pointing to various rectangular boxes that likely represent different stages or data points. The flow appears to be organized into a structured sequence, possibly representing a manufacturing process or a data analysis pipeline. The text accompanying the diagram is too faint to be transcribed accurately, but it likely provides a detailed description of each step and the relationships between them.



# Chapter 7

## DISCUSSIONS AND THEORY BUILDING

This chapter aims at validating, confirming and expanding the findings and theory building. It broadens the research findings out to the literature, existing ecodesign theory and other research as well as the world at large. To do this some general statements representing current ecodesign epistemology will be presented and the findings of this research discussed in reference to these.

### 7.1 Validating and expanding the findings and Building Theory

This section compares and contrasts the research findings to existing ecodesign theory and epistemology. It compares, discusses and expands the research findings against theoretical propositions or questions developed from the literature which represent current epistemology of ecodesign. The key research findings are 'filtered through' these theoretical propositions for validation purposes, with the aims of building theory and new knowledge (as illustrated in figure 7.1).

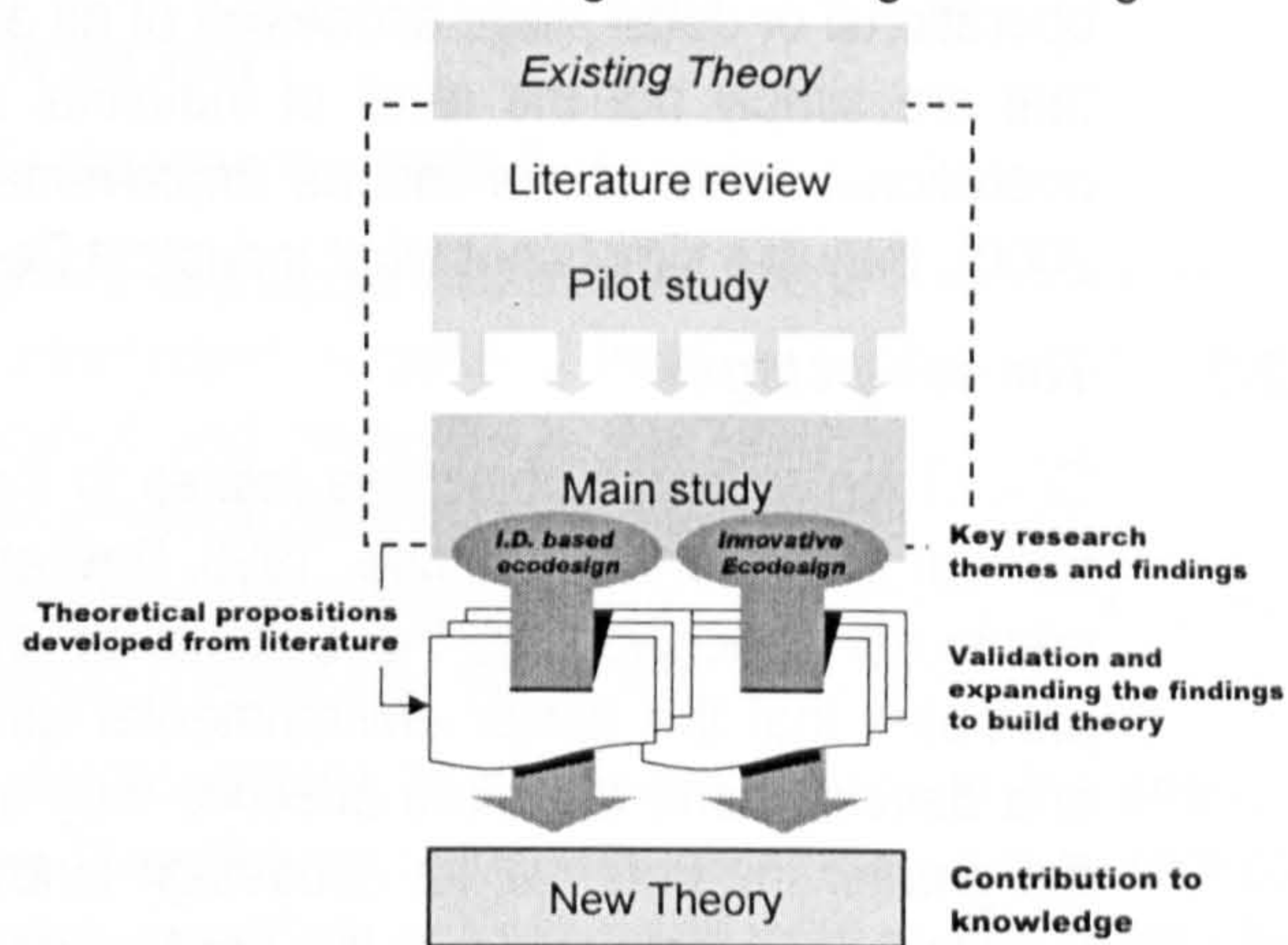


Figure 7.1: Schematic representation of validation and theory building process

### 7.2 How do industrial designers use ecodesign to innovate?

A key finding of this research is that industrial designers conduct ecodesign in their own way. Existing practices, processes and methods have not developed in sympathy with this and do not to 'fit' Industrial Design (section 6.5.1.3). There are a variety of reasons for this, as described below.

#### 7.2.1 *It's in the concepts, not the details*

The conceptual models, particularly of Industrial Design based ecodesign (figure 6.14) illustrates that they have specific parts to play within product development, at specific stages. The model broadly maps the types of Industrial Design projects and roles against the product development process, and concludes that designer's abilities to do ecodesign diminishes towards the more operational stages characterised by Continuous Improvement and later design stages. Designers feel these more operational and incremental forms of ecodesign are best left to other designers,



departments or product development stages. There was also a strong sense that such types of ecodesign activities (more generally conducted at the detail stages) have very little influence on Industrial Design, as they don't get down to this level of detail and rarely, if ever specify materials. Industrial Design based ecodesign is very much in the concepts, rather than the details. That is to say, conceptual design input is their most significant contribution, especially when projects have high degrees of freedom and require creative and innovative input (or new ideas, see section 6.5.3.1). Innovative Ecodesign therefore requires environmental issues and the notion of ecodesign to be lifted out of the details (where it currently located, section 2.8) and dropped into the concept stages. This would question not only what the product is 'made of', or 'how it is made', but also 'what the product is'.

Some problems occurred in this research in the transition from concept based ecodesign down to the more operational level. Further research is needed to explain this, but the work undertaken here does questions whether these type of design (also known as incremental innovations, perhaps mainly technologically focused) are conducive to or simply not the territory of Industrial Design. There are certainly forms of operational or detail stage ecodesign of an especially 'technical or technological' nature that are simply not the remit of industrial designers. This is particularly true in the operational roles of continuous improvement or core design (Sherwin and Evans, 2000), they are simply not what Industrial Design does.

## **7.2.2 *The early stages***

One of the research objectives relates to the 'early stages of product development. A number of authors (McAloone, 1998; Bakker, 1995; Van Nes and Cramer, 1997) have previously concluded on the benefits of 'early stage' ecodesign integration. Theory promotes that the earlier environmental issues are considered within product design and development, the more effective they are in reducing environmental impacts and the greater the potential for ecodesign innovation. The conceptual model of Industrial Design based ecodesign in the product development process (figure 6.14) indicates clearly that the effectiveness of industrial designers mirrors this effectiveness of ecodesign throughout the process. The literature highlighted the potential of environmental design intervention as diminishing as the product develops. This requires freedom within the design process and environmental issues to be an integral part of the design brief and project specifications. It also requires both designers and environmental issues to be included early on.

### **7.2.2.1 Is early always best?**

This 'early is best' theory highlights the importance of the 'timing' of both environmental issues and design involvement. Both Dewberry (1996) and McAloone (1998) conclude that designers are rarely involved in environmental decision making processes early enough, or often not involved at all. In many cases decisions having the greatest effect on the impact of the product are often made elsewhere, before designers come into contact with the project. Here lies a major contradiction, as on the one hand design and ecodesign involvement needs to be early, while on the other hand this rarely, if ever happens in design as clients or senior management set project, make important decisions and write briefs.



This early is best theory can neither be confirmed or refuted in this research, as there is inference of both early and occasionally later ecodesign interventions being successful. When ecodesign was considered indeed driven by environmental issues as with Concept Design, it is clear that integrating very early (written in the design brief) was fundamental to success, to innovation and (potential) environmental performance. This work assumed industrial designers as the early stage designers. There is also strong evidence that with other types of design activity, for instance the Continuous Improvement of an existing product, it may not be 'best' to integrate ecodesign at Industrial Design stages, but to leave this to other, perhaps later design and product development stages. In short the 'early is always best' theory is overly simplistic and no panacea. It is particularly questionable when the early stages are considered as a design department or phase of the development process, rather than part of the 'life' of the product. Industrial Designers undertake a wide variety of projects and design activities, all of which might not be considered 'early'. Similarly ecodesign issues vary greatly in their nature, all of which do not require integration at the 'early stages'. It depends very much on what is to be integrated and who is doing the integrating (Sherwin and Evans, 2000). For Industrial Design, perhaps only in Concept Design does the 'early' theory hold true universally.

### **7.2.3 *What ecodesign information do designers require?***

There are questions as to designer's ecodesign information, which may contradict the current provision of ecodesign information. A general trend in ecodesign is towards exacting environmental quantification and precision in the analysis of environmental impacts. In this research no environmental qualifications were used or required, which questions the conventional wisdom that environmental data on products, processes or materials is a critical to the ecodesign process and ecodesign innovation.

Information requirements were almost entirely of a 'general' nature in the shape of ecodesign principles or strategies (described as 'nuggets' of information) to stimulate designing and thinking. Precise and quantified, environmental data seems of little help or relevance to designers for idea generation. This very much fits the profile of designers as 'generalists' – knowing a little about a variety of issues (see section 2.6.4.1). Exacting and quantified environmental data may be of some use in selecting environmentally preferable ideas previously generated, but there was little evidence of design interest here.

### **7.2.4 *An environmental audit is the key to ecodesign innovation***

The perceived wisdom on ecodesign innovation indicates that a first step is to select an existing product and conduct an environmental analysis in order to highlight environmental 'bottlenecks' and potential places for ecodesign intervention (Brezet and Van Hemel, 1997; McAloone, 1998). Using this logic, the way to facilitate ecodesign innovation is via the environmental audit or analysis of an existing product as the analysis illustrates where to focus design attentions. This was not the case here, No product orientated environmental audits or analyses were used or requested. In fact, as highlighted earlier, such analyses may foster the more incremental approach to ecodesign and actually stifle creativity (Beard and Hartmann, 1999). Until these misguided views of ecodesign information are broken, the development of more innovative ecodesign will be seriously hindered.



### **7.2.5 What format and presentation?**

As well as its type and accuracy, information needs presenting in an appropriate manner for designers. A key current problem with ecodesign information is that it is not visually presented using case studies and examples of substantiated or applied ecodesign practice. In her study of information for industrial designers, Bakker (1995) similarly concluded:

*"..designers very often referred to 'examples' existing products and materials that inspired them to new and analogous solutions. Given the importance of examples for designers, it is recommended that these are made available to designers in for instance handbooks or databases. These examples should include product innovations that enhance more sustainable lifestyles, as well as good examples of incremental environmental product improvements" (p.174)*

This study would unquestionably support and add weight to this. The researcher would go further in saying that if you really want to motivate a designer, to educate and empower them in an appropriate manner, to quote the Environmental Design Co-ordinator at Electrolux, *"show them a picture with no more than 10 words!"*

### **7.2.6 Motivating and stimulating designers**

Especially important to successful and Innovative Ecodesign are questions of motivation. Findings here indicate that novelty and innovation; new ideas and concepts will best motivate designers. Informant feedback highlighted this as of particular importance, that the personal motivations of designers to innovate were among the best forms of motivators and most relevant means to drive ecodesign. Ecodesign is seen as 'new and fertile ground' in which designers might 'leave their mark on the world'. Here many existing protocols may not yet exist, so designers could exploit and explore these without predefined agendas, methods or aesthetics.

Other work has prioritised personal commitment and motivation also. McAloone (1998) concluded that the design engineer's personal motivation was a key success factor to ecodesign integration, by making close associations between economy and ecology (between technical and economic or eco-efficiency). Personal motivation was of similarly high importance in this enquiry though the actual motivators were somewhat different, being novelty and innovation more than economy or efficiency. Whereas McAloone (1998) termed this 'ecology=economy', this research indicates that for designers the association should perhaps be described as 'ecology=innovation'. Generally ecodesign education (company as well as academic) needs to acknowledge that the greatest motivating factor for designers is novelty and innovation. Thus there are perhaps, more subtle and suitable ways to motivate designers (such as the new creativity and innovation paradigm) than the political or economic arguments often used elsewhere to promote ecodesign and sustainability.

Also, because personal motivations seem of such high priority, integrating ecodesign needs to take a more long-term view. What is required is a more systematic and holistic process of 'greening' the department, which needs to be as fundamental part of the judgement criteria as aesthetics or usability within the design process. It will not be enough to just get ecodesign into individual projects or products, though ironically this may be an important part of the long-term process.



### **7.3 Why use an industrial designer?**

These findings paint a slightly unfavourable picture of industrial designers' ability to conduct ecodesign. It suggests they do not and cannot engage in most ecodesign practice to date, as it does not fit their working practice. Also their skills are of little use to these largely optimisation and efficiency (incremental) based ecodesign activities. This view however, will change and is changing. There is increasing recognition over the last few years of the need to pursue and embrace more radical, discontinuous and innovative practices (Manzini, 1997; Mackenzie, 1997a; Ryan, 1996). Concepts such as eco-efficient services, function and systems innovation, eco-innovation and product-service-systems (see sections 2.10.5) all require different skill-sets and thinking than this largely incremental ecodesign. They also place an increasing emphasis on the creativity and innovation of the individual designers (Beard and Hartmann, 1999; Beard and Hartmann, 1997). This is the design territory of Industrial Design. It is within these more radical and innovative practices that industrial designers may find their niche and most significant role.

#### **7.3.1 Industrial Design in Sustainability**

As well as being important to emergent ecodesign concepts, design skills also connects well to the requirements of sustainability. The literature highlights the need for more radical and consumption based innovation (UNEP, 1992b, UNEP, 1992a) to fall in line with sustainability targets such as Factor 4 to 10 (Fussler and James, 1996; Von Weiszacker, 1997). Not only do industrial designers seem to have the ability for this, but is perhaps their most significant contribution. There have been a number of other reasons to champion design as a more strategic resource, again Bakker (1995) relates this to sustainability, "*Industrial designers are in general creative, product-orientated, user orientated and capable of conceiving innovative solutions*" (p.175), which this work again confirms.

#### **7.3.2 The Greening of Desire**

Among the most striking omissions from existing ecodesign theory is any reference to design and desirability. Almost nowhere in the literature do authors (except Ryan 1992, 1994 and Manzini, 1995b, 1994) refer to design having any role as increasing the desirability of new eco-products or behavioural options. This is surprising as designers themselves saw this as a major role, and much design based literature and design practice is focussed towards these ends. Within the current socio-economic context a (many would argue *the*) major role for design is increasing the desirability of products and stimulating economic activity (often through product differentiation), thus increasing the profitability of the company and improving the standard of living of the consumer (see section 2.4.1). Discussions on these matters tend to fluctuate somewhere between charging designers as 'creating' the demand for the product (i.e. increase consumption and desire), to views of designers not affecting the market, but being completely subordinate (market-led). What these views share is the agreement that there *are* interventions. It is this final point, not the type of, but that there *are* market intervention of importance here.

Few, if any promote the role of design as increasing the desirability of environmentally preferable products or lifestyles in ecodesign epistemology, choosing instead to focus



almost without question on the 'technicalities', the design and detailing of eco-products. This work demands existing ecodesign theory be revisited to include designers playing a significant role not only in the technical development of products with reduced environmental impact, but in the design and promotion of alternatives that are acceptable and desirable to people. Though Manzini (1995b) has previously highlighted this, the research conducted here offers an empirical basis and confirmation to this as designers very much embraced this under the guise of 'eco-erotica' and 'ecology can be sexy!'

This predominant lack of acknowledgement of what design currently does extends the call for ecodesign to respect (or fit) Industrial Design, and enable it to embrace notions of 'design' more broadly. Elsewhere, the researcher has termed these contradictions as 'finding design in ecodesign' (Sherwin, 1999). In metaphoric terms, in much literature, the emphasis is on finding the 'eco' in ecodesign i.e. what environmental issues to place in the design process. These conclusions contradict this and call for us to 'find design in ecodesign. Stated more simply, this means defining and exploiting the true potential of design's contribution to sustainability. This is not yet happening for various reasons, the more obvious of these can be highlighted from design literature.

### **7.3.3 Finding 'design' in ecodesign**

Design tends to be viewed and traced back to the design and detail of products for industrial production. Forty (1986) offers a convincing and comprehensive thesis tracing design back to the production, dissemination and consumption of 'ideas' within varying social frameworks from the Industrial Revolution to the present. Translated and applied to ecodesign, this offers great potential especially for the notion of 'selling' sustainability, but is strikingly absent from the ecodesign literature, existing theory and practice. At present, ecodesign does not completely connect to what design does and can do. Today ecodesign is largely confined to the technical dimensions of the design and detail of products whose impacts are reduced in their production and material selection. This is unfortunate as design offers so much more.

## **7.4 What is Innovative Ecodesign?**

Before questions on the nature and purpose of the more innovative practice of ecodesign can be discussed, it is important to define what it is. The researcher does this with some reservation due to Walker's (1998) comments on the pointlessness of definitive definitions of Sustainable Product Design. However some form of description is needed here, though not promoted as the one and only approach to Innovative Ecodesign. Referring extensively to the conceptual model present in figure 6.15, the following can be stated:

*Innovative Ecodesign aligns closely to the design dimensions of ecodesign innovation, or design practices of eco-innovation. It is characterised by an emphasis on new product concepts (rather than existing product redesign) requiring design interventions in the very 'early' product development stages (pre-specification or at concept stages). Its approaches are of a more innovative and radical nature with more dramatic reductions in environmental impact (improvements in environmental performance) strived for. It is however exploratory and places a strong requirement on openness and creativity, with high degrees of freedom within the design space. A specific aspect of its success is that it is not directly answerable to or does not feed into product development.*



*Environmental issues are placed centrally in the design brief, though are not always used as the primary generator or part of the design process. Innovative practices of ecodesign broaden the design space out to consider other systems than those previously considered, most notably systems of consumption and use, or demand-side factors. However where practised by industrial designers is still likely to result in the 'products' of this system, which implicitly expresses and embodies key environmental and sustainability principles, which are aimed to educate, communicate, and extend the benefits and potential of ecodesign and design.*

The purpose and value of these practices of Innovative Ecodesign can be better understood by comparing it to ecodesign innovation.

Relating back to the literature, there is more to conclude. The literature summarised approaches to ecodesign often in polarities described here as 'innovative and 'incremental'. This research very much explored the innovative approach to ecodesign. However the findings indicate the simplicity of these distinctions. Though the research has indicated clear characteristics of Innovative Ecodesign, in some ways this does not marry with various descriptions within the literature. As highlighted in section 2.3.4, there variety within the more innovative approach. Simon (1994) and Datchefski (1999a) refer more to an ecological or biological approach to design, whereas Van Weenan and Charter (1998a) promote ethical equity and developing world issues in design. None of the activities here considered this type of innovative practice. Similarly, McLaren et al. (1998) promoted 'efficiency' and 'sufficiency' while Pepper (1994), describes an 'ecocentric' or 'technocentric' ideology. Again the types of activity do not accurately describe the types of innovative ecodesign undertaken here. Though they were not 'ecocentric' (ecological limits, biocentric, decentralised) they were just also not 'technocentric' (blind faith in power of technology, step change), so perhaps the term 'radical technocentrism' should be created for it.

In short these polarities are over simplistic and do not represent the breadth and scope or the full possibilities of ecodesign (both incremental or radical, or anywhere in between). Ecodesign theory and practice is better understood as a spectrum or continuum rather than polarities.

#### **7.4.1 *How is Innovative Ecodesign transferred to ecodesign innovation?***

Such concepts of Innovative Ecodesign relate more to the creative and innovative practices of 'ecodesigning' (the design process and experiences of designers) than to the launch of innovations to market. This begs the question as to how this innovative design can be transferred into ecodesign innovation (products to market). The above description indicates that Innovative Ecodesign does not always result in ecodesign innovations. This is an important point, as frequently, the results of these concept based projects are greeted with some confusion (certainly from the institute in which the researcher is located), and questions such as '*well they don't work!*' or '*you could never produce/sell those!*'. This dismisses these forms of design project for their impracticality and unproducability, which is to miss their point and purpose. Practices of Innovative Ecodesign should not solely be judged on the same criteria as ecodesign innovations. They are exploratory, with the aims of expressing, educating and communicating ecodesign and sustainability to various stakeholders. This is still a viable role for design, but within this research was best conducted as part of the Concept Design or Primary Development (research and development) functions. The



advise to product developers should perhaps be, look for some general concepts to feed into product development in the mid to long-term and be patient!

This form of design activity is also a means of exploring new design possibilities and future product or market opportunities, in a relatively low risk, low cost way. In this case ideas, aspects or details of Innovative Ecodesign concepts are expected to 'flip-down' into product development later. Similar notions and aims of ecodesign has been termed 'concept demonstrators' by Simon et al (2000) though not so closely connected to educational and exploratory purposes. Manzini (1995b) takes a broader view on this in stating:

*"At this level of activity (new schemes), the designer is not so much a professional capable of solving given problems, as a cultural figure in the process of creatively linking the possible with the hoped-for in visible form. To take a specific example, the designer provides scenarios that visualize some aspects of how the world could be, at the same time, presents it with characteristics that can be supported by complex ecological equilibria, which are acceptable socially and attractive culturally. (p-237)*

The notion of 'visioning' (see section 2.7.1) he proposes falls very much in line with the types of design activity undertaken as Innovative Ecodesign. As such there technical performance, their practicality and produceability are not there main judgement criteria or quality. This work provides a practical, empirical, industrial design and company based manifestation of Manzini's challenge. Similar types of design project can be found outside of the ecodesign context, most visibly as 'concept car'. There are some striking similarities between concept cars, and for instance the 'eco-kitchen' project, in that both help create new technological and behavioural possibilities, which in turn educate the market and create demand by massaging consumer expectation. It is ironic to state the practices of Innovative Ecodesign as the 'concept cars' of sustainability.

## **7.5 How do you 'do' Innovative Ecodesign?**

As well as specific characteristics of Industrial Design based ecodesign, Innovative Ecodesign also has a unique nature. Most significant of all perhaps is its requirement for openness, creativity and strategic thinking. In here comparative study of 'incremental' versus 'innovative' Industrial Design practices of ecodesign, Bakker (1995) indicated that more innovative ecodesign practices appears to be conducted in a non-systematic way. This is in stark contrast to the more incremental approaches to ecodesign being systematic and methodological:

*"The rather random way in which the (innovative ecodesign) subjects... introduce environmental design strategies, seems to be in sharp contrast to the relatively thorough approach of the subjects in the (incremental ecodesign) group... Although generating innovative, possibly environmentally benign ideas did not seem to be problematic for (them)"*

Implicit within this suggestion is that the ad-hoc and random method of approaching Innovative Ecodesign is one of its failings, and that tools and methods need to make it more systematic and 'rational'. It is this researchers opinion that far from a sign of its failings and weaknesses, it is a sign of its health and success as it illustrates the openness and freedom with which designers can stretch themselves and the boundaries of ecodesign. More than being systematic, ordered, rational and logical, such forms of exploratory designing are more likely to be characterised by 'ad hoc' or



'random' behaviour. This falls in line with Beard (1999) and Beard and Hartmann's, (1997) ideas that the management of 'eco-innovation' is its antithesis as it stifles creativity itself and its practices will be anything but rigid and mechanistic. Designers own views that prescriptive tools would "*take the creativity out of the whole process*" also suggest that innovation tools are not required, but also if provided would not be used. In this sense a key 'tool' or 'method' to more Innovative Ecodesign is the open context in which to do so. All projects cannot do this, but Concept Design is ideal. This author feels no such creative (rigid or mechanistic) idea generation tools are needed, though agrees with Bakker (1995) on the need to develop environmental evaluation and validation tools to test and evaluate the environmental performance of these ideas.

### **7.5.1 The key to ecodesign innovation is the lifecycle**

Much existing theory promotes 'the lifecycle' as the core concepts within ecodesign innovation and ecodesign literature generally (see for example the PROMISE manual (Brezet and Van Hemel, 1997, section 2.8.4). Within this literature the lifecycle concept appears in a variety of guises, as Fletcher (1999) states:

*"The basic concept underlying the generic ecological design approach to design is the lifecycle. It involves connecting the design of a product to the larger situation of materials extraction, production, transportation, use and disposal and attempts to minimize environmental impacts across this entire lifecycle."* (p.98)

McAloone (1998) offers an empirical basis for this in describing the lifecycle perspective as a key integration factor in industry experiences of ecodesign. Fussler and James (1996) go further in stating the lifecycle's principles more quantitative and specific manifestation, Life Cycle Analysis (LCA see section 2.9) as critical to the process of driving 'eco-innovations'. This author has previously written on this subject of the lifecycle being viewed as the key to ecodesign innovation (Sherwin, 1999). From this view, ecodesign *is* lifecycle design, with the two principle being inseparable. Van Hemel (1998) however begins to question the sanctity and universality of the lifecycle principle in highlighting that Life Cycle Analyses are viewed as either central or no use to ecodesign innovation.

This research contradicts the universal view of the lifecycle principle. Industrial designers rarely demonstrated or used life cycle thinking and never used Life Cycle Analyses. It is important therefore to state that the lifecycle principle and approach to ecodesign is not the *only*, but perhaps not even the *best* way to facilitate design innovation. No environmental analysis of products, quantification or identification of environmental bottlenecks was little used in any of these projects. This seems especially true when innovations of a more radical nature are required, or where conducted by industrial designers. Other factors appear of greater relevance to designers, most notably the identification of core business and the identification of consumer needs. With projects that have a high degree of freedom, and where the product concept are ill defined (as is the case here), the concept of the lifecycle is of little use other than for environmental validation and idea selection. When designers are working with a high emphasis on the concept stages, the criticism of lifecycle thinking as a means to facilitate Innovative Design is... the lifecycle of what?



### 7.5.2 *If not the lifecycle then what?*

Innovative Ecodesign appears to require the identification of the company's core business and of consumer needs rather than using concepts of the lifecycle. In effect these two questions, though different perform the same task, to broaden the design space and the perspective of the design project. Some notion of the company's core business allows designers to metaphorically 'lose' the existing product, though paradoxically another product is likely to result. Such notion of core business or competencies appear in a number of ways in Electrolux, often related to Foodcare, Clothescare and/or Floorcare, or perhaps definitions of product categories such as Hot, Wet and Cold. It also seems that the defined core business does not need to be especially accurate or truthful, so long as it allows the resultant broadening of perspective. This also applies to the identification of consumer needs seen as another essential ingredients for Innovative Ecodesign.

Among the most novel findings of this research is the consumer orientation of industrial design based ecodesign. To conclude and generalise, such concepts require some qualification. The consumer orientation occurred in many ways and from a variety of sources. It must however be stated that this consumer orientation in design is only likely to occur in companies that are (or at least describing themselves as) consumer or customer focussed as is the case here. This was described in a number of ways such as social innovations, consumer orientation or focus and well as user centred. All broadly describe the same thing, that being a predominant orientation towards demand-side design factors and issues in design. But that is not to infer that designers can 'design' demand-side solutions in the sense of behaviour, lifestyles, or even values or beliefs. Rather designers will design the material means to influence and effect these issues. This was the case with the pilot 'Eco-kitchen' concepts, with a focus on raising consumer 'Awareness' seeing designers consider new and more environmentally preferable types of behaviour. But these issues were materialised via the product, which attempts to coax, promote or enable such behaviours.

Again the achievements or accuracy of these definitions are questionable or at least not critical. It is very much the identification of designers notions of 'core business and consumer needs' that is important, though this may be explained by the absence of such information. There was little or indeed no concern as to how or whether these consumer focussed design interjections actually changed or were likely to transform behaviour. These notions of consumer orientation were largely resigned to speculation with no desire to test any design proposals with consumers, although proposals were likely to remain as concepts. Designers and the world at large have no idea whether consumer focussed ecodesign is actually consumer focussed outside of the designer's head.

Most interesting is that 'demand-side' or 'consumer focussed' ecodesign is not apparent in the literature, with ecodesign having the kind of predominantly technological and production bias as well as incremental highlighted earlier (section 2.8). Consumer focused ecodesign rarely appears in epistemology of ecodesign, though 'user-centred' design is among the most prevalent topics in design literature. The analogies between the two concepts are strikingly obvious, again highlighting the immaturity of ecodesign.



### **7.5.3 *What part does the product play?***

Notions of 'the product' are central to innovative practices of ecodesign. The focus of such projects should be broad with relatively few initial design constraints allowing designers to 'push around' ideas in an exploratory manner. Its primary aims are to educate and communicate to a variety of stakeholders, as well as being to express environmental and sustainable design related principles and potential. The means to do this is within the product, which embodies these principles implicitly. Though much attention is placed on 'the product', there is evidence of systems based perspective and a more holistic view, extending to new and novel aspects of the system not previously considered. Industrial designers felt that the systems of use and consumption were most appropriate for them (see section 6.5.5.2).

The idea of the product is irrevocably caught up in design, which can be both a help and hindrance. One important point however relates the product within ecodesign methodology. So much emphasis is placed on the product in design and as a stimulus and information source for design that one could say that in many ways the product is part of the methodology. Ecodesign methodologies, especially those to facilitate design-based innovation would be incomplete and seriously limited by not acknowledging this centrality and methodology developers need to acknowledge this.

### **7.5.4 *Questioning the product in the design output!***

Designers seem hold on to the product, even when there is evidence of a more systems based thinking and perspectives. However there is some anecdotal evidence of this changing, and perhaps needing to change for the future development of more Innovative Ecodesign. Towards the end of this research the product orientation became less prevalent or certainly began to change. Not in the sense that designers no longer design 'the product', but that the notion of a product as the sole goal or outcome began to be questioned. Towards the end of this research, there was some evidence of designers beginning to propose different forms of design, such as adverts', or cartoon strips' as the output or a better way of communicating and expressing the required principles. Further research is needed to validate and confirm whether this is a general trend.

This is not to say that proposals will not contain new products (in the sense of hard, material stuff!), rather the idea that *only* designing and communicating the product might not be the only or even the best means to do this. There may be better means of communicating the system itself. The most obvious example of this was the Service Selector – the concept project to emerge from the Service Design project. This saw designers not only proposing a new business concept (strategic design, see section 6.6.5), but also an information based product in the form of an Internet tool and website for consumers to purchase directly from the company. This effectively saw 'product' designers proposing a dematerialised and information-based product. It is this kind of cross disciplinary designing, with the freedom to redefine or find a suitable type of design output that will be increasingly important for future Innovative Ecodesign. It requires a broader definition of 'product' and perhaps a redefinition of the notion of a 'product' designer. It is the authors belief that in the mid to long term, there will be other possibility better ways to express, embody and communicate Innovative Ecodesign, and in turn designers will develop the skills to do this.



### **7.5.5 The need to move the goal-posts**

Unlike the other research findings, this relates to processes of time and change. There is some evidence that Innovative Ecodesign requires designers to lose their reliance on the product-orientation as the output, and begin to explore other more appropriate means of expressing, communicating and designing proposals or 'products'.

Towards the end of the research this blinkered preconception of the product as the sole outcome and goal of the design process became less prevalent, with examples of designer turning to less materially reliant and examples of more systemic design outcomes:

*"lets just look at new idea for how they can live there lives. So we say, they live in apartment block, they have some food delivered, which is mostly part-cooked, they just add some ingredients. Well there clothes washing, well they do a minimal amount, they can actually afford to do that when they go shopping. And try and do one, one, its like a cartoon strip through one day in their life..! I'm trying to imagine this thing and it could almost be just like an advert...."*

This is of particular relevance to the more innovative industrial design context described above, which values a more systems based or holistic approach in which broader systems of production are considered such as the life cycle or consumption and use scenarios. In this sense, though designers may still design the material dimensions of this, other aspects may be key consideration and the output may certainly be less materially reliant, and more importantly may be more appropriate to issues of consideration. Within such projects, designers need freedom to explore these new forms of designed output. Effectively moving these metaphorical 'goal-posts' throughout the design process is important to the development of Innovative Ecodesign. One way to visualise this is referring back to the 'Four Orders of Design' proposed by Buchanan (1990) in section 2.4.2 including: communication (signs symbols); construction (products); strategic planning (service or processes); and systematic integration (systems, organisations values). Basically these 'Four Orders' represent a broadening of the design space out from things and products to larger systems. Innovative Ecodesign practices need the space to move between these orders and to define the most suitable form of design output. Rarely do Industrial Designers get to think and design out of the 'Second Order' of products.

This requirement is perhaps a more general trend in design not simply changing for ecodesign, as Industrial Design moves towards more strategic roles and contexts (Domus, 1998, Manzini, 1998). As one designer put it here:

*"I think some of the major problems with the subject is the nature of industrial design at present... its still has the big white box image – the product must be a product! But this is changing, and not just because of the environment and ecodesign."*

### **7.5.6 How do designers dematerialise?**

A general trend within ecodesign and sustainability related literature is towards dematerialization, diminishing the importance of materials and the centrality of the product within our systems of production and consumption. In design, this means reducing the amount and importance of materials in products, using a variety of strategies and ties in with ideas of systems thinking. One increasingly important strategy is the shift towards 'service' (section 2.10.5). This general trend is manifest and described in a variety of ways (as product-service-systems, systems innovation,



etc) all with similar aims and methods. Within this research, this dematerialization was the general aim of all the projects, especially the Service Design project. The logical and often posited extension of this general trend and thinking is that 'designers should focus on the service or system!', with the inference being that designers will 'design' the service, system itself. This research raises major questions and contradictions of such suggestions, asking how or even whether designers can design a service, and in turn how designers materialise.

A key finding here was the product-orientated nature of Industrial Design based ecodesign. This product orientation is further supported by design research indicating that designers cognitive strategies are essentially product orientated (Dorst and Dijkhuis, 1995; Cross, 1992). Effectively, designers 'design' the product, think, sketch and work via the material dimensions of design. As such designers are unlikely (and perhaps cannot) design 'service', which is by its very nature non-material. This limiting their ability to dematerialise and though the distinction between 'material' products, and 'non-material' services is not so black and white, to ask designers to design 'service' is naive and fanciful. They are much more likely to design the material dimensions of any service offering - the 'products' of service. Though broader systems may be considered, design processes are still likely to result in products, 'hard' things and stuff! Product developers should acknowledge this in projects and design briefs. Design projects and activities aimed at dematerialising to service, system, etc conducted by industrial designers are still likely to see designers 'design' the product!

To summarise on 'product orientation' and Innovative Ecodesign, designers 'design' the product and via the product. However more innovative practices of ecodesign require designers to break this reliance, to question preconceived notions of the product and redefine other, perhaps more appropriate design outputs of broader systems. However, design is still likely to result in a product.

#### **7.5.6 Partnerships and integration**

There was also recognition that Innovative Ecodesign required new levels of partnershiping and integration both internally and externally. Many environmental problems cross the traditional sectorial boundaries again illustrated using the example of product 'use'. In Electrolux, for example, the greatest environmental impact of products comes almost entirely from the energy they consume during their use. Electrolux do not supply energy, as public or private utilities within individual nations do this. Use of products is dictated to a an extent by lifestyle, and culture specific values and beliefs. The issue of reducing the most significant environmental impacts of their products is therefore, outside of the traditional company boundaries after they have sold the product. For the company to tackle this they have to extend their boundaries of responsibility, in the above case by partnering with the energy supplier. Though only one example, these links, partnerships and networks within the production and consumption chain (such as those required to tackle the environmental impacts of product use) are recognised as fundamental to the mid to long-term success of more Innovative Ecodesign. Projects of the future therefore need not only to metaphorically look outside the factory and production processes, but also perhaps outside the individual company.



## **7.6 Why do Innovative Ecodesign?**

Along with these questions of how to conduct Innovative Ecodesign, the question also remains of 'why' to do so. The first answer to this is that the aim of Innovative Ecodesign is *not always* to transfer to product development and result in a new or redesigned product (section 6.6.1.1). It is perhaps not worth conducting Innovative Ecodesign if the sole purpose and goal is product development. Part of its success is in not being answerable to product development or the more operational roles of design. As an exploratory form of research its purpose should be viewed as a goal in itself, though this is not to say its transfer and relationship is untenable. But what part do environmental issues play?

### **7.6.1 What part do environmental issues play in Innovative Ecodesign?**

This study deals broadly with innovations in ecodesign. It would therefore be trite to ignore the role that environmental factors play within the design processes followed here. There are several points to raise about the use of environmental issues and goals within design processes and projects. The findings indicate that even when stated as a priority within the design brief (which is a fundamental part of their success), they are often not the primary generating design factor and often 'piggy-bag' on other design drivers. There seems little concern as to how much or even whether such design concepts *actually* reduce impacts and improve eco-efficiency. Like with the consumer orientation in design, designers work on speculation and supposition as to the environmental benefits of their decisions, where concepts are environmentally preferable by association and intention, but not actually known. This can in part be because these were concept design projects and resigned to remain at concept stages, so further research is needed to generalise this to all Innovative Ecodesign and Industrial Design practice more broadly.

In some cases projects might not actually result in environmental improvements, which seems self-defeating though again designers don't seem especially concerned with this. Projects and in fact ecodesign was seen very much as a springboard or platform for ideas, and once this was achieved the "*eco-stuff will pretty much be left behind*", as one designers put it. The point here is that the resultant Innovative Ecodesign project may not always result in the 'greenest' or even a 'green' concept as the onus is on novelty, innovation and newness. Though such projects are aimed at radical environmental improvements, the 'optimal' ecodesign solution is not there sole or even their primary aims or judgement criteria. Rather than the 'greenest' concept, it is often the most visible, novel, or achievable design task that are selected and developed by designers. In terms of environmental benefits of such projects, apparently designers won't always do the 'right or best' thing, but they might do an 'interesting' thing. They will almost always do a 'new' thing!

## **7.7 How is Innovative Ecodesign managed and integrated?**

The work within this thesis broadly explores 'early stage' ecodesign integration with these early stage considered to be Industrial Design. A number of conclusions related to the management and integration of ecodesign into a department of Industrial Design. Innovative Ecodesign is also a suitable means to integrate ecodesign from its early



conception and filter down to everyday practice with these departments as it was used here.

### **7.7.1 *Incremental or radical ecodesign integration?***

McAloone (1998) concluded that ecodesign is integrated into companies in a distinct way. This research contrasts this against a differing perspective on ecodesign integration at a departmental level (a single department of Industrial Design). Companies from the electrical and electronics sector tend to integrate ecodesign by conducting small and simple projects, considering perhaps a single environmental issue (green design, section 2.3.4) and using an existing product as the reference. Within this study, the Industrial Design department's approach was more radical than incremental and from the top-down, rather than bottom-up. Here ecodesign was integrated at concept stages, the most conceptual, open and challenging design context and then aimed to 'filter-down' to the every-day and product development focussed design contexts. The integration process for companies differs from that of a single Industrial Design department by being inverse and directly opposed. In other words integration into companies and engineering functions start small, take small steps to build confidence, commitment and experience slowly. Whereas ecodesign is integrated into Industrial Design by aiming high, leaping far and percolating down.

### **7.7.2 *How does ecodesign fit product design and development?***

Various company and management related factors significantly affected the nature and practice of more Innovative Ecodesign (see section 3.2). The first of these is the companies 'Total Approach' to ecodesign. Fundamentally the Total Approach is the lifecycle approach which, as highlighted before can be a hindrance to more innovative practices of ecodesign (section 2.9). Historical descriptions of ecodesign describe it as developing 'up through' the product development process, from 'end of pipe' solutions, through production to the product (James, 1997; van Weenan, 1995; van Hemel, 1998). Whereas previously ecodesign factors may be confined to certain technological and technical alterations to process or product, largely at the detail stages of product development, but for its current developmental stages this view may not be suitable. As the design interface between marketing and production, and 'bridge' between production and consumption, in an Industrial Design context ecodesign becomes more 'people centred'. Fortunately this is exactly mirrored by the greatest impact of most electrical products (in 'use') and certainly where consumers have ownership of products outside the 'factory gates' (Fletcher, 1999). Though projects and ecodesign developments as described within this study are perhaps representative of this progressive move up the product development process, the future should see increasing recognition of and planning for these fundamental ecodesign differences.

This might and indeed did see industrial designers working differently, but possibly in advance of environmental policy and strategy, simply because their potential is not understood. The key problems here are of recognition and restriction. Policy and strategy that do not utilise the potential of designers is missing an great opportunity, but may in extreme cases stifle and restrict creativity or greater environmental improvements so essential for sustainability. To some extent this happened with the Service Design project, where design had very much to define and communicate there own path and unique 'spin' on the project. As a senior designers described:



*"I'm now finding that we are in advance or at least have different thinking than other departments on the ecodesign stuff. I know go to the services department, to the people dealing with functional sales, and show them what we are doing and where we are going and they just say 'Wow! Go on ahead with this!...'"*

The management of both design and ecodesign can significantly influence their effectiveness and innovation potential.

### **7.7.3 *Is product development conducive to ecodesign?***

A more formal problem relates to the location of environmental factors within product development and where it is integrated. In Electrolux product development is organised using the Integrated Product Development Process (IPDP, figure 3.4). In IPDP, environmental considerations are not mentioned until stage CP1, where an environmental analysis of the concept is stated as part of the 'Concept Solutions and Verification' (section 3.2.5). This means that formally within IPDP, environmental factors are viewed very much as a validation issue (as is the case with LCA, section 2.9), rather than a *generation* issues or the *source* of new concepts. This confines ecodesign to later design stages demoting it to a peripheral role as a reflective form of design i.e. validating ideas and concept *after* they are generated. It also sends out symbolic messages as to where and at what stages 'the environment' should be considered. Finally it misses the seemingly primary interest of industrial designers in design and ecodesign, that of generating new and novel ideas.

### **7.7.4 *Managing design***

A final organisational obstacle to ecodesign relates to the manner in which design is organised. Concepts of integration and concurrency are widely recognised as important to successful product development (Lettice et al., 1999; Bhamra et al., 1999; McAlone, 1998). These aim to amongst other things reduce cost, improve communication, quality and lead time and have a proven track record. More recently, concepts of concurrency and integration have been successfully extended to ecodesign. First and foremost perhaps, integration and concurrency requires participants to work together, commencing projects at the same time, while involving many or all the actors in the early stages of product development for their success. The clear distinctions between the Industrial Design and Design Engineering functions (see section 3.3) in this company (no design engineer is employed in Industrial Design, and vice versa) is perhaps not conducive to such notions of concurrency and integration in ecodesign. Though there is communication within projects, the clear distinction between the departments is the cause of confusion about design where two departments are seen to 'do' product design. This could also be the cause of the development of ecodesign methods that are inappropriate to Industrial Design as concluded here. Notions of concurrency and integration seem especially relevant in the case of ecodesign and environmental issues, which are widely acknowledged as multi-disciplinary whilst breaching traditional design, knowledge and skills boundaries. Separating the Industrial Design and Design Engineering functions is perhaps not the most suitable design context in which to integrate ecodesign and is clearly the cause of unnecessary obstacles.



## **7.8 What are the main barriers to more Innovative Ecodesign?**

The first and most obvious barrier to Innovative Ecodesign is that such radical innovation of this type is normally the exception rather than the rule. Various authors (Dewberry, 1996; Dermody and Hanmer-Lloyd, 1995; Bakker, 1995) describe the types of innovation undertaken here (new or discontinuous concepts, etc) as making up somewhere between 2-10% of products launched to market. This is not a favourable number and promotes a more incremental approach as more likely to succeed. Paradoxically these incremental types of ecodesign innovation are almost universally accepted as being unable to achieve the environmental improvements required for sustainability, thus radical innovation is very much needed. This does not invalidate this work, which considered designing only, whilst largely ignoring barriers external to the abilities of designers or the actual development and launch of innovations. It does suggest however that many innovation barriers to ecodesign are outside the capabilities of designers themselves and highlights a dichotomy that is yet to be resolved

### **7.8.1 *Recognising design***

Several potential barriers also emerged from preconceptions of both design and ecodesign. Much of the ecodesign literature, particularly that on eco-innovation has a tendency to highlight the need for more radical innovation without giving many indications of how or where to do it. This research proposes Industrial Designers as having the capacity to conduct innovations of this more radical nature (section 6.5.3.2). They are a good 'place' to look as "*ideas are what designers do!*" It is no longer enough for companies say they don't have the capacity to conduct eco-innovations. Most have design departments (or at least access) with the interest, motivation and right skills to do this. The main barriers are recognition and therefore rest not in the skills and capabilities to conduct more Innovative Ecodesign, but in the inability to recognise and utilise these design competencies. Among the best example of this are the designers and company's views on information provided to influence consumer behaviour. The company attempts to change consumer behaviour through leaflets and literature which accompanies products when you purchase. Designers have strong beliefs they can embody certain kinds of environmentally preferable information within the product architecture. This will communicate and elicit and encourage certain types of behaviour as and when you use the product – during use (see section 5.6). Not being fully aware of this capability, the company is unlikely to commission it even though it is potentially powerful tool. The problem is more the profile and recognition of Industrial Design and the misconception of what design 'is'.

### **7.8.2 *Perceptions of ecodesign.***

Further barriers appear with preconception of ecodesign. The historic view of ecodesign, dealing with materials, technologies and processes and remaining within the factory gates (Fletcher, 1999) is perpetuated by the environmental science tradition out of which it emerged (Allenby and Fullerton, 1992). This view seriously limits the development of the subject and in the case of the electrical and electronics sector it is wrong. Again, the emerging acceptance of the 'use phase' as the greatest impacts of electronic products lifts ecodesign out of the factory and into people's homes and lives.



In this research, a key purpose of these types of design was to educate stakeholders as to its possibilities and potential, not considered previously. Designers often worked differently than with previous methods, to break and extend old notions of what ecodesign is and does. Holding on to old and perhaps limiting view of ecodesign as 'eco-technology', seriously hinders its development. This is not to say that the old view is not correct, just that it is not the *only* view. Ecodesign needs to develop and expand into other areas, such as the social sciences, anthropology and cultural studies for it to realise its full potential. This need to take ecodesign out of the 'technology', and place it within 'design' is well articulated by Hawken et al., (1999) in paraphrasing ecological architect William McDonough:

*The design concept, as he puts it, had "taken the filters out of the pipes and out them where they belong - in the designers' heads"... Design mentality can reshape production processes - and even the entire structure and logic of a business. (p.72-3)*

Many barriers and obstacles are therefore not inherent within design, rather in the profile and context in which both design and ecodesign are currently played out.

### **7.8.3 Internal barriers and obstacle**

Barriers do occur however, within the traditions, protocols and mentality of designers themselves. In this research there was serious evidence of what is termed 'product-orientation'. Design research in part explains and justifies this, but is not a totally satisfactory explanation. The author believes that the product orientation of design practice is often a cloak behind which designers hide their unwillingness to change, mature and question their own preconceptions on increasingly obsolete working practices.

Many of the findings related to the idea that ecodesign should 'fit' industrial design and that existing ecodesign practices within the company, and in the field more generally did not do this. The researcher continues to promote the development of more appropriate Industrial Design based tools and methods, yet states this with a note of caution. The idea of ecodesign fitting industrial design is a double-edged sword. It not only requires ecodesign as a concept to change, but also design. A key obstacle is also that of designers' own unwillingness to stretch and extend their own competencies. Designers need also to change, and this change must come from within, as well as external views of design and ecodesign. If this were to happen, so much emphasis on the material dimensions of the product may diminish not just in the product itself, but more importantly in the designer's mind.

Another large design obstacle to sustainability lies within novelty and innovation designers being the core personal motivations. Though important to plan for this, in the long-term this constant search for novelty, innovation and 'newness' is in itself unsustainable. Constantly striving for new solutions, new innovations, technologies and designs is perhaps antithetical to sustainability, as many truly sustainable solutions will come from old, traditional or past ways of designing, which are more in tune with environmental limits, natural rhythms and human scale.

#### **7.8.3.1 Responsibility... as well as empowerment**

Ecodesign places a strong emphasis on ethics, systems and holistic thinking and even a more deep-seated knowledge of materials, processes, their impacts and place



(section 6.5.1.6). The sustainability critique also asks designers to extend their concerns from the conception, design and use (both physical and symbolic, Buchanan and Margolin, 1995) of the product, to the impacts and implications of design decisions on society and our futures at large. These changes may not be especially comfortable, and may cause periods of insecurity and uncertainty within design, but they are essential for the future development of more innovative practices of ecodesign. There was increasing recognition for these more fundamental and searching changes within Electrolux as indicated in the Environmental Design Co-ordinators when reflecting on the 'Eco-kitchen' project':

*The outcome is firmly within redesign – this is possible to champion from industrial design almost without support – ideas are what we do. When you get to rethink – as much of the later work, which followed, has we start to redefine and rethink player's roles and company boundaries. We perhaps question the skills of existing industrial design – sketching model making etc. and call for more strategic insight and planning. Design itself can be a little uncomfortable or unsure of its capabilities, as those involved are forced further outside the day to day activities of a 'design' operation.*

*However this is where design must go – it must question the norm and constantly create new languages of what is acceptable in terms of technology, sociology and environment..... In doing so it will create new businesses and in turn new providers will emerge....*

This limiting view of designers as the 'screw-driver merchants' (as one designer put it) which is in part perpetuated by themselves, needs very much to change from both without and within.

## **7.9 Is sustainability a design problem?**

Sustainability literature paints a contradictory picture of design being both the cause of environmental problems (Margolin, 1998a; Van Der Ryn and Cowan, 1996) as well as paradoxically being in part their solution (Von Weiszacker et al, 1997; Hawken, 1993). At its most basic the argument proposes a revolution in design, and that we redesign and reconceive our technological, our economic and even our social systems. These design threads have been explored by Von Weiszacker et al (1997) and more recently via the concept of Natural Capitalism (Hawken et al., 1999). Drawing on the work of Hawken (1993), Dewberry (1996) discusses the idea that complex and comprehensive environmental problems can be resolved 'by design'. She comments that:

*"Although Hawken suggests that the global problems facing late twentieth century society' are soluble by design', it is clear from the empirical work of this research study that this is not the case. In an ideal situation, the innovative nature and creativity of a design profession may well produce inspired solutions associated with an ever-expanding production and consumption system. However, we do not exist in an 'ideal' context and designers have to balance inspired creativeness with the realities and constraints of a commercial world..Unfortunately many of these 'opportunities' within the commercial arena (i.e., commercial pressures, anticipated legislation, cost saving exercise) are out of the designers hands". (p.224)*

She places the blame with the contexts or systems into which design operates as it is embedded in inherently unsustainable systems of production and consumption. There is a strong argument therefore that design should dislocate itself from these contexts and develop better, more appropriate ones (outside the corporate context) in which to conduct more sustainable practice (Walker, 1995, 2000; Margolin, 1996, 1998a), though these lines of inquiry were not pursued in this study. There is also a similarly strong argument for change within. Like Dewberry this work concludes that in reality



many current factors essential to more innovative ecodesign are outside the control and decision making of design. On more serious and strategic design matters, which characterize Innovative Ecodesign, designers are often simply not included at those higher decision making stages. However, this study suggests that this is not because design does not have the capacity to do so. On the contrary, there is evidence that designers can and do have the skills to design and propose solutions that can strategically redirect and help environmentally re-orientate company, society and products to fall in line with sustainability targets. What they lack is not the skills, ability or talents to do this, rather the profile, voice and recognition to do so.

Within Dewberry's (1996) critique however, is implicit that the 'design' of Hawken is conducted by designers as we traditionally understand them. It is the author's belief that the design to which they (Von Weiszacker et al., 1997; Hawken et al., 1999) refer is the practice and the thought processes of design (design thinking) rather than the profession of design (designers). Here, though sustainability is a design problem resolved by design, the 'designer' (as we traditionally understand them) may not necessarily resolve it. The logical extension of this is to change our current notion of what constitutes 'a designer'. Clearly the challenges of sustainability are a challenge of and to design. To manifest such widespread transformation to industry, society and economy design itself must change. Therefore sustainability requires us not only to redesign the foundations of production and consumption but also 'design, itself – a redesigning of design.

## **7.10 Summarising the Discussion and Conclusions**

This chapter compared and contrasted the research finding against some theoretical propositions and themes developed from the literature. These represent existing ecodesign theory with the aims of building theory and were a form of verifying, validating and expanding the research conclusions. These were presented in the two key research streams and are briefly summarised below:

Industrial designers conduct ecodesign in their own manner, and this research concludes that existing ecodesign epistemology makes little acknowledgement for and is not adequately descriptive of Industrial Design practice. Their contribution can be described as in the concepts, rather than the details and towards the early stages of product development. Contrary to much existing ecodesign theory and practice, this study also raises questions as to the provision of precise and quantified data on environmental impacts, which seems of little use to designers to generate ideas. It also promotes industrial designers as having some specific parts to play within the transition to more sustainable practices, specifically where more radical and consumption orientated innovations are required, which marry the requirements of sustainability with practices and processes of Industrial Design. In many ways ecodesign epistemology does not especially 'fit' practices of Industrial Design.

Innovative Ecodesign as practised by industrial designers also has some unique characteristics, not represented in existing theory. It is exploratory in its nature with the aims of embodying, expressing and communicating novel ecodesign and sustainability principles and potential to others. Amongst its successes are that it is not directly answerable to product development, and its 'success' is not wholly measurable in



either resultant products launched to market, or in the (potential) magnitude of environmental reductions. Key factors within the design process are the identification of the company's core business, and notions of consumer needs. These latter points raise questions about ideas of the 'lifecycle' as the key to ecodesign innovations. It is strategic, requiring a systems based and holistic approach, which in the long-term will require participation outside the normal design and company remit. However, Innovative Ecodesign whilst moving broadly to dematerialise will still see designers designing products, or the material dimensions. Its integration is from the top-down, where 'high-level' concepts and approaches are expected to 'filter-down' to more operational design. There are also some questions as to the transferability of Innovative Ecodesign to existing product development practices and especially where it is formally considered too late. Barriers to its practice appear both in perceptions and preconceptions of design, ecodesign and within designers themselves, all three of which need to change.

The following chapter concludes and makes some recommendations for further work.







# CONCLUSIONS AND RECOMMENDATIONS

## Chapter 8

*This chapter summarises the research within this study and concludes. It presents the research aims and objectives and describes ways in which they were met. It will the research novelty and close with some recommendations for further research.*

### 8.1 Research Findings and Conclusions

This research aimed to study practices of ecodesign. Its particular focus was its early stage integration into product development as conducted by industrial designers and was based on a single case study methodology. This early stage focus led to two key research themes within the main study, giving more clarity and helping satisfy these research requirements. These were:

- Practice of Industrial Design based ecodesign
- The nature and characteristics of more Innovative Ecodesign

For the main study, it presents findings and conclusions for both. These two research themes developed and explored up to and throughout for the main study. They were then presented as two conceptual and descriptive models along with lists of the key research findings. These research findings were then validated and expanded against theoretical propositions and questions developed from the literature with the aims of building theory. As well as being a satisfying the being specific research objectives, these models and lists of characteristics help satisfy the other research aims and objectives also.

### 8.2 How the research aims and objectives were met

The aim of this study were stated as follows:

- To explore and describe the integration of ecodesign at the early stages of the design and product development process

The emergent nature of qualitative research meant that the objectives, as well as the research question developed and transformed throughout the study, most notably at the pilot study. The 'early stages' of product development were interpreted here as those activities conducted by the Industrial Design department (the early stage designers) and as the concept stages of product development (Concept Design, this being Primary (pre-product) Development). The purpose of studying the early stages was in exploring and describing more innovative practices of ecodesign. These early stages are also stated as critical to this. For this reason, both Industrial Design and Innovative Ecodesign were seen as the key themes for the research aims. The key research objectives were:



### **8.2.1 To critically review ecodesign literature as "state of the art" theory.**

- The problems of environmental sustainability are of a nature and magnitude that require radical approaches and dramatic environmental improvements. This requires social and well as technological and organisational innovations and implicates all actors in production and consumption, especially companies and the designers who work within them.
- As negative impacts are most closely associated with company products, environmental problems are matters of product development. This questions not only the 'ways in which products are made' (clean production) but particularly 'what the product is' (clean products). This is chiefly an issue of design, leading to the development of the concept and practice of ecodesign.
- Literature on ecodesign tends to polarise its theory (definition and description, models, principle and strategies) and practice into 'innovative' (radical or revolutionary), or 'incremental' (improvement, evolutionary) approaches.
- Though theory and practice extensively highlights the need for more Innovative Ecodesign, most theory and practice (and the resultant tools and methods) favour the more incremental approach, which paradoxically is unable to deliver sustainability. There is very little empirical research on the theory and practice of Innovative Ecodesign.
- Historically ecodesign has moved up the product development process and at present in the production or engineering stages (how to make the product) rather than design stages (what the product is). Previous research highlights these 'early stages' of product development as critical to products environmental impacts whilst offering the greatest opportunity to for more innovative practice.
- Industrial Design is the 'early stage' designers associated with such activities. This is a specific design discipline and department whose skills and ability offer great potential to early stage integration and more innovative practices of ecodesign.
- However, at present industrial designers work mostly in operational types of design and are rarely if ever involved in such early stages decision making being an underused and little understood resource. Most current research and indeed the epistemology of ecodesign is not adequately descriptive of Industrial Design practices or its potential.
- Both industrial designers and early stage ecodesign integration are critical to more innovative practices of ecodesign, though there is little research or practice conducted here at present.

### **8.2.2 To identify the nature of early stage ecodesign integration.**

- Often companies integrate ecodesign using an incremental approach. A pilot project will select an existing product on which an environmental analysis may highlight environmental problems and potential design interventions. The resultant designs will consider perhaps one or two ecodesign issues within this product redesign. These activities start small and simple, and build confidence slowly. In this study, ecodesign was integrated more from the 'top-down' using an innovative approach. It was at integrated at Concept Design stages, the most radical design



context, then aimed to 'filter-down' to the more operational forms of Industrial Design. The integration of ecodesign into an Industrial Design department is therefore inversely proportional to that of its integration into other functions or companies.

- Successful ecodesign integration is dependent on its fit to the department and the designers in question. The language and content of ecodesign needs to respect the practices and processes of industrial designers for it to be transferable and applicable. Much existing ecodesign practice, tools and methods do not do so.
- Motivation also plays an important part for the department and individual designers. The potential to innovate and the high level of novelty of this relatively new design subject are of great importance. It is this potential (ecology=innovation) to generate new concepts and designs and tread new design territory which is seen as the greatest motivation for industrial designers.
- The informal and non-prescriptive nature of Industrial Design practice places a special responsibility on the individual designer to incorporate ecodesign into projects and design briefs. It is individual and motivated designers whom will drive the subject most effectively and successfully within design. However for its long-term successes and development it should become a senior management and more formal issue.

### **8.2.3 To describe the characteristics of Industrial Design based ecodesign.**

- Industrial designer's information requirements are for general ecodesign principles and strategies (rather specific or quantitative environmental data). This should be presented visually and in a manner that is transferable and applicable to design. Case studies and examples of where ecodesign is substantiated and applied seem most appropriate for this.
- Industrial Design is described as the 'consumer orientated' design discipline, therefore their design processes are consumer-focussed and user-centred. They require demand-side information, which appears in a variety of forms such as: needs, behaviour, lifestyle profiles or clusters; or wants and desires, and incorporate such factors into their designs and products. Though designers may consider such 'social innovations' they will still design products, as their processes are 'product-orientated'.
- Industrial designers can influence the desirability and acceptability of eco-products or new forms of environmental conscious behaviour as well their technical performance and producability. This is of great potential and use to sustainability.
- Environmental issues seem to play an ambiguous role in the design process. Though they are often of high priority, they are not always the primary generator within design. Often environmental issues 'piggy-back' on other design drivers or factors, and ideas are proposed and selected using guesswork or speculation.
- Industrial designer's most significant role and contribution is creativity and strategic thinking (new ideas). This is the more innovative practice of ecodesign such as 're-design' and 're-think' of new products, rather than the incremental and largely technically focused redesign of existing ones. Though this role is high on



conceptual input, their contribution diminishes towards the operational types of design characterised by most Industrial Design and ecodesign practice to date.

#### **8.2.4 To explain how industrial designers conduct Innovative Ecodesign**

- Practices of Innovative Ecodesign are characterised by their openness and freedom within the design process. Their success is aided by not being immediately answerable to product development or directly linked to the launch of new products. This is best located within a Primary Development (Concept Design) or Research and Development context. Environmental factors need to be prioritised as a fundamental part or aims of the design brief.
- Innovative Ecodesign is of an exploratory nature and often for educational purposes, for designers, consumers and the company alike. The results aim to embody certain ecodesign or Industrial Design based principles and communicate these to various stakeholders.
- It is systems based and holistic requiring broader design considerations, in this case to systems of extraction and disposal, but particularly with industrial designers usage and consumption patterns. Though broader systems may be a design consideration, design processes will still be product-orientated and still likely to result in a product. Many characteristics of Innovative Ecodesign are more strategic in nature though designers often don't have the context, role or profile to undertake these forms of activities.
- Key parts of these Innovative Ecodesign processes are the identification and use of core business and consumer needs within the design process. This metaphorically sees designers 'loosing' the product and broadening the design space.

### **8.3 Contribution to Knowledge**

This enquiry contributes to knowledge in several ways:

- It studies ecodesign integration at novel stages of the design product development process – the 'early or concept' stages.
- It explores more innovative practices of ecodesign whereas most existing theory and practice views ecodesign as a more incremental design activity.
- Its design context is Industrial Design. Existing ecodesign theory and research largely ignores the role and nature of Industrial Design seeing ecodesign more as a material, technological or engineering or 'later stage' design practice.

### **8.4 Recommendations for Further Work**

This section makes some recommendations for further work drawn from the research findings. These are its logical extensions as well as work that should lead directly from it.

#### **8.4.1 For Practitioners**

This section makes recommendations for ecodesign practitioners.

##### **8.4.1.1 *Transferring Innovative Ecodesign into Innovations***



Further research is required to highlight how Innovative Ecodesign as conducted here can be transferred into ecodesign innovations resulting in the launch of new products. This may predominantly venture outside of design. Many of the hurdles indicated within this research appear less within the capabilities of designers themselves and more in the socio-economic and organisational contexts in which design is played out. Such work should highlight these potential barriers as well as developing methods to overcome them. It might also promote sectors, markets or product lifecycles prime for the integration of such innovative practices.

As a first and simple step, companies might also examine their product development procedure to check it is conducive to ecodesign. As was the case here, considering its integration at inappropriate stages can be a serious hindrance to its success, to its potential to innovate and to those attempting to practice it. Suitable adjustments should also be made.

## **8.4.2 For Research**

This section makes some recommendations for research in ecodesign

### **8.4.2.1 *Ecodesign education***

As many of the conclusions of this study relate to design practice or the responsibility of the individual designer, further work should be undertaken within design education. This should look for ways of ensuring that environmental issues are a fundamental part of the design curriculum, via specific projects, within every project or at least as contextual or complimentary studies. In doing this, research should also develop methods to ensure ecodesign and environmental considerations are as fundamental a part of design discourse and the designers skills-set as communication, visual literacy and materials or construction issues.

### **8.4.2.2 *Tools for early stage environmental impact assessment***

There is a clear need for tools and methods for the 'early stages' of product design and development. There is a requirement for an environmental impact assessment tool, which might perform two tasks. The first would be in assessing the actual environmental improvements of the kind of concept stage designs developed and proposed within this study, as this has not yet been successfully conducted. No one at present knows if these ecodesign concepts are environmentally preferable. The second requirement is a tool for idea selection, when designers are working at these early stages. This could be used to select the most environmental preferable idea when designs are generated rather than when detailed.



### **8.4.2.3 *Even earlier ecodesign integration***

As ecodesign advances up the product development process historically, it is now perhaps at the 'earliest design stages' (Industrial Design), in this case Concept Design. The next logical steps are its integration into even earlier product development stages or Marketing functions. This is where the more strategic decisions (task clarification, see figure 2.14), are often made and where lies the greatest potential for impact reduction. In many ways Marketing is not a 'design' department at all and do not do design. Ecodesign integration into Marketing will bring its own difficulties and dilemma's somewhat different from those of Industrial Design.

### **8.4.2.4 *Consumer-focused ecodesign***

A clear hole in this research is the development and further testing of the product concepts within the market or with consumers. This is perhaps the next 'logical step' as many of these design proposals are stated as consumer-focussed, whilst not actually including the consumer in there development. These were often merely speculative designs based on designers' ideas about behaviour, values and needs, etc. Further research needs to test such consumer orientated design proposals with consumers, for their desirability, acceptability and usability. Along with this, research is also required to highlight the correct sorts of consumer focussed information then develop methods to ensure designers incorporate this into consumer-orientated ecodesign projects. The future needs ecodesign to develop out of the 'products and the 'technology', and into the 'people'.



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**APPENDIX A: SAMPLE INTERVIEW**

**Appendices**



Date: 21.12.99

Interviewee: Phil Thompson, New Ecodesign co-ordinator  
Location: Industrial Design Centre UK, Spennymoor

**Discussion: New post as Ecodesign Co-ordinator + general issue**

*Interviewer in Italics*

Interviewee in normal text

*So tell me about this new role?*

This new post is strange, because now I don't answer to anyone and I don't belong anywhere. Well I'm based in Spennymoor but I don't do any of the core design activities. My time and direction is totally my own now. And its like, well who do I answer to? Shaun's not very happy about the whole thing, because I can come and go as I please. So some days I can work from home and I can come in at whatever time I like. And Shaun's point is, 'well if you do it, why can't everyone do it?'

*Is he upset?*

No I just think he can't see the point, and he can't see why he has to deal with this in Spennymoor. Its nothing personal and he is Ok with me, but he's got a point though. He also doesn't see why he should have to deal with it here. I'm in this flouting, virtual position where they are saying, well you don't simply work for ID now. Your job is to get out there and talk to people..

*Talk to people internally?*

Talk to people internally, and also get out there and speak to other companies. My main, the role that I have now is to manage and conduct eco-activities, as well as the service ideas, with the main, the key parts of the service stuff is going out to find other case studies of other, where other companies are doing this and that we can use as examples. But its like, the company realises that we don't have anyone else doing this, and so now they are now saying well you can liase with new and future business 'cos they'd be interested and with others. This post is trying to do lots of things that we don't do at present. Originally when I discussed it with Robin, I said so are you going to make me environmental design manager and he said 'Nah!', it a co-ordinators role. And Also, originally Christian was saying OK you'll manage all the projects and do the case studies, and also do all the design projects, do the design work!' So I said 'hang on a minute, that's almost impossible. And said well Ok I'll organise the projects and come to you as I want people... As I want foot soldiers.

This role is a management post, it's a design management role and I see my main activities as co-ordinating projects and mostly getting out there to talk to others. That's most interesting about that is that they've never done this before... They've never had anyone within the department who doesn't do design. It's a new, animal, er, idea, and of course they don't really know how to handle it. Its like previously if you weren't doing design, if you weren't at the computer, or the sketch book or making models, they'd be like 'hey get on with your work!'. That's how they measured your work, your value. But of course this is completely different, and no ones quite sure how to handle it, or what to do about it.

*Ok there is two things. One how does ecodesign affect design. Are there any differences, if there are what are they?*

*Two is the connections to other departments. The conference is about design as a collaborative connective and co operative activity so I wanted to talk about how ecodesign has really been a bot of an enabler for design to do different things..*



Ok because ecodesign is very holistic. You have to know more about other departments, you have to go and talk to them and in talking them you understand there problems much more clearly and then you have a better brief and it's a better product. Its often the reason to do something gives you a better brief, gives you a better product.

*So really it allows you to go into new and other areas?*

Holism brings a load of other issues which means you are going to have to go and look at disassembly. Well what the hell is disassembly? You don't know so you go and talk to the factory about what disassembly might mean. What are the problems in that, well its separation, its mixing materials, its handling when it comes back into site. The size of it. You go to marketing about the branding issues and about how you handle second hand and how you have to handle that. You go and talk to the retailer about how they might physically handle returns. From that you get a good brief. And then you come back and you apply everyday common or garden design techniques to it. But before, without a good brief you are just swinging in the trees

*So what do the ideas of lifecycle thinking and sustainability mean for new design areas and subjects What are the major vectors*

There's 3 areas. There's E-commerce, obviously technology and that massive growth that's effecting how we do business. That's leading a lot to, what is a brand mean when you portray it on the web, you portray it on the web and you rely on brands and a gain in how does the product have to portray itself, when you can show it in demonstration. You can actually train people up to do every model with every detail and every detail and you can put it in its right environment again so that's how e-commerce affects our business.

There's the environment, with, well with the legislation obviously but also all the opportunities and the restrictions. And there's three well call it the ageing Population and the extended life span of people. So you've got a lot of people that are a lot older. So you've got the three major areas and that's taken from the Design Council people and its fairly well supported so within these 3 areas, well I think ecodesign wasn't originally ecodesign, it was new business concepts.

*Internally?*

Internally. And. Still, it isn't right to call it ecodesign or sustainable design or any one title really. But,. Its quite interesting what we have tended to realise is that in giving me this job they are saying that well you'll be talking to a lot more people out there, by the nature of this job, and within the group, while your at it, can you do these other jobs. So its recognised that this job is a communications post. its almost saying that well nobody else does these kinds of things..

*In the organisation or the department?*

In the organisation. 'Cos I could go and talk tomorrow to Herman Miller about the Phoenix project, I could go and talk to Mercedes about the Smart car. I could go and talk to Xerox about Photocopiers. So there's not many other projects where you'd be encouraged to go and talk to people who've gone there before, and come across the same problem, but with a different industry.

*This new role sounds like you are making links within the design department, but not even that, within different industry's. Its about making links within the organisation.*

Yes it's a design management role without staff, or a budget. It's really about talking to people who are around at that moment in time



*Do you think those external links are gonna push the boundaries of what industrial design is or does?*

Its not really like that because its early days. Whenever you ring up Nike or whatever, they say, well we haven't really got anything to talk about. They don't really have anything to show you and neither can we. So why don't we just get together anyway. So everybody is really in the same boat. But through the conversations, you know I have various conversations and it just gets my head ticking and I can start to form some Electrolux opinions, circulate them internally within the group, get a consensus and then it almost becomes the external put-out. A year ago we didn't have this focus on links and relationships, well we did, but it wasn't so clear who were the partners and why we should do it. Now, even a year down the line, that's the major project

*Were you hoping the find some decent business models out there? Because there are obviously some other models or companies that are doing the kinds of things you want to.*

Well yeh! The two main one's are Herman Miller with their Aeron chair. Because that was such a smart piece of design, clearly driven by design. And also the Smart car by Mercedes and I'd like to go and talk to them..

*You'd like to?*

Yeh, and will! I'm gonna go and talk to Avis, car hire. Why do they buy Corsa and Vauxhall, what was there criteria for using that. If they could go along and write a brief for Rover or Vauxhall, what would be in it, what would it be?

*So you see the answer in the brief?*

Yes, well actually a lot more of it is talking to design managers, and people that write briefs for designers. But being a designer, you can help them because half the time they are scared by designers

*The way I understand it then is what these people can contribute to the projects. That's what I; m particularly interested in, in the development of ecodesign. Because you had to go to other departments and show them what you could do. This is what it seems to me, I don't know whether its right.*

Yes that right, Its true!

*OK you move environment up the product development process into industrial designers. When they knocked at your door they probably said 'we don't know what you can do'*

Yes. I'll give you an example. They were saying, can you look at ecodesign, and the major project out of that was the bin. A smart bin for the kitchen. Because that was the way it was understood, it was waste management, literally waste management. So rather than embedding eco-principles into core design lets do a 'flagship' green product. And its like, yes!, that's a perfectly good project to do. But its not necessarily the best one, but it's a very visible one.

And then what was happening was that you'd have a new product concept, and you'd show it to the other people and they'd say well it's a nice product but its as useful as showing us an Electrolux car or an Electrolux ironing board. We don't do them know. We don't quite see why we should do them in the future. The real business benefit isn't really there

*Who was it that handled those projects and where are you going to locate this work? Where is it going to happen.*



Well... OK, This is a difficult one to answer. Its will be quite interesting to see what happens. New projects always go to the concept design group because they've got the freedom to think outside the box. But in actual fact it can have a s much impact and probably a greater impact at core. So you go along and you say, well you are doing a new platform project. How do you incorporate some of these issues. So its not reinventing the wheel, its just improving what we do already. Like what Herman Miller are doing.

*I have a real problem with this chair. I know that it's an incredibly smart piece of design, piece of engineering. I know that it's incredibly comfortable because we had a visit to Herman Miller on my Masters. I know its an amazing chair. I know that it does so much and that there are some smart and sophisticated technologies in there and that its all singing and all dancing. It seems to have won all the awards But for me at the end of the day, its still just a chair. And for me, the answers will come from simplicity rather than complexity*

Well the question I'd ask is, how much of it is really a system. They are saying, well we only produce... it is dimensioned in only 3 models, that look exactly alike and had nothing to do with the owners job titles..

*Dimensioned in 3 models?*

So there's one with wheels, one with fixed legs and one without arm rests. So there's basically a core product. So its not like we do one here, on ethere, on ehtere. WE do 20 products with 3000 PNC's. Why do you need 3000 chairs when you can have 3 chairs. And this one chair fits all people. That's a better way of doing it. And again on their website they make some clear statements...

*Sounds good!*

Yes! One chair fits all, and it does. And it's a smart piece of design and a core product, you could argue that its over engineered and if someone doesn't repair it and they do just scrap it as is the nature of office furniture then whatever. But I think that it's the leasing concept, because you go on the website and there's a leasing opinion and after this we'll go and have a look at it.

*And it makes sense to do that for something that is so technically sophisticated for them, because why leave take-back in the hands of consumers*

There's also the thing about... well I could go along and talk to Dyson. It could be viewed as a slight conflict of interests. But the idea there is that he said' start with the functionality, don't cow down to loads of market research. Question it! If its an existing technology question it! Question these interesting consumer perceptions. And then just go for it and just build, form follows function and I think a lot of this ecodesign is going back to form follows function and it goes back an awful lot to the Philip Stark idea that the most beautiful line is a simple straight line

Go look at Honda.. they've been unable to say that well look its simply an electric car, why not make a few compromises in terms of speed and fuelling and its just simply not acceptable. You cannot ask people to sleep on a horse powered badly, But the Honda, that's an interesting one, well a cooker that does that. Well build a cooker, a fridge or a washing machine that does it one for aesthetic reasons and another for environmental reasons so there's all that stuff about repairing, disassembly, upgrading, etc all of that stuff there.

Already we can do this, we have the Zanussi ideas range where you can go on a computer terminal and it will do exactly what this does and say, well that door, that configuration, its great.



*So what sort of external contacts are you looking for, what sort of examples?*

Well its things like industrial washing machines, launderettes carpet leasers. Internet operators like the internet banking. Amazon books, the power of those hinges to questions norms. I'm looking for off the shelf briefs for services/functional sales

*And what about internally what will be the connections there?*

Well its within new business. Its about new business. Within new business we've got Jan Agri whose developing partnerships with people like the Institute for the Future. So we have the partnership with Ericsson. Electrolux has actually merged with Ericsson as a company and they have a company called E2 and you can go on the E2 website and it tells you about Electrolux partnering wioth other major organisations. So you've got Electrolux, you've got Vatenfall, the Swedish energy board saying well you could provide that part of it and we could provide the other part of it. So in terms of Electrolux future business, its partnerships isn't it. And you may be developing new products to meet those market needs. Or you may be tweaking existing products

*So what happens when you've got the same projects going on different departments, Because if you get Hics and he's doing that in other places? Do you design it in or do you come together when you share ground?*

You design it in I think! No not necessarily design it in, but share information. This kind of thing happens all the time I think two people doing the same thing in different places. IT may be seen as a case of, well you should do that and they should do this. That was a common military tactic – give two people the same task and see how hard they work at it, 2atch how hard they work. Watch how much sharing they do or don't do and the outcome will be a brilliant solution, better than one person coasting.

So using, military analogies for you collaboration. I remember seeing that on some programme somewhere and thinking, well that's clever.

*So do you think that what the two departments will be doing will be dramatically different?*

Well yes. They are going to be focussing on business. New and future business. We are looking at products cos' we can instigate that. You know they will be having massive plans like, in the future having networked homes. The Millennium Home is the networked home, so what does the network home mean for Electrolux. Are you at Home everywhere? If you are Electrolux Home products, what will the networked home be? There's big questions in there. Then you obviously come onto things like the service relationship with the networked home. We also have the options area and how to provide an Essentials range. How to satisfy the needs and provide first time buyers with new and exiting designs.

*So this has come from where?*

Essential range was identified category, obviously the guys from business have said that, I think that in Europe there are 4.5 million first time buyers every year. Now what do they want as a first time entry point to the market. What income have they got, etc, etc. Essential range is really reduce to the max. What's the minimum you can get away with, without compromising quality or innovation. And you've got the Essential range cooker, you've got the Essential range washing machine, you've got all those products that have come out of that market. Then you can look back later and wonder how you got to where you were, well you start somewhere. You start with a plan and you work with it rather than stick to it.

*That's driven predominantly by marketing I presume.*



Well essentials, the essential range.., I went along and I had a talk to Edwin, about doing the essential range. Here's the essential range and its driven by reduce to the max at one level. But what about if the Essentials range is reduce to the max. but pump to the max.... the eco-thing. So that's really to try and make, 'what's the greenest product you can buy on the market, without doing Extreme Green and putting a massive price tag on it and taking it out of everyone's price range. So making it a very sensible, lean product. So you would say, well what's the best fuel. Is flat pack the best, etc.

*OK can I move on a little here. Its seems to me that what you are doing with the service work is quite clearly connected to sufficiency, while work on projects like Extreme Green and more tackling the issues of efficiency.*

I wouldn't say it was quite so clear as that yet! As you are working through you start to say well, as you said, it is about sufficiency. IF you are looking at sufficiently meeting your needs at one point in time and leasing this, could you lease this for first time buyers. They don't want that capital outlay. They are more green and aware from there education and stuff, but they haven't go the money. They are willing to compromise their conceptions of what an existing design looks like. Hey are the ones that will buy a dishwasher/sink rather than saying well hang on a minute this has to go in my cupboard. They are the people who are wanting to challenge convention, buying the Smart car, having the Mac notebook, you know all those sort of things. They are just kind of up for it.

Then there's the opposite idea, this idea of mass customisation. Mass customisation affects us on two levels. One there's this idea of choice so what does this mean for refurbishment..

*These are things that you do that you want to lever ecodesign into? Like mass customisation.*

Yes, yes. Well these are the kind of projects, and the main umbrella's within new and future business.

*And these have been written by them and you are trying to connect into.*

Well I'm just on the side really trying to be supportive of these projects and every other project going. I don't really get invited at the beginning, so it as a case of find out about it, hear about it and go along and say, well I'm actually doing something quite similar to that. So for example mass customisation is a nice idea! Why are you doing that? Well because I want to give people choice Well why are you thinking about that and the idea of being able to fit 10 different doors and snap fits an ftsuff like that. And that really fits in with disassembly, refurbishment I think. So can we write that into the brief.

The essential sufficiency, well it wasn't really a case of necessarily starting there. Going back to that conference actually. There's three major areas E-commerce, environment and ageing population and if any of our projects doesn't have each of those three areas in it then it can't be a very valuable thing to do, because those are the three major areas of concern or opportunity. So every single one of these has a large percentage of those three in, and environment is one of those three so that's it really.

Zanussi have this its a little bit like the Screen Fridge really. Why do we have it, well you could say its for convenience and safety, but you could also say its for efficiency and home management, so it goes two ways there.

*So do you think it's that others are starting to see how industrial design can make a difference?*



They will do shortly. These are senior managers and the plan was that, at the last meeting I went to and presented the whole scope of projects, he said well lets look at this multi-use, take back give back and I want you to talk to these people in new and future business, so that's how it will come about. Whereas before I'd been knocking on the door, with a little sole voice and now its going to be senior commitment. If Christian says there's some money behind it and some people behind it, it will happen.

*So his opinion must have dramatically changed, because when I first met you his attitude was a really sceptical?*

Well yes! I've never really understood his angle on it totally, but he's a realist. He say like well there's no point in going in there and reading up on all the green books and stuff. Look at what the business needs, look at how we operate today. We have to work with what we've got rather than with whats ideal. Or else you blow it out the water

*So how are you with Environmental Affairs?*

With Environmental Affairs.... I've put down two major subject areas. I've divided eco and sustainable design into two areas. The first one – New and Future Business, with multi-use take back/give back as the major project. The second side is the knowledge, the tools and processes to do this. And that's been like gathering together eco-examples, looking at eco-articles, interfacing with environmental co-ordinators, and they come underneath the Environmental Affairs, looking at IPDP eco-development. I mean there are eco-handbooks for every stage of IPDP apparently in existence, it just trying to get those guys to..... So there its more structured, so trying to represent design at their meetings and just sharing experiences. Its not been as successful as perhaps it should have been.

*Why not?*

I think a lot of that is down to location. I mean they are tied up a lot with policy.

*From what they've said about what they imagine you do...*

They don't really know!

*It sounds like a slightly more reactive. It sounds like there perspective on this subject is fairly compliant.*

Well yes, they have a fairly traditional view on this, you can imagine their view. They are not necessarily championing new product development. They're not looking for new ideas, they are looking for compliance. But having said that I've been there and showed them the last months work, they've been like 'Wow!' can you show this again. We can do things and they want us to do things because it makes it more glamorous. Its like a little company that for years didn't have a designer, and one day they get a designer working for them and the first thing is 'Oh my God!, what's all this!' And then as the relationship builds you find the level ground. I should be like a constant monitor like keep bringing then when the other areas deliver something keep bringing it back to Environmental Affairs and let them use it for promotional purposes and let them use it for educational purposes. I can se them making use out of what I've given them, I can't see them making much use out of what they've given me.

*So you feel like it's a one way relationship?*

Yes

*So how do you think these developments have changed the internal perception of design*



I think again its too early to say! I think as a designer whose been lucky enough to spend time with this area, its completely changed my view of design, but its not turned me into a Gaian or a Red-Green. But I think it has made me think about the basic values in design. You remember those examples we had before, we couldn't just sort of launch, all this information onto every designer in the company 'cos they'd say well what do you want me to do about it. I'm a designer how can I affect the brief if I get given the brief. So how has activity changed in terms of perceptions, well I would say, well its starting to. Its becoming the case that if we do this project and we create a nice object or a nice bag of ideas we can then go to the, and people will start to say 'that's a good idea! I'd like an idea like that. How can I change my project so as to have an idea like that. Its like Osmosis!

*For me one of the most important moments was the realisation that we were wasting a hell of lot of energy and time trying lessen the damage we have already done. Whereas what we should be doing is different things in the first place.*

That thing about design being 'repair or redesign' or 'redesign and rethink'. I think designer struggle with the repair and refine because its totally about management and authority and restructuring and all that. Whereas when you get into redesign and rethink you are in open fields and you can just through off your shackles and charge across. Do you watch these programmes about, 'well we are going to take all the CO2 to Mars and warm the planet up' well that's a design solution rather than a repair solution. Its like, how do we move forward out of it. I have this belief that yeah, somebody will design the hydrogen powered car, somebody will design the electric that car that's efficient and acceptable and it will probably be a combination through market intelligent and branding and marketing. With efficient technologies and sustainable consumption with just a good idea at the bottom of it. Its possible.

As a designer I don't se that there's any point in looking back. It might be the wrong approach but you tend to think that that's somebody else's role, not wishing to distance it.

*I asked that question 'cos I thought that a couple of the activities, and design projects that you'd done so far, that were quite successful internally, the kitchen – Awareness and functional sales might have changed perceptions.*

Well you could say that the kitchen has sparked off other ideas. With design you pick up a magazine with an article and you think Hmmm, something drops and you reflect back on that. With the ecodesign as flagship idea. There's two sides to it, you can either pump out loads of lit. material, and ask them to read it and they probably don't. Well you can do that or you just pass it around. Well I mean again, that Seeds thing again, the problem was we don't have the internal structure to make it work yet and I haven't made it a proper Newsletter. You see no one has ever sent anything to me, for it. It's a reflection that most designers don't want to be given things that will make there job any bigger or more responsible.

*What were you trying to do with that?*

Create a dialogue. The first question... There was a one sentence opening said. This problem rests with us, it is all our responsibility. This is aimed to start a dialogue with 100 designer European, Worldwide, whatever...

*And really did it work?*

No, it all comes down to software problems, really because they don't have powerpoint and internet access, because I was told they were gonna get it



*And was that a response to some of the existing eco tools you showed me last time I was here. 'Cos I remember last time I was here you showed me some of the web-based tools. The eco-Know how and Hazardous materials checklists, etc...*

Yes I remember showing you that, things like the eco (?)....., its like dreadful!

*Not appropriate to Industrial designers?*

Not appropriate at all for the designers I know its just meanness.

*Right, I don't want to put words into your mouth, but do you feel that innovative examples...*

Yes, that's it! OK I have a lot of them saying, Well everything I have, and I have huge scrap book at home with articles full of old stuff and with articles I've come across. And they are the lifeblood really. If there wasn't something giving you ideas from other markets and from other businesses then you wouldn't get any ideas yourself. Because its wrong to say....., no idea is new. No idea is ever new. It's a reappraisal, representation of an existing concept.

*That as a starting point, if you wanna say anything interesting within that Martin Charter article is really interesting. Its this of what designer respond to, is it quantitative lifecycle studies or is it case studies ad examples etc. What turns designers on, what makes them tick? How does the information have to be represented*

Yes it has to be visual, its very much picture form.

*But I can't get a PhD from that*

And even know as I go through it as you get more data you start of compile it into certain categories. Things that are about communication, things that are about engineering innovation, things that are about material innovation. You can actually start to break it down.

How I though about consumption. Have I through about materials? Have I looked engineering principles within it

*OK How has ecodesign changed what designers do? Actually designing.*

I think once again its limited at present. But there's questions about materials, questions about products. At the moment everyone just talk about 'less is more' its more things to think about, more things to do.

But how will it affect it. I think its huge, because we've just got to start to get some decent design briefs, that lay out the ground work.....

*It asks some Big Questions*

Yes the Big Questions. I think as more people get exposed to that

*Has or How has ecodesign activity changed what designers do?*

I think its limited at present. I think we tend to focus on materials and on the product, the less is more efficiency ideas. Using less to get more out of. But how will it change... it will be huge. The future is about generating decent design briefs It will be huge, only in the fact that we'll be able to say that this product must be able to reduce waste by 20% and reduce materials by 10%. It will have to come into the factory and be disassembled. This will be the new cause for design to champion..



### *The new design paradigm!*

So like first it was manufacturing was king, then everyone could do that. Then marketing was king and now everyone could do that. But now we are back to ideas, its ideas that matter. With manufacturing you don't have to be concerned with the quality of ideas. With ideas you don't have to be good at manufacturing or marketing. I almost wanna write down that the eco question refocuses on the quality of ideas.

There's been an awful lot written about benchmarking. For years we've had to benchmark design. How much time do you charge for this, how does this help you to design, What brand value is that design. How do you measure that stuff, it can be PNC's. But if you say that in the next year you'll reduce this product by this, you'll be rewarded as design. You want some clear distinctions..

### *Some objectives....?*

E want some figures, to work to. That's what I was saying about ecodesign being a science, and design being an art. If its engineering, it works or it doesn't.

*But isn't there a sort of contradiction there in asking designers to do that sort of thing. You are asking them to do something they aren't used to?*

Well you ask them to do something for a certain cost, they can do that. You know this cardboard box has only got to cost 30 quid and only have 2 colour screening on it. They can get their heads around that. If you go to the next level and say. Well I want you to reduce the weight and stuff, well it certainly asks for different sorts of designers. You are going to have very good CAD drawers, very good illustrators that work with designers.

### *So they might be a specific breed?*

Yes

*So you'd have graphics, you'd have your product designers, you have people who work CAD, and you would have an ecodesign within teams like this that just helped out with every product.*

Well yes, that's just like design management. Design managers have to have an appreciation of many areas now, about the size of the company. I think we have to afford somebody dedicated solely to ecodesign.

*So your actually saying there that that's slightly different than everybody being well versed or well educated in ecodesign.. each project in which you want to do this, you'd go to a specific person for that.*

OK you go back to those 3 areas: e-commerce, environmental and ageing, most designers now if they produce a product that an old person couldn't lift, couldn't read, you'd have failed as the designer. Similarly now they are every familiar with technology and the ability to model 3D and all those kind of things. And so if you can't do that you've got to wonder is he a designer. And then that third one about environment. Its more like footprint or efficiency so that ecodesigners are producing things for that triple bottom line, it doesn't damage the planet, is safe to make and makes a profit.

*What do you think about things beyond that. About processes, methods ,etc. Is that short to medium term?*

I think the processes and methods should include a lot more communication with the end user or the retailer or certainly other parties in the picture. I've just written out a project to do with take-back, give back and one of the first stages of it is opinion leader



research. Normally you produce your design and you take it along and say, what do you think of this idea? Now you go along to them and say 'what's your problem today? Given an ideal world what would you like? Where's your biggest race, where's your biggest profit.

*Was that to retailers or was that to consumers?*

That was to everyone so now I've listed it....

*So it task or problem led, rather than product led?*

yes.

*Is that something that's specific to ecodesign or is that the whole direction that industrial design is going?*

Certainly it should be its something that within every project, but its not necessarily done, but with ecodesign its given a sort of rebirth. The first point of doing that was to gain senior level electrolux commitment. So who within Electrolux was working within this project, with what angle? Who should design talk to and who should design talk to? 'Cos that's as important. Is it brand led or is it category led, so get some of the internal politics sorted out. And the second thing was to set up meetings keeping everybody informed, set retailers, Dixons Argos, Commit, Sony, Sanyo, you know people we are visibly in competition with, but we aren't you know people we have no relationship with at all so we can just share some common ground. And the objective, the purpose of the opinion leader research is to give an indication from a product designer's perspective. First hand thoughts on how could and should business change to meet sustainable criteria. How when and what? So you go along to them and you say, well look, if we did this tomorrow, what would be the outlook, the outcome. Could you handle this? Could we handle that? So you step it down in the right sort of generation patterns. The write a brief and actually spend some time writing a detailed brief, basically to direct the product output. because again, if you can't write a decent brief, if you don't know where you are going, or where you hope to go. if you have no idea, you have no way of knowing when you've actually got there. A lot of this is that we sort of do a project and we say well do we like it?'. Well no what we are measuring it against is a brief that says does it do this, this and this? That's the idea of putting the measurable in. So it just gets improved on. So its weight reduction, for example 5% hazardous material reduction, 20% reuse, increase the amount of reused material or reusable material are there modularity options, if it only comes in the one, Can we make 6 different products out of the one basic chassis? About reduction of the assembly time. Can you reduce the assembly time? You've got 3 screws, but designers don't get down to that level of detail. So if you're gonna redesign and rethink, those are the sort of criteria that need to be in the brief. So you produce not only product concepts, but also business and customer scenarios. You've gotta think beyond the product, you've gotta write the cartoon strip to say ' Here it is, its bought. After its bought and used, it comes back. Where does it go? Who takes it apart?

*It's just the whole systems thinking?*

The whole systems thinking. And the objective of the development is to produce basically stuff. as designers we are expected basically to produce models and visuals and information, we don't do business plans.

*But isn't that a hindrance to the sorts of things we are talking about, I mean expectations.*



Well no I don't think so, because we are not yet at that stage. So when you look at it – the E2 project, the networked home. You don't need 100 designers to come up with the networked home. 1 consumer segmentation person could look at that, and that's the visual stuff.

*You mean them to be aware of the system*

But is you are gonna use an existing designer, probably the good brief, probably what level of designer you are talking to. You've got the good brief and they are soldiers really. In the firing line

A lot of point in ( ) is that at the same time as you are developing a new product you are totally addressing your own company structure.

*Is that, you don't think designers are in a position to do that?*

No it's a transition

*In the mid to long term can you see that happening?*

Yes in the mid to long term, design will reinvent itself. Its interesting to look at Dyson, where there's no Industrial Designers, they are all Design Engineers. They don't have designers they have wizards and witches.?

Yes. I think in a way the names... If you say I'm a designer, they say, Oh right! Were you good at Art at School then. If you say I'm a wizard they haven't got a clue what you are doing. They just imagine that its some kind of mystic potion who makes lotion and conjuring, so that probably the work you'd have. And you've also got to work within the company's mind-set. So at Electrolux I doubt if they'd except the idea of wizards. An appliance manufacturer of some 75 years. If you ask them what an engineer is?

Pause

The concept of living your life, type thing. OK you look at someone's life p there's them. The dog the house the car. What she does. The idea that you sort of look att he way they live their life, throughput the day, work ,etc and fit it into that... that's what the Service Selector was really, rather than actually sort of, well you ask them how the live their life, and they could put questions in there, and then at weekends they actually live there life slightly different. What are the key concerns for you – to feel responsible, to feel attractive.. and then package this, pleasure package, what ever the object is, the thing, How do you want to customise it for you, we deliver you a service, its like being a bank. OK you're a member of a bank but do you want the Goldclub credit card or do you want the executive.

*And really what you designed in that project wasn't the things they get, it was the interface through which people obtain these.*

Well that was the hope of doing it, that was the plan to sort of say, 'Can we make up this digital catalogue where you went through a series of little gates with questions, like a flow chart that leads you to a solution, so it was meeting your personal needs although it was a piece of mass customisation. As you can see we weren't working on the same project, but they tend to merge and connect together somehow.. its not intentional but it just happens

*How are there differences between service and product design*

I think for me the most obvious example is when people who design products and try to adapt them to service and get it wrong and there seems to be no similarity. Service is about a process and product is about an artefact. So when you take an existing artefact and put into a process you make all kinds of compromises. So what we are



actually understanding now is that when people buy an artefact, that they are actually wanting a process and a service, so therefore you are selling the entire package, rather, then a door then a window, then a roof.

The scenario planning of how people will live their lives in this way and then we've just sort of extracted one little thread from that whole woven image and designed a product for that thread. What Electrolux do know is actually leave in the thread. And now have to be part of the process rather than standing outside it.

You couldn't actually point to anything now and say 'yes that products been designed for service, because they don't exist, but in terms of the strategic thinking we probably have it.

*And is this part of concept design.*

Well the idea is that this becomes part of the product brief rather than you know just dropping out a product brief and having adapt to a service that it was never intended for. You could look at the car industry and say well these automobiles were designed to be left in the garage, and now car companies are saying we want to provide the transport service, we want to provide the repair, we want all that. We will design it so that its effectively impossible for you to fix it, so therefore when you buy a car now you get the warranty, you get different services, etc.

*I remember you saying though that you are consumer focused, but now how is that dramatically different than what you do?*

We always say that we are consumer focussed, well we start from the consumer and the product again. But now its like the consumer as a day in their life rather than the consumer standing in front of the dishwasher or whatever. A lot of different people want different things

*OK what are the obstacles and difficulties for service design*

Well its got to be, the fact that we don't do it. Its not our business, we are a manufacturer, we are not a service company. Now if someone said Electrolux is a service provider as a statement from the head of home products, that's our business

*And are there any signs internally of this kind of things happening*

Well again its coming, its coming. But its like well I don't think I could actually say well that's a cracking piece of service design. I'm sure there are bits out there, but I can't see them certainly within our limited range.

*What about anything within the designers capabilities, skills, or the obstacles within the design departments*

Its acceptance, as to how you translate this into the brief. You know, at the end of the day that all comes down once again to the brief. You don't go up to a designer and say OK, so we want you to consider the shift from product to service. The way you put it is to have a business strategy and ferment it down into a decent brief and say, well what I want you to do that, and you to do that. So the briefs no different, at the end of the day, in terms of what you do, it might be a different activity, but the structure's the same.

*In my experiences from teaching there seems to be some reluctance to think about service in relation to product just because, of the question of what can I style, what can I design? I can't get it and grasp it?*

That's because, no one today has actually seemingly produced a great solution. I think there still will be this human thing of 'stuff'. Its amazing how different people have different values. They have different lifestyles, different ethics. Its amazing how ethics



you can't see ethics but they are changing, and values, you can't see values but they are changing. You can see appearances and things that you can wrestle with, but at the end of the day that whole thing is what makes up a good thing. so I think the only thing with students is that if they want a job, and how are they gonna get a job if they design services

Is it Seti where they've got this huge, great thing pointing into space to listen to alien sounds. And so we are saying here we've got this million pound big project and then you've got dolphins which are the second most intelligent animal on the planet and you can't hear them speak so what the hell is the point of pointing the satellite out there when you can't hear a dolphin speak. Its like you have a IQ and you have an EQ. Your EQ is the size of you brain in comparison to your body. And like a humans 7, 1 to 7 or whatever. A monkey's is 4 I think, the dolphin is 5 and an elephants is 1 and everything else is like 1. So you've got a dolphin and you can say that that dolphin has just said something to that dolphin and in the same way you can say that two humans have done the same thing. You see that's the link... Its speaking the same language

*With the Service project its seemed like you and Ingrid really wrestled with that. You came down to Cranfield and we discussed it, etc. Then you went away and said 'I'm not gonna think it anymore' and it all worked out why was that? You just came up with ideas and just presented them to people. That's it, so different?*

Well yeh! You change your job you change your life, etc. The Eureka moment, well with the service project it was slightly different, But with the kitchen project we had – appealing, adaptable, alternatives and that's it. It has to be appealing because people have got to like it. It has to be adaptable because people don't always do what they do today, they could always change and it has to be an alternative. I would say that's true of services. You know I've got, you get a salary. And set the end of the day you've got to weigh it up and say well with the model of my life – what's going in, what's going out, what you want, what you don't want. How long you wanna have that so its like, the whole concept of owning a house is now, to me its just stupid. To me, why do you want a house?

*Culture?*

Culture, yes, but why? Why do I want a house? Why do I keep buying things for 25 years. So for me it's just the questions.

*OK so last one. Where has the service design project gone?*

It's moved into things. It could move into e-commerce projects and that's looking at IT. Its gone into the multi-use, take-back/give-back, the functional sales. Because I always thought there was that funny sit between functional sales and design for services. And yet when you've done service orientated its service or need orientated well that's actually a function that you are buying. So it sits there. Its carried on within functional sales. Perhaps, this is looking at new products and IT, this is looking at new platforms. New product platforms and closed loop systems. So those are the two main areas, I think you could look at other things like Branding.

*So what about your case studies*

Case studies now is really your multi-use and I'm going to take the subject of category, the subject of kitchen systems but I'm going to take it to concept. It sits naturally in concept, because it's newer than core. I think that if core was on a time sheet and if it was billed to a direct category. Concept shoots out a project like the washing machine toilet and you get there and OK you have to go and talk to the core people about the mechanics of it. So, concept is being reeled in now, whereas previous they'd say 'oh well its all the size of a matchbox, etc. They now have to focus on future business, but that doesn't mean dream, but that means new business and things that are linked to



the categories. It's about categories and future business. So what they are saying is don't you worry about it in the categories, we'll worry about it in new and future business

*So how are you involved in that?*

Well my first meeting with Robin was like, you work for me, but you don't work for me!

*Is what he's saying that he doesn't want to pay anyone?*

Well it's just another head. In some ways they are also saying just go out and do the right thing and meet the right people... Its all about building up the right networks and the right partnerships... I have my brief and the title written on the computer, Do you wanna go see it? I can always print you a copy of if its of any use, I mean I don't think its especially confidential or anything

*Yeah, that would be great...*

Leave interview and go to computer

Interview Ends

Transcribed by Chris Sherwin,  
15.03.00



# APPENDIX B: SAMPLE CLUSTER

## Appendix



## INFORMATION CLUSTER.

Date	Notes	Code	
Simple		Inno-sim	But then when we went away and went over what you had said about it... Ecodesign is system not product, ecodesign is good design, etc, it all fitted into place and made sense.
	Eco-scrap book! Culture of designing as ID is hands-on	Inno-sim	Basically design is about on the job learning and educational programmes don't really fit the way we work, What we want is like a scrap-book, or a database of ecodesign examples for inspiration Cs-Should this be on the internal intranet? Ir-Well our designers don't really work like that, with electronic material all the time. We use scrap books and cutting and bits out of magazines and competitors catalogues. These are really the drivers for innovations. I mean my scrap-book is my life a sole!
	Eco-survey Service Design report	Inno-sim Inno-sim	We can't tell them to do this. It should be a tick box use Pt-Talk about that. Its almost like... a secondary school language...not, not patronising, but very much clear chapters and you can go as deep as you want. I mean you can use your knowledge to throw long balls. But is you only throw long balls then everyone will sort of, lose the grey area.
		Inno-sim	I also really like the way Edwin is defining ecodesign. I mean he's saying that ecodesign needs to be Solar, Safe, Cyclical and Efficient., and that's it. That's all it needs to be for me. So our designers just say Ok solar, safe, cyclical, and efficient, that's all I need to think about and if I've done one of them then that's OK. I think having 4 simple approaches is an excellent idea for people to understand ecodesign on this really simple level
	Don't understand the concept!	Inno-sim	It needs to be short. The questions need to be short... and simple, I mean It needs to be like Janet and John. You know what Electrolux is like... if its not short then designers won't do it! and then there's a service opportunities coming in and that's where there is different between what you normally do and what we are trying to do here. IR - But that's why I think we should be clear about what we mean when we say service opportunities and what some of the service opportunities are. Because I don't think we are clear
	Screensaver as reminder	Inno-sim	Developing new methods and tools and stuff is now my job, not environmental affairs. That's what I'm doing right now. I'm currently developing a Screensaver, which is a kind of eco-checklist. Which is always on designers desktops, as a kind of reminder of what they should have done, or being doing... Have you... have you done, this, etc
	Service report feedback	Info-sim/inno-sta	PT- Chris I just wanted to say that this was an excellent report, in terms of both the content and the language. Its perfect for designers and you manage to explain some quite complex topics in real simple ways.
	Simple and brief. Senior management direction	Info-sim/info-par	Ideally I would like to be able to tell you exactly what it is we want but I know we will be told in time from Top management what they want then it is up to us to tailor their wishes as best we can. It has worked better if we propose the best idea we can come up with that we want to do and if they disagree, that usually gets the dialogue going. Make sure you keep it brief for your sake as I do think there will be development.
	<i>Not quantitative</i>		
		Inno-sim-qua	Pt-I think what you bring to the process rather than people who aren't from the design background, is that we'd be getting terribly involved in the environmental data. I think there would be too many numbers and the figures. Whereas this is still realising that there is this human element, this social, rather than the structural and the technological side to it.
	Uses of existing ecodesign material	Inno-sim-qua/inno-exi	Cs-Your hot, wet and cold environmental documents that have been handed out, that you are supposed to use, and I've only really seen one of them and it was this incredibly technical document.. Pt-Yes, yes Cs-And you are supposed to use them and yet you work like that and its just seems to be this huge contradiction between the two. Pt-Yes, yes, Ohh yes! Cs-And you know to get you industrial designers involved its got to be quite visual Pt-Oh, yeah like databases or things, like description of green products and like little captions above it to stimulate thinking
		Inno-ex/inno-sim-qua/inno-mot-inno	I mean this is just not what we do. They are interested in innovations and things and he shows figures and graphs
	<i>Visual</i>		
	Eco-Ideas map	Inno-vis	They basically mapped all the ideas we could use to generate ideas and product concepts. What was great about that was having all the ideas and approaches on one page in a manageable form.
	RE: Env. Affairs/ID interaction	Inno-vis	PT-I-Mmmm. Jan Agri, good bloke. This looks like the sort of general presentation that he gives out to everyone, the overview. He came in to do this to design.... What you've got to realise that by the time it gets to this point everyone in design has like... gone. They've all gone! And by this one they've definitely gone! I mean what am I looking at here? Is there a picture coming on the next one?
	SEEDS database	Inno-vis	What I want to do is collect projects and examples and put them on a website, or in a newsletter. I just think that if you want to get designers motivated and excited, this is the best way to do it, with sexy products and lots of visuals. I know its wrong and we don't want it to be that way, but I just know what designers respond too. So what I want to do is develop a gallery or notice-board of sustainable innovation. Something that you and we can pool and both have the same examples.... ...its things like that which should be on the Sustainable Innovations Gallery. Then give it a sexy name and everyone will use it!
		Inno-vis Inno-vis	And also remember they'll fill it in if it looks nice That's what I'm doing right now I'm currently developing a Screensaver, which is a kind of eco-checklist. Which is always on designers desktops, as a kind of reminder of what they should have done, or being doing... Have you... have you done, this, etc
		Inno-vis	PT - Well have you got that drawn up. Because that's something we need for this workshop, if you can do that really pictorially, nicely.
		Inno-eg/inno-vis	Cs-Right, I don't want to put words into your mouth, but do you feel that innovative examples... Pt-Yes, that's it! OK I have a lot of them saying, Well everything I have, and I have huge scrap book at home with articles full of old stuff and with articles I've come across. And they are the lifeblood really. If there wasn't something giving you ideas from other markets and from other businesses then you wouldn't get any ideas yourself. Because its wrong to say....., no idea is new. No idea is ever new. It's a reappraisal, representation of an existing concept. Cs-That as a starting point, if you wanna say anything interesting within that Martin Charter article is really interesting. Its this of what designer respond to, is it quantitative lifecycle studies or is it case studies ad examples etc. What turns designers on, what makes them tick? How does the information have to be represented? Pt-Yes it has to be visual, its very much picture form.



Consumer/user

	Inno-eg/inno-vis	PT - OK I think you need to put the terms in, draw it and give an example of each one, 'cos everyone goes, well 'what's this and what's that?
	Inno-con	So we said ah yes, we need to get people not to cook to much... what about a portion projector.. etc. It was all about awareness...., consumer awareness.
	Inno-con	What we really need to know is how we test a product at the moment... The Department of Consumer Science at Newcastle University. ..The main problem is getting customer input.
	Inno-con	Firstly, I think your comment on the consumers perspective on a service from Electrolux is excellent. We definitely need to focus on the user needs....It is a good question, what are our services regarding the business of foodcare. The consumer perspective is very important. We have done previous work with scenarios and I am not sure it will be relevant for this work. We have also hired a large consultancy to come up with new business solutions for services, but I think we will be missing what the consumer may want. This is why I liked your original proposal.
Re:quest for Green Consumer survey	Inno-con	I think really what we need next is a kind of map that we can apply to our existing consumer profiles, you know, turtles, innovators, etc. Then we want to, sot of spot the difference between the two. We need to know who's more likely to buy or invest in services' or 'functional sales', etc. Consumer profiles of likely service substitutes
Service Design project discussion	Inno-con	So what I could really do with you doing is to pick out some examples of tailored services. Also can you get some psychological stuff on the acceptance of services –materialism and stuff like that. I think we need to get under the skin of a service sales person. I think it would be a really good idea to go talk to a Xerox sales person and see how he sells his tailored services. What are the questions, how does he deliver a service to satisfy customer needs. He probably goes in and says... how do you photocopy?... What do you use?... Is it colour or black and white. The real issue is how can we best fit our service and the resultant products to consumer needs. 'What would you like sir?'
Re.request from Green consumer survey	Inno-con	PT- Ok so what we want you to do know is to prepare a report of environmental consumer profiles as the next stage of the Service Design project. I talked to Robin about the Service project and he said we need to know who these people are. Who's going to buy services, what do they want?. So we'd like this study to be a comparison of different countries Green Consumer profiles. CS-Is this what, world-wide? PT-No European wide, well it can be world-wide if you want but we only really are interested in the European consumer profile. We want to marry and compare this against our own 'Consumer of the Future' study. To check out similitanties and differences. What we want is cluster groups of possible European Green Consumers - What do they buy? - How do they buy? - How do they live? CS-So what are you interested in here is it just purchasing ..? Is this just buying behaviour, because there is work on all sorts of other stuff as well like domestic behaviour such as recycling rates, and composting, and energy saving, like switching your lights of and things like that. PT-Yeah, all that stuff would be great. Buying, behaviour, attitudes and things like that. All that would be great. What we are really interested in relates to the services project and the service idea. Who is likely to buy services.., but also green products more generally? This is like a European Green Consumer Profile study.
	Inno-con	The new bit for both industrial designers and for ecodesign has this sustainable consumption – how to engage consumers. The study of purchasing and behavioural patterns.
	Inno-con	What things do we really have to own? What I really want is some scenarios.. and some consumer profiles for a variety of eco-strategies like service, consumption change, etc We need scenanos and situations that help us understand what sustainable consumption and sustainable lifestyles need on a micro scale.
Green consumer request	Inno-con	PT-WE want profiles and lifestyle descriptions of Green Consumers, they have to be specific This is very closely tied to Service Design – we want to know the similitanties and differences green and service consumers Cs- And do you want anything on green consumensm? PT-Well, yes general stuff on Green Consumensm is useful but not essential Defining Service Consumer workshop Reasons for Service. WE want to know the reasons why people would want to buy or consumer services. So its like speed, convenience, luxury or social and environmental responsibility. Is it new consumption expenence or is it new features that were previously unavailable So pick out reasons to buy services.
	Inno-con	pt-Oh we have the material! We've got plenty of information..., we've got more information than anyone else, we've got it coming out of our ears. Its just not used. I mean we have the Hazardous material database which tells you what to use and what not to use, like toxic materials and all that stuff. cs-And can designers get access to that. pt-yes yes, its on the, its on the internal intranet, in Lotus notes. But when you show it to anyone, they just go, Oh right yeah, that's really interesting. I mean it just doesn't really connect to what we do here, or to how designers work. Its more like, the Hazardous materials database is more useful to design Engineering and to Production Designers, to those who are choosing and specifying materials. We just don't really do that. We do, we are responsible for eco-consumption, how it is used... and for ease of manufacture
Relate to designers	Inno-app/inno-eg/inno-con	Well first of all what is design for service, the whole question of what is service? What does services mean? And you are trying to relate that to designers. And you are giving lots of example, because at the end of the day, environmentally we want to know what services is, but you are trying to relate that much more to design, and so here you can read profit, or business. Here you can read motivation. And here might be your consumer satisfaction.
Relate to designers	Inno-app/inno-eg/inno-con	Well first of all what is design for service, the whole question of what is service? What does services mean? And you are trying to relate that to designers. And you are giving lots of example, because at the end of the day, environmentally we want to know what services is, but you are trying to relate that much more to design, and so here you can read profit, or business. Here you can read motivation. And here might be your consumer satisfaction.
	Pro-mod/info-eg/info-con/inno-par	I'm not quite sure what we are going to get out of it, but I'm just interested in meeting people anyway. My new role mainly involves going out to talk to relevant people about the direction to develop, and to develop relevant case studies - When I spoke to Tim Cooper about the Centre for Sustainable Consumption he was making all the right noises about the sustainable consumption issues, saying that he was doing quite a lot of research with green consumers and stuff like that. I told him about the Consumer of the Future work and he was mad keen to get a copy I have to do a case study of things like the major retail shifts and the major service shifts and stuff like



that. So I have to go talk to Granada, I have to go and talk to Vauxhall, or Network Q the second hand Vauxhall dealer and develop a single case study of the major trends, the major drivers in the service shift. This thing has to be quite comprehensive and contain directions for us to follow and models for us to use directly in functional sales. The idea is by studying others we can get a much clearer direction to follow

## Empowering

Empower to do the same thing

Fit to ID needs

Info-emp/info  
-app-bri  
Info-emp

The way you put it is to have a business strategy and ferment it down into a decent brief and say, well what I want you to do that, and you to do that. So the briefs no different, at the end of the day, in terms of what you do, it might be a different activity, but the structure's the same.

My role now is like a fitter – I have to beat the ecodesign stuff into the department and make it fit what we do already and work within the existing work patterns. To fit industrial designers needs. You have to also realise that this is the first time that design has ever employed anyone to do anything other than design. So this is a new role and responsibilities not only for me, but also for the department. And as such they don't really know how to handle it.

Info-emp/info  
-sim

*Pt-You have to realise that for most designers this is just something else to contend with, its just another issues to get into design. So for the individual ecodesign champions and for individual designers, they just do a 9-5 job and something like this just makes it more difficult. And it doesn't help that the subject is hard to define and even harder to do. Designers just want to say – look you tell me what to do and I'll do it! And if you can't then they just say well I'm not going to bother then.*

## To Innovate

Inno-inno

*The purpose of the data collection is to steer design  
You job as Cranfield is to stimulate design process... by what means?  
For some of the explore projects; workshops quotes games meals lunch  
We are interested in anything that is design stimulus  
Anything that stimulates and shapes design innovation*

Inno-inno

*PT - I would say that the idea here is to get, for you to provide feeders for design to create models, sketches, visuals, scenario maps whatever they need to be, to say this is how the business can run*

## Motivation

Inno-Mot/inno  
-app-bri

*What I really want to talk to you about is ecodesign within the department. I can't help but feel that my job as environmental co ordinator has not been totally successful. In Electrolux we have 8 ecodesign co-ordinators, based at the various offices throughout the world. And basically only me and Phil are active in this field. So basically want to find out why? What aren't the other ecodesign co-ordinators within the other offices active? What turns them on or would turn them on? And how do we get them to do it? For th eme the real questions are... How do you sell ecodesign to a design management based organisation. A bnef, reason or methods, etc?*

Inno-mot/inno  
-app-bri

*I don't feel I've been totally successful within the organisation, I haven't done ,my job properly!'. Its not that the ecodesign co-ordinators don't want to do this job because they have the motivations.. They just don't know how to! Ultimately they will be driven by design management and I'm not sure how to motivate and engage design management*

Inno-ex/inno-sim-qua/inno-mot-inno

*I mean this is just not what we do. They are interested in innovations and things and he shows figures and graphs*

Various motivation factors

Inno-app/inno-eg/inno-con

*Well first of all what is design for service, the whole question of what is service? What does services mean? And you are trying to relate that to designers. And you are giving lots of example, because at the end of the day, environmentally we want to know what services is, but you are trying to relate that much more to design, and so here you can read profit, or business. Here you can read motivation. And here might be your consumer satisfaction.*

Info-mot

*In Electrolux we have 8 ecodesign co-ordinators, based at the various offices throughout the world. And basically only me and Phil are active in this field So basically want to find out why? What aren't the other ecodesign co-ordinators within the other offices active? What turns them on or would turn them on?*

Success is motivated senior manager

Inno-mot

*Cs-Successful offices, well there's also Sweden. Sweden has also got the vice-president who's personally committed and interested*

Inno-mot

*IR - I've thought about this and designers are going to say that 'of course environmental issues are included in our project briefs... because we put them there!'*

Inno-mot

*IR - You have to understand how the design briefs are written at Electrolux. You see we don't have a formal design brief as such, I mean we get information from marketing and through our design managers and then we rewrite it and fax it back to them, Its not really a design brief as such*

## Innovate, not ethics

Payoff for design

Inno-Mot-inno  
Inno-mot-inno  
Inno-Mot-inno

*Phil believes that all designers are motivation to do ecodesign is the same as his own: New things, new ideas and ways to innovate*

*Cs-Innovation, A new way to have some fun*

*Pt-I was just thinking, but its not a word but the pay out for design. For design.*

*I mean you pick up sexy product magazines with the odd item, I mean the green database and put sexy products in there and give the reason for it that AT & T book you had with the other Italians, I mean things like that are what people would go for. And the idea of Donor products again for me is really nice. I mean I saw recently an advert with an Absolut vodka bottle smashed up and its all mad into a necklace and its called absolute recycled, and I thought well that's cool.*

## Personal

Inno-Mot-per

*CS – I was also thinking of asking about environmental issues within the project bnef....? How often or are environmental issues incorporated into project briefs??*

*IR - I've thought about this and designers are going to say that 'of course environmental issues are included in our project briefs... because we put them there!'*

Inno-Mot-per

*IR - You have to understand how the design briefs are written at Electrolux. You see we don't have a formal design bnef as such, I mean we get information from marketing and through our design managers and then we rewrite it and fax it back to them, Its not really a design brief as such*

Inno-Mot-per

*cs-Who's supposed to drive this?  
pt-Well it has to come from designers, from the individual designers on the job because it won't come from the managers,*

Inno-Mot-per

*CS-So do you think that's the way to get your design involved in the subject?*

*Pt-Absolutely, its about motivation and empowerment. My job is just to get them interested in the first place and then let them get on with it. Its like here you are, and here's what it is, now you get on with it. Then they have to go and get the nght information , the nght sources for themselves. The much more specific stuff for themselves*

Inno-

*Cs-What were you trying to do with that? (SEEDS)*







**TEXT BOUND INTO  
THE SPINE**



	Inno-app-bri	<p>Cs-What about anything within the designers capabilities, skills, or the obstacles within the design departments</p> <p><i>Pt-Its acceptance, as to how you translate this into the brief. You know, at the end of the day that all comes down once again to the brief. You don't go up to a designer and say OK, so we want you to consider the shift from product to service. The way you put it is to have a business strategy and ferment it down into a decent brief and say, well what I want you to do that, and you to do that. So the briefs no different, at the end of the day, in terms of what you do, it might be a different activity, but the structure's the same.</i></p>
Integration problems	Inno-app-bri/mot-per Inno-Mot/inno-app-bri	<p><i>IR - You have to understand how the design briefs are written at Electrolux. You see we don't have a formal design brief as such, I mean we get information from marketing and through our design managers and then we rewrite it and fax it back to them, its not really a design brief as such</i></p> <p><i>What I really want to talk to you about is ecodesign within the department. I can't help but feel that my job as environmental co ordinator has not been totally successful. In Electrolux we have 8 ecodesign co-ordinators, based at the various offices throughout the world. And basically only me and Phil are active in this field. So basically want to find out why? What aren't the other ecodesign co-ordinators within the other offices active? What turns them on or would turn them on? And how do we get them to do it? For them the real questions are... How do you sell ecodesign to a design management based organisation. A brief, reason or methods, etc?</i></p>
Integration problems	Inno-mot/inno-app-bri	<p><i>I don't feel I've been totally successful within the organization, I haven't done ,my job properly!'. Its not that the ecodesign co-ordinators don't want to do this job because they have the motivations . They just don't know how to! Ultimately they will be driven by design management and I'm not sure how to motivate and engage design management</i></p>
Products of system	Pro-pro-sys/pro-pro/inno-bri	<p><i>So what we are actually understanding now is that when people buy an artefact, that they are actually wanting a process and a service, so therefore you are selling the entire package, rather, then a door then a window, then a roof.</i></p> <p><i>The scenario planning of how people will live there lives in this way an then we've just sort of extracted one little thread from that whole woven image and designed a product for that thread What Electrolux do know is actually leave in the thread. A now have to be part of the process rather than standing outside it.</i></p> <p><i>You couldn't actually point to anything now and say 'yes that products been designed for service, because they don't exist, but in terms of the strategic thinking we probably have it.</i></p> <p><i>And is this part of concept design.</i></p> <p><i>Well the idea is that this becomes part of the product brief rather than you know just dropping out a product brief and having adapt to a service that it was never intended for.</i></p>
Clear guidelines	Info-app-bri	<p><i>Well we think its was a very successful project. I think that one of the key factors was the competition. Having this project as a competition to enter, with a tight deadline and clear deliverables was really useful. It meant that we didn't wander around and not make any decisions or not go anywhere ..</i></p> <p><i>The next thing to do is to develop a design brief which should inform various design projects.</i></p>
In the brief	Inno-app-bri Inno-app-bri	<p><i>The write a brief and actually spend some time writing a detailed brief, basically to direct the product output. Because again, if you can't write a decent brief, if you don't know where you are going, or where you hope to go. if you have no idea, you have no way of knowing when you've actually got there. A lot of this is that we sort of do a project and we say well do we like it?'. Well no what we are measuring it against is a brief that says does it do this, this and this?</i></p> <p><i>So if you're gonna redesign and rethink, those are the sort of criteria that need to be in the brief. So you produce not only product concepts, but also business and customer scenarios. You've gotta think beyond the product, you've gotta write the cartoon strip to say 'Here it is, its bought. After its bought and used, it comes back. Where does it go? Who takes it apart?</i></p>
Freedom and motivation in design	Inno-pur-expl/info-app-bri	<p>Cs-So why was the Eco-Kitchen project so successful.</p> <p><i>Pt-That was successful because of the personal motivations of the individual designers and of the tam, and also in that there was so much freedom there. Basically because it was a concept project and because we were allowed to push it around for some time and just understand what the subject was and define how we could best do it.</i></p> <p>All projects can't push the boundaries of what design does</p>
<b>Substantiated (with case studies and examples)</b>		
	Inno-eg	<p>But also put like loads of good examples of, this is what A is doing, this is what they did. Cash point machines, mobile phones and all this stuff in there.</p>
	Inno-eg/inno-cha	<p><i>We had this thing going on with new business and he bought in his friend from Volvo, to talk about the T80 or T70 this environmental car. This big thing. And I just said, I can't get it! I mean yes it has lower emissions and its aerodynamic and they've reduced the co efficient drag by point. But its like, it's a car. It's a CAR. And to my mind its one example, but not a particularly stimulating example.</i></p>
	Inno-eg	<p><i>So what sort of external contacts are you looking for, what sort of examples?</i></p> <p><i>Well its things like industrial washing machines, launderettes carpet leasers. Internet operators like the internet banking. Amazon books, the power of those hinges to questions norms.</i></p>
	Inno-eg/inno-vis	<p><i>I mean you pick up sexy product magazines with the odd item, I mean the green database and put sexy products in there and give the reason for it that AT &amp; T book you had with the other Italians, I mean things like that are what people would go for. And the idea of Donor products again for me is really nice. I mean I saw recently an advert with an Absolut vodka bottle smashed up and its all mad into a necklace and its called absolute recycled, and I thought well that's cool.</i></p>
Examples to stimulate designers to do this themselves	Inno-eg	<p><i>The tools and methods I'm working on for industrial designers to do ecodesign are examples and case studies. They're innovative products that inspire designers to engage with ecodesign. The tools are not specific bits of eco-information fort each product. They are general paths and directions to guide designers to do this by themselves, not specific and detailed information, but case studies and products</i></p>
	Inno-eg	<p><i>I have to do a case study of things like the major retail shifts and the major service shifts and stuff like that. So I have to go talk to Granada, I have to go and talk to Vauxhall, or Network Q the second hand Vauxhall dealer and develop a single case study of the major trends, the major drivers in the service shift. This thing has to be quite comprehensive and contain directions for us to follow and models for us to use directly in functional sales. The idea is by studying others we can get a much clearer direction to follow</i></p> <p>Cs-Were you hoping the find some decent business models out there? Because there are obviously some other models or companies that are doing the kinds of things you want to.</p> <p><i>Pt-Well yeh! The two main ones are Herman Miller with their Aeron chair. Because that was such a smart piece of design, clearly driven by design. And also the Smart car by Mercedes and I'd like to go and talk to them..</i></p> <p>Cs-You'd like to?</p> <p><i>Pt-Yeh, and will I'm gonna go and talk to Avis, car hire. Why do they buy Corsa and Vauxhall, what was there cntena for using that. If they could go along and write a brief for Rover or Vauxhall, what</i></p>



would be in it, what would it be?  
**Inno-eg/inno-vis** *Cs-Right, I don't want to put words into your mouth, but do you feel that innovative examples...*  
*Pt-Yes, that's it! OK I have a lot of them saying, Well everything I have, and I have huge scrap book at home with articles full of old stuff and with articles I've come across. And they are the lifeblood really. If there wasn't something giving you ideas from other markets and from other businesses then you wouldn't get any ideas yourself. Because its wrong to say....., no idea is new. No idea is ever new. It's a reappraisal, representation of an existing concept.*  
*Cs-That as a starting point, if you wanna say anything interesting within that Martin Charter article is really interesting. Its this of what designer respond to, is it quantitative lifecycle studies or is it case studies ad examples etc. What turns designers on, what makes them tick? How does the information have to be represented?*  
**Inno-eg** *Pt-Yes it has to be visual, its very much picture form.*  
*PT - Well, yes, maybe we start suggesting that this is a network between the supermarket and us as a supplier of the fridge. I mean that would be ideal/I get an airline ticket, I mean from British airways you get one ticket for British Airways and they'll make sure that whatever airline you go on, they sort it all out for you anywhere in the world. That's what want as a user. And if I go the supermarket and know its going to fit the rest of the system, because the companies got together. I mean that VW, who was in that car-pool. I mean you buy a flat and you get to poll-share a VW car, an I mean the architects had also done that as well with the washing machine, who was it?*  
**Inno-eg** *Cs - Miele, it ws Milele*  
*PT - Or maybe we look to other industries of who has done this before. And when you find one that's doing it better and you copy it. So I was just thinking again of banks, insurance.*  
*TB - Phones, what the telephone companies are doing regarding service is really advanced*  
*PT - For me where we are failing here is that we haven't got a wall full of good examples of were other people are doing it elsewhere and we look at them and say, that's so bloody good. because most things in white good is, you copy somebody else else whose actually innovating. For service I guess the only people who would actually do this would b our manufacturing and its a case of just absorbing some of the idea that are already out there*  
**Inno-eg** *PT - We've said 5-10 years. We have a presentation in November and its something that consumer will walk past and say, I want one of those!*  
*IR - Like when Toyota started putting the way-finder system in there cars. So now you have a screen on your dashboard, it that kind of leap*  
**Inno-eg** *What I want to do is collect projects and examples and put them on a website, or in a newsletter. I just think that if you want to get designers motivated and excited, this is the best way to do it, with sexy products and lots of visuals. I know its wrong and we don't want it to be that way, but I just know what designers respond too.*  
*So what I want to do is develop a gallery or notice-board of sustainable innovation. Something that you and we can pool and both have the same examples. Also that someone in the different design offices can see something and say 'Yep! I think that should go on the examples' So that its constantly growing. I just think that this would be a really good way of motivating designers, with examples...*  
**Inno-eg** *I'm also developing our intranet as an eco-pool of products and project examples*  
**Inno-eg** *We will be able to gain perspective from other industries and their services that they provide the consumer but as for looking upon white goods, we will be developing new ideas all the time.*  
**Inno-eg** *Pt-Have you seen the Biothinker email magazine. Edwin's got 50 examples of sustainable product design on there. Its just what we need. I really like the idea of a database of examples of ecodesign.. The edible lollipop stick, etc. That's what I was trying to do with the SEED. It was collect lots of good examples of ecodesign to inspire and influence and to motivate designers into actions. To make them say... Mmm that's interesting!*  
**Inno-eg** *PT-Like the taxi driver, you mean not buying the car not buying the transport, buying the...*  
**Inno-eg/inno-vis** *PT - OK I think you need to put the terms in, draw it and give an example of each one, 'cos everyone goes, well 'what's this and what's that?'*  
**Pro-mod/info-eg/info-con/inno-par** *I'm not quite sure what we are going to get out of it, but I'm just interested in meeting people anyway. My new role mainly involves going out to talk to relevant people about the direction to develop, and to develop relevant case studies*  

- When I spoke to Tim Cooper about the Centre for Sustainable Consumption he was making all the right noises about the sustainable consumption issues, saying that he was doing quite a lot of research with green consumers and stuff like that. I told him about the Consumer of the Future work and he was mad keen to get a copy

*I have to do a case study of things like the major retail shifts and the major service shifts and stuff like that. So I have to go talk to Granada, I have to go and talk to Vauxhall, or Network Q the second hand Vauxhall dealer and develop a single case study of the major trends, the major drivers in the service shift. This thing has to be quite comprehensive and contain directions for us to follow and models for us to use directly in functional sales. The idea is by studying others we can get a much clearer direction to follow*  
**Inno-par/info-eg/pro-mod** *I'm in this flouting, virtual position where they are saying, well you don't simply work for ID now. Your job is to get out there and talk to people..*  
*Talk to people internally?*  
*Talk to people internally, and also get out there and speak to other companies. My main, the role that I have now is to manage and conduct eco-activities, as well as the service ideas, with the main, the key parts of the service stuff is going out to find other case studies of other, where other companies are doing this and that we can use as examples.*  
**Inno-par/inno-dif/info-eg** *But.. Its quite interesting what we have tended to realise is that in giving me this job they are saying that well you'll be talking to a lot more people out there, by the nature of this job, and within the group, while your at it, can you do these other jobs. So its recognised that this job is a communications post. its almost saying that well nobody else does these kinds of things..*  
*In the organisation or the department?*  
*In the organisation. 'Cos I could go and talk tomorrow to Hermann Miller about the Phoenix project, I could go and talk to Mercedes about the Smart car. I could go and talk to Xerox about Photocopiers. So there's not many other projects where you'd be encouraged to go and talk to people who've gone there before, and come across the same problem, but with a different industry.*

**Irrelevance (of existing information)**

**Inno-exi** *pt-yes yes, its on the, its on the internal intranet, in Lotus notes. But when you show it to anyone, they just go, Oh nght yeah, that's really interesting. I mean it just doesn't really connect to what we do here, or to how designers work. Its more like, the Hazardous materials database is more useful to design Engineering and to Production Designers, to those who are choosing and specifying materials.*  
**Inno-sim-qua/inno-exi** *Cs-Your hot, wet and cold environmental documents that have been handed out, that you are supposed to use, and I've only really seen one of them and it was this incredibly technical document..*  
*Pt-Yes, yes*  
*Cs-And you are supposed to use them and yet you work like that and its just seems to be this huge contradiction between the two.*  
 Uses of existing ecodesign material



Pt-Yes, yes, Ohh yes!  
 Cs-And you know to get you industrial designers involved its got to be quite visual  
 Pt-Oh, yeah like databases or things, like description of green products and like little captions above it to stimulate thinking.

Inno-ex Its not just about tools on the intranet, because we have loads of information and data on our intranet... its selectively sifting through it

Inno-ex Ingrid - we have plenty of checklists which say.. have you done this, did you do this.., did you consider this? And of course designers go along and tick them all. But they are no use! We need things for the beginning of the design process, not things for after, to do things reflectively. We need to consider this stuff at the start of designing rather than after we've designed the thing!

Inappropriate material for ID Inno-ex We had Henrik coming around to each industrial design office pitching the LCA stuff, you know the results of the Hot, Wet and Cold environmental reports. And unfortunately it was just not successful, our designers fall asleep within 20 minutes. I mean he puts up a lifecycle a lifecycle matrix, with lots of figures and numbers on it.... and they are away! Its not his fault, its an inherent problem with designers.. They're all pumped-up.. I mean they use pictures extensively as the stimulus for the project. The farthest you can get them to read is Design Week and then they turn straight to the back for the jobs page. So they walk away from their magic markers to this presentation... I mean this is just not what we do. They are interested in innovations and things and he shows figures and graphs

irrelevant Inno-ex cs-Is it that you don't have access to right sort of information for these kind of ecodesign activities. Is it that, like data on environmental impacts and on materials, and processes etc is just not available to people?  
 pt-Oh we have the material! We've got plenty of information..., we've got more information than anyone else, we've got it coming out of our ears. Its just not used. I mean we have the Hazardous material database which tells you what to use and what not to use, like toxic materials and all that stuff.  
 cs-And can designers get access to that.  
 pt-yes yes, its on the, its on the internal intranet, in Lotus notes. But when you show it to anyone, they just go, Oh right yeah, that's really interesting. I mean it just doesn't really connect to what we do here, or to how designers work. Its more like, the Hazardous materials database is more useful to Design Engineering and to Production Designers, to those who are choosing and specifying materials.  
 We just don't really do that

Inno-ex Pt-Also have you seen the Eco Know-How tool?  
 Cs- No  
 Pt-Well I'll show it to you. Basically its in-house environmental training, its to train up all the staff on every site. And basically anyone anywhere can and does have access to this on the Intranet. We've won awards for this, it was, I think it was the first in-house training tool to be developed and implemented into a factory..  
 Look it basically takes you generally, through environmental issues...., through our corporate policy, Through more specific environmental material, etc...!  
 Ask a designer if they use it, and its like 'No!' Oh and well why is that?, Well because its pig ugly, and it's a pig! I mean look at, how long have we had to wait for this to download, Its like designers would be off by now. They'd be board and go check out..., I don't know the Alessi website or the new I don't know..., Philips products, to try and get a job or something. Or even the weather!

Inappropriateness Inno-ex Like over there in Sweden the Eco Know How guide is viewed as great. They assume that a computer terminal with the Eco Know How guide will really turn every one on, just because it does them. I mean you go across to the factory over there and mention the Eco Know How guide and its like, what? Who? I mean they would be more interested in I don't know if you gave them a bigger ash-tray in the canteen. I mean that would make Bill on the production line's week.  
 This stuff just says to me, do it because you'll win an award, rather than because it's of any use to anyone, or because it's the right thing to do.

Inno-ex The second side is the knowledge, the tools and processes to do this. And that's been like gathering together eco-examples, looking at eco-articles, interfacing with environmental coordinators, and they come underneath the Environmental Affairs, looking at IPDP eco-development.

V.Imp. - don't comprehend value of design. Inno-ex Pt-I think a lot of that is down to location. I mean they are tied up a lot with policy.  
 Cs-From what they've said about what they imagine you do...  
 Pt-They don't really know!  
 Cs-It sounds like a slightly more reactive. It sounds like their perspective on this subject is fairly compliant.  
 Pt-Well yes, they have a fairly traditional view on this, you can imagine their view. They are not necessarily championing new product development. They're not looking for new ideas, they are looking for compliance. But having said that I've been their and showed them the last months work, they've been like 'Wow!' can you show this again. WE can do things and they want us to do things because it makes it more glamorous. Its like a little company that for years didn't have a designer, and one day they get a designer working for them and the first thing is 'Oh my God!, what's all this!'