# Design and optimisation of a user-engaged system for sustainable fashion

## Eun Suk Hur

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# Declaration of Originality

The candidate confirms that the work submitted is her own, except where work which has formed part of jointly-authored publications has been included. The candidate confirms that appropriate credit has been given within the thesis where reference has been made to the work of others. The candidate has published five papers in which she is the first named author. All others named were in supervisor or advisor roles.  This copy has been supplied on the understanding that it is copyright material and that no quotation from the thesis may be published without proper acknowledgement.

# Publications

Hur ES, Cassidy T & Thomas BG (2013), *Seeding sustainability through social innovation in fashion design*, Proceedings of the 10th European Academy of Design Conference –Crafting the Future, (Sweden).

Hur ES, Beverley KJ & Cassidy T (2012), *The development of an ideation toolkit supporting sustainable fashion design and consumption*, Research Journal of Textile and Apparel, Vol. 17, No. 2.

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# Abstract

There is increasing pressure to consider sustainability in fashion design from consumers, industry and educators. Although awareness has grown significantly in the last decade, there are various challenges for linking sustainable production and consumption. Tools to support sustainable design practices exist in some disciplines; however, only a few tools exist to support fashion design. Furthermore, there is a lack of enabling tools which support designers to engage with diverse social actors to encourage sustainable fashion as a process of co-design.

The purpose of this study was to investigate and develop an effective enabling design system and tool to support fashion designers and other users in considering production and consumption. In order to achieve this, Soft Systems Methodology (SSM) was selected. When initially approaching the problem, the results of two online surveys identified designers' and general public groups' previous attitudes, experiences and challenges towards sustainable fashion.

The key lessons from this study were that although both these groups considered sustainability an important issue, this was not actualised in their daily activities. Secondly, fashion design groups were not aware of existing sustainable design tools and had not actively used them. There is demand for useful design tools for sustainable fashion design.

After identifying the problems, a toolkit and co-design process was proposed to aid fashion designers and other users, to generate sustainable fashion designs during idea generation. The toolkit was iteratively refined through participatory research and its effectiveness was evaluated through a series of workshops and interviews. There emerged key considerations for the development of the tool and that a systematic level of change, triggering continuous actions, is essential for sustainable design practices rather than one-off events.

Additional findings are discussed along with the feasibility and effectiveness of the toolkit, opportunities and challenges of co-designing in the sustainable fashion design system.

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## 1.1 Introduction

## 1.2 Background to research

Clothing production and consumption has been on the increase since the Industrial Revolution and at present there is a strong negative perception of the textile and apparel industry, which is considered amongst the most unsustainable of modern industries, generating significant environmental and social impacts throughout every stage of the product lifecycle. These include cultivation and processing of the textiles (manufacturing yarn, fabric, dyeing and finishing), clothing production, distribution, maintaining the product during use or reuse and final disposal (Defra, 2008).

Within the production process, there is excessive use of resources and energy and pesticides in growing natural fibres, particularly cotton production; then yarn and fabric production involving the various chemical inputs necessary throughout the manufacturing and production processes including bleaching, dyeing, printing, finishing processes. Furthermore, apparel production involves the labour-intensive garment making process from unethical labour sourcing in overseas clothing suppliers and manufacturers (cited in Saicheua *et al.*, 2012).

What is more, recent lifecycle analyses by Allwood *et al.* (2006) and WBCSD (2008) have indicated that the major environmental impact of a garment occurs in the post-purchase phase. Whilst a recent comparison of lifecycle assessments has identified the assumptions made around consumer behaviour as the most likely area for potential errors in such assessments (Chapman, 2010), there can be no doubt that consumer behaviour has a significant influence on the environmental impact of clothing (WRAP, 2012).

This includes repeated purchase and disposal of fashion apparel which characterises the 'fast fashion' paradigm. The fast fashion clothing market now accounts for approximately one-fifth of the total clothing market in the UK (Morgan & Birtwistle, 2009; Defra, 2008). Fast fashion is predominantly based on 'mass fashion' products and is characterised by large volume production, mass suppliers and retailers (Doeringer and Crean, 2006). Furthermore, global market mechanisms mean that the cost of fashion goods is artificially low in developed countries, and in

no way reflects their environmental and social costs (Armstrong and LeHew, 2011). The phenomenon has led to consumers purchasing and disposing of ever-larger quantities of clothing and the tendency to keep clothing for a shorter time (Morgan and Birtwistle, 2009). From a production view, it is common for clothing manufacturing companies to be threatened by cheaper imported products (Pitimaneeyakul *et al.*, 2004). Fashion companies are under constant pressure to reduce prices, whilst increasing the rate of production; the resultant shortening of the design process, and particularly the ideation phase, gives increased homogeneity of products. Fletcher (2008) has argued that this characteristic of 'fast fashion' breeds passive consumers and leads to a reduction in the emotional and symbolic value of a fashion product and to an increase in the level of consumption and resultant volumes of waste.

The effects of this industrial model can be seen in the shortening of the design process in recent years. A further impact is a lack of consumer awareness of best practice regarding care in use. Fashion items are bought, abused and discarded with little consideration of the impact of this behaviour. 'Fast fashion' engenders little brand loyalty; the similarities between products mean that in most cases purchase is driven by cost considerations, rather than the intangible assets a brand offers.

Addressing the sustainability issues in the fashion industry is extremely challenging and now it has been faced with a critically complex dilemma between sustainable production and consumption.

This involves complex 'wicked' problems "*which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications of the whole system are thoroughly confusing*" (cited in Wahl and Baxter, 2008).

It becomes apparent, then, that sustainable fashion production and consumption is counter to the current industrial model and this implies that fundamental changes are needed to the existing system and thinking in relation to the design process as well as a consideration of how design affects production and consumption.

It has been argued that 'wicked' complex design problems and the transition towards sustainable design requires an enabling system that engages with diverse social

actors facilitating discussion and co-operation to obtain flexible design solutions (Manzini, 2008).

Participatory design, or co-design, has received academic attention for sustainable design being a relatively straightforward rationale based on a number of assumptions. According to Bell and Morse (2010), different actors have a fundamental right to be included in the design process that impacts on their lives. Secondly, listening to their opinions as partners and including them in the design process can help bring about better transformation, as they are considered a 'change agent' rather than having change imposed upon them. Therefore, the process of change can lead to a sense of ownership, felt in a deeply personal and internal way by change agents through self-reflection and the 'owned' process (Bell and Morse, 2010).

Despite the participatory process benefits outlined above, this is not to say that the approach is without its weaknesses. Participatory design is currently more of a movement or research orientation and there is a significant gap between theory and practice (Spinuzzi, 2005; Bell and Morse, 2010). For example, there is no clarification of who the actors of the process are and how different actors can be engaged in the participatory design process. Furthermore, without appropriate tools, common goals (e.g. sustainable fashion) and appropriate platforms, it is difficult to achieve the benefits outlined.

In order to address the social and environmental issues relevant to fashion production and consumption, it is necessary to articulate more clearly how an enabling co-design can contribute to fashion design; particularly with regard to the point at which designers and other actors should become involved in the design process.

The designer's role is more important than ever before. In this age of mass production and consumption in society, *"design has become the most powerful tool with which man shapes his tools and environments (and, by extension, society and himself). This demands a higher social and moral responsibility from the designer"* (Papanek, 1985, p ix).

Designers are the industry's connection to the marketplace, dealing with the use and experience aspect between the product and the person (Heeley, 1999, p203).

Consequently, designers should be a 'change agent' to sustainable design action. They can influence overall design practices, including methods of production and consumption through communication of marketing strategies as well as influencing people's life style and patterns of consumption.

In order to achieve this, Wahl and Baxter (2008) argued that designers need to step further back to acknowledge the holistic picture whilst engaging self-reflectively in the system itself.

However, traditional design practices and designers' positions often passively respond to pre-determined design briefs, focusing on the process at the late stage of concept development and then often little more than dealing with styling and add-on functionality (Richardson *et al.*, 2005). This phenomenon reduces internal designers' capability of problem solving and restricts entrepreneurial and sustainable skills (Richardson *et al.*, 2005). What is more, Muirhead (1999, p7) observed that most designers often appear to distance the implementation of sustainable design in practice due to lack of appropriate information or specialist knowledge, time pressures in the design process, and poor communication and interconnection of manufacturing, design, marketing and production.

A number of studies have emphasised that decisions made during the early stage of the design process can both reduce environmental impacts and stimulate product innovation rather than product being formulated at the production stage (Bhamra *et al.*, 1999; Heeley, 1999; Sherwin and Bhamra, 2001; Richardson *et al.*, 2005). The early design process plays a key role in 'locking in' the environmental and social impacts of the product and service design; beyond a certain point in the design process, it is particularly difficult to affect positive environmental and social impacts (Bhamra *et al.*, 1999; Heeley, 1999; Sherwin and Bhamra, 2001; Richardson *et al.*, 2005). Indeed, in order to maximise co-design benefits and facilitate sustainable design practice, the co-design process must be undertaken in the early stages of design.

The purpose of this study is to develop an appropriate and effective enabling design system and tool to assist designers and potential other actors to address sustainable design practices and become aware of the importance of facilitating sustainable production and consumption at the idea generation phase.

According to Dale and English (1999, p2) the term "tool" can be defined as *"anything regarded as necessary to carrying out the one's tasks or mission".*

It also implies the systemic capability to deal with problems through providing a holistic method to certain situations. The tools can be used by groups of people with different backgrounds, skills, access to information and equipment, and degrees of involvement in decision-making processes (Dale and English, 1999).

The research explores the development of an alternative co-design system which assists fashion designers to enact sustainable design practices themselves as well as enabling other actors to involve themselves in sustainable design.

### 1.2.1 Soft Systems Methodology (SSM)

System thinking is a way of understanding the inter-relationships between components of a system. It was developed by Peter Checkland (Checkland, 1981; Checkland, 1999) and many other researchers (Checkland and Scholes, 1990; Checkland and Poulter, 2006), over 30 years of research, to convey the insights of system theory to real world 'wicked problems' involving human systems. SSM utilises continuous action research to support and enable people to address real-world situations and interpret complex problems. It helps to identify what to do, why and how to solve this problem, who can be involved in the solution and what different perspective and situations actors have on the problem. SSM has been widely used in social science and health care sectors and is considered a powerful tool for developing better understanding of human activities and situations. SSM shares the same epistemology of almost all participatory approaches in that it allows a space for individuals to communicate and share insights focusing towards problem solving (Bell and Morse, 2010). In the SSM process, researchers do not simply observe the situation as externally, but are embedded in the transformation process; in this way, they are more likely to bring about lasting change. SSM generally uses a visual illustration and conceptual model which depicts the multidimensional issues associated with 'soft problems' (people, issues and relationship). Figure 1.1 illustrates the flow of common soft systems activities for implementing a solution in a soft situation and humanity disciplines (social, psychological, cultural aspects).
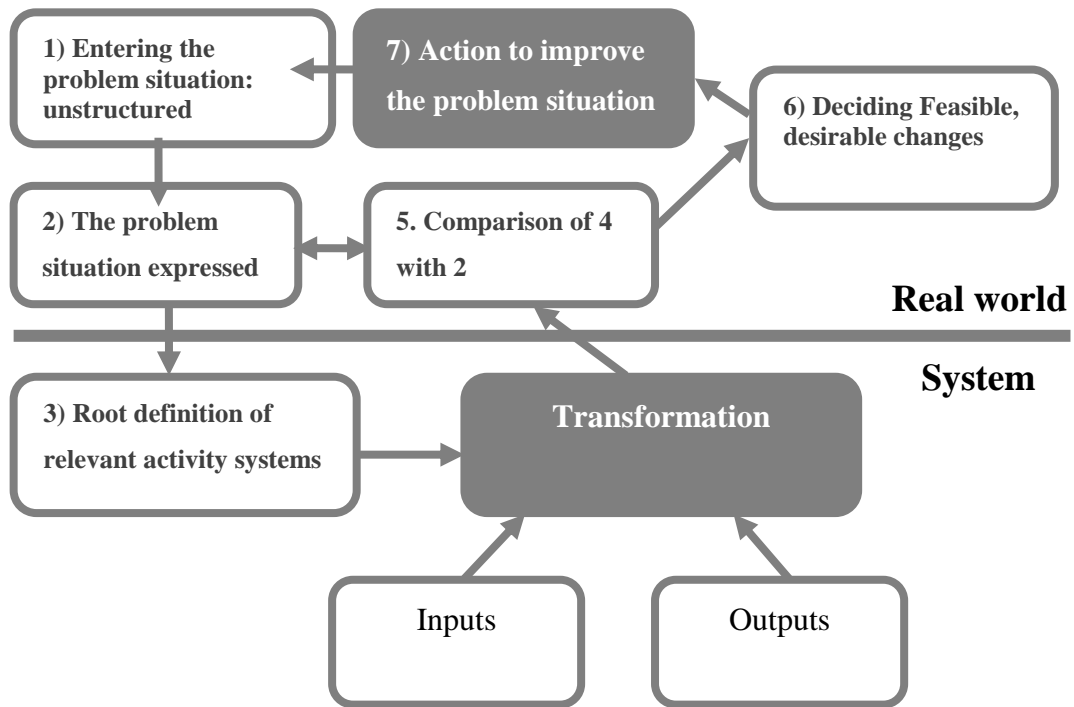
**Figure 1.1: Checkland's seven-stage soft systems methodology (Checkland, 1999, p163)**

The methodology consists of two major areas defined as the 'real world' and the 'systems world'. Stages 1, 2, 5, 6, and 7 are 'real-world' activities (and commonly use action research methods) and are inevitably engaged with the people involved in the problem situation. Stages 3, 4, 4a and 4b are the 'systems thinking' activities needed for critical evaluation of existing systems and sub-system activities.

1) *Entering the problem situation*: The first phase of the SSM process starts from the identification and evaluation of a real world problem as being unclear. The data collected may be qualitative, quantitative or mixed and the researcher can select the most appropriate methods.

2) *The problem situation expressed*: In expressing the problem situation, the researcher evaluates the problem situation whilst at the same time not imposing a particular structure on it. Within this stage, the problem situation is usually expressed using a 'Rich Picture' that can reflect and examine the circumstances within the relevant system/s. 'Rich Pictures' are effective tools for designers to visualise their thinking and record their insight. Using 'Rich Pictures', designers use their design thinking to represent actors, linkages and issues involved in the issue to stakeholders.

3) *Root definition of relevant activity systems:* The formulation of the 'root definition' represents the transition from the 'real world' to the 'system'.

This definition begins with the stating of hypotheses concerning final improvement of the problem situation by means of implemented transformation and whether it will be feasible or desirable (Checkland, 1999, p167). It is a structured description of a system drawn by the researcher from the initial research activities and the objective of the system. Therefore, it needs to consider that what the system is, what objectives it aims to achieve; the persons who could be affected by it or affect it and who would be part of the new system (Checkland, 1999). It also identifies the transformation considering other key elements of the system, human activity and environment. Several criteria need to be specified in order to certify that a given root definition is comprehensive and valid. The summarised criteria can be evaluated using the CATWOE test. Application of CATWOE helps ensure the necessary components of the system are addressed in the root definition.

C= Customers or clients: Who (or what) benefits from this transformation?

A= Actors or agents: Who is engaged in system activities and facilitates its operation?

T=Transformation process: How is the system transformed? This is an essential part of process of change.

W= Weltanschauung or Worldview: What makes the definition meaningful?

O=Owners: Who controls the system / could cause it not to exist?

E=Environment: What does this system take as given from the world that surrounds and influences the system?

4) ***Building a conceptual model*** may occur concurrently with formulation of the root definition. The conceptual model commonly illustrates the relationship between the system activities underpinned by the root definition. Patching (1990) suggests that the development of conceptual model is illustrated by assembling and structuring the minimum number of verbs necessary to describe each component or activity in the system (commonly expressed in diagrammatic form).

5) ***Making the comparison:*** The conceptual model is compared to the existing situation (commonly using the 'Rich Picture' expression of the problem). If there are mismatches between the real world and conceptual model, this may indicate that the new model is inappropriate. In this case, returning to stages

3 and 4 may be necessary to consider both the root definition and associated model, a process can be repeated until the client (users) are satisfied (Patching, 1990).

6) *Deciding Feasible/ desirable changes:* The purpose of Stage 6 is to identify whether the transformation is culturally feasible or desirable for stakeholders. In this stage, the technical feasibility of the system may also be assessed, depending on the problem situation.

7) *Taking Action to improve:* The final stage involves considering the implementation of change and occurs when individuals or organisations adopt the suggested new model and system. Checkland (1981) and other researchers (Checkland and Scholes, 1990; Checkland and Poulter, 2006; Patching, 1990; Wilson, 2001) who use SSM emphasised that the seven stage approach of SSM is a logical sequence which is suitable to illustrate methodology, but it is not necessary to utilise each state. The process can begin at any stage, but interaction with the real world is essential to achieve the benefits of the method.
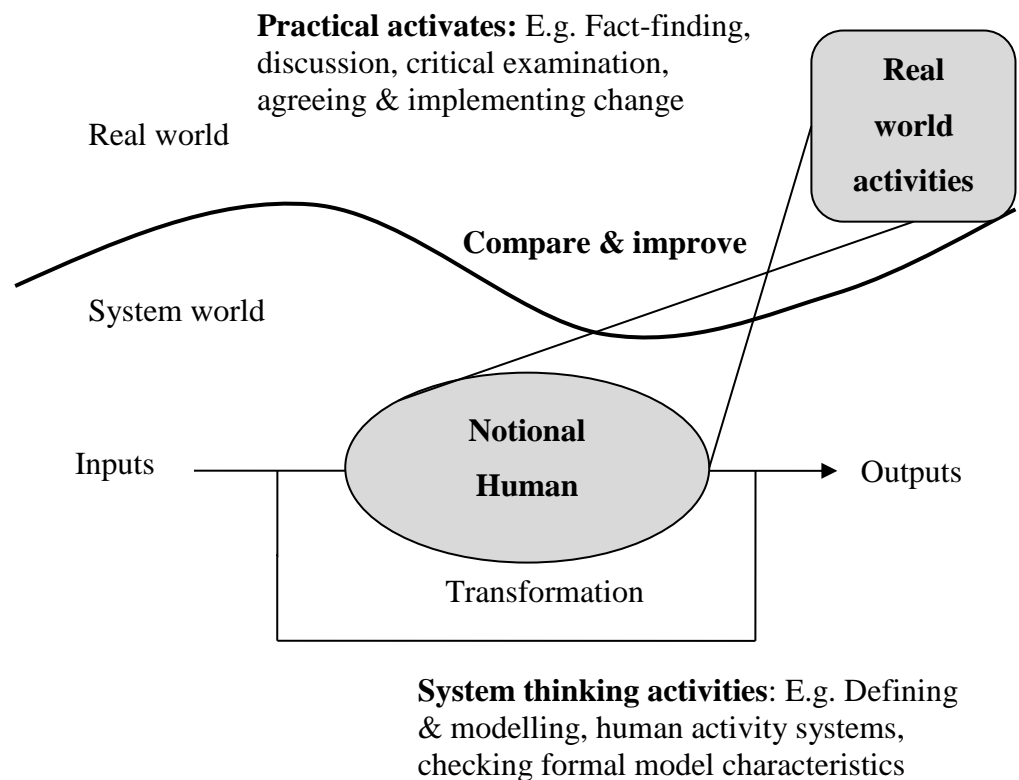


**Figure 1.2: Use of the systems model (Patching, 1990, p42-43)**

## 1.3   Research questions

This thesis addresses the following questions:

(a) How can fashion design incorporate sustainability at the early design development stage?

(b)  How can a design system be created in which a designer and other actors are encouraged to implement more sustainable design practices at the early concept generation phase?

(c) How can a systemic approach facilitate apparel designers and potential users to rethink their design process and provide inspiration in the integration of sustainability in their design project?

(d) What are the potential opportunities to support sustainability in fashion and textile design through co-design system?


## 1.4   Research aim and objectives

### 1.4.1  Research aim

The main aim of the study is to investigate an appropriate and effective enabling system and tool to assist fashion and textile designers to action sustainable design practices themselves.  It was also aimed at enabling designers to encourage other stakeholders to explore sustainability as a way of thinking at the early stages of the fashion design development process.

### 1.4.2  Research objectives

The overall aim of the research will be accomplished through seven objectives:

1.  To critically review essential literatures through the examination of secondary sources:

   -To define the definition of sustainable fashion design through reviewing the literature on sustainable development, sustainable design and the interpretation of sustainability within fashion design.

-To identify the fundamental problems of current design practice by reviewing the post-industrial revolution historical context and the contemporary shift towards sustainable fashion design.

-To examine and review existing sustainable design principles and tools and investigate their strengths and weaknesses.

2. To provide an overview of research methodology to develop an effective enabling sustainable designs system to assist fashion designers and potentially other users to address sustainable design practices.

3. To clarify and understand underlying problem points in relation to sustainable fashion design in the real world and investigate barriers and challenges to the consideration of sustainable fashion design practices.

4. To establish key criteria and a conceptual model for the development of an enabling sustainable design system at the idea generation stage, through utilisation of the Soft Systems Methodology.

5. To develop key inputs and outputs of the system and design a sustainable fashion design tool for the concept development stage.

6. To demonstrate how to apply a new tool in a real world situation and evaluate the new tool through a series of participatory workshops and interviews.

7. To discuss both the strengths and weaknesses of the research outcome and its opportunities for sustainable fashion design.

## 1.5   Thesis structure and organisation of study

**Chapter 1** introduces the research context and scope and discusses the fundamental aim and objectives of this study.

**Chapter 2** reviews the growing body of literature relevant to sustainable fashion design.   It begins by discussing what is meant by 'sustainable design' and developing an understanding of sustainability in fashion design by reviewing historical evolution of sustainable fashion. The drivers for sustainable fashion design and the challenges to its adoption are considered. The chapter also illustrates the limitations of current approaches to sustainable fashion.

**Chapter 3** critically examines relevant research concerning sustainable design methods and tools. The chapter provides useful information of how other research

has tackled the challenge of sustainability and examines existing sustainable design tools in various industries (e.g. industrial design, architecture, engineering, multidisciplinary theories and government design framework). The research offers useful insights that can also be applied to sustainable fashion. Through an in-depth analysis of tools and methods including the production approach of eco-design tools and the consumption approach for sustainable design for behaviour change tools, the strengths and weaknesses of the approaches are discussed and the knowledge gap is evaluated in design practice in order to suggest the future direction of the primary research. It provides decisive knowledge for the primary research and sets the objectives for the ideation toolkit development.

**Chapter 4** presents overall research strategies and methodology. Through adoption of the Soft Systems Methodology (SSM) with participatory action research (PAR), the key research direction and a landscape of research methodology are introduced in order to suggest a systematic design tool to support designers to enact sustainable fashion design practices.

**Chapter 5** investigates how different actors have considered sustainable fashion and identified the challenges of sustainable production and consumption in their daily activities through considering problem situations in the real world. The data was collected using two online surveys from both a fashion design involved group and a public group. The findings of the results are summarised in 'Rich pictures' in order to clearly identify the problem situation. The results are also used to build a root definition for a relevant activity system and contribute to the development of a co-design model and criteria for the development of a sustainable design toolkit. Using CATWOE, the key criterion is established for the input and output of the system including the purpose of the tool, target audiences, performance and transformation process.

**Chapter 6** describes the input of the system and the process of development of the toolkit. This chapter elaborates on the structure of the toolkit and describes a theoretical framework for a sustainable fashion design toolkit. The toolkit is designed specifically for the sustainable fashion design sector at the idea generation phase, in order for fashion design practitioners to rethink the design process.

**Chapter 7** focuses on the workshop method and identifies best practice in toolkit use through evaluation of participants' feedback using both qualitative and quantitative data. This chapter also outlines the potential of the toolkit for design education and how this may promote proactive responses to sustainability in the idea generation stage. The discussion highlights how the developed toolkit and workshop process encourages design thinking to support designers in moving towards sustainable innovative design solutions.

**Chapter 8** presents how the co-design process and web platform can act as an agent for environmental and social change in the early fashion design development phase. This chapter discusses how a developed co-design system assists in addressing sustainable issues in the fashion design process. Utilising a meta-design mechanism, an online-platform has been developed as a social e-learning process, which allows the user to discover new insights into sustainability and synergistically contribute to a sustainable solution at the early phase of the fashion design development process. The chapter will discuss the potential opportunities and barriers for an ideation co-design system and its new role for the designer and its educational interpretation for sustainability in fashion and textile.

**Chapter 9** is the conclusion of the research and discusses key findings of the contribution of this study, including the practical application of the toolkit and the theoretical contribution to the integration of sustainability into the fashion design development process. The final chapter demonstrates how the research meets its initial aim and objectives as well as the research questions. It also discusses the limitations of the research and suggests further research which could be expanded in the future.

Chapter 2: **Design for Sustainable Fashion and Its Drivers and Challenges**

## 2.1 Introduction

A considerable number of meanings and interpretations are attached to sustainability and areas of concern that designers can work on which fall under the broad umbrella of 'sustainable design" have been identified by a number of authors (see, for example, McDonough and Braungart, 2002; Fletcher, 2008; Black, 2008; Thorpe, 2007; Bhamra & Lofthouse, 2007; Chapman, 2005; Fuad-Luke, 2009). Despite this, the term remains confusing and ambiguous and many designers still find it difficult to understand this concept. This discussion hints at a wider debate about the very nature of sustainability itself. O'Riorden (1985) commented on the difficulty of defining sustainability and sustainable development, describing the process as: 'Exploration into a tangled conceptual jungle where watchful eyes lurk at every bend', whilst Spedding (1996) noted that perhaps this was the reason for:

*"The remarkable number of books, chapters and papers, that even use 'sustainable' or 'sustainability' in the title but do not define either"* (Spedding , 1996, p151).

The aim of this chapter is to develop a working definition of sustainability in fashion design and assess its progress. The historical evolution of sustainable fashion is provided and the key drivers and challenges for sustainable fashion design are considered.

## 2.2 Defining sustainability and sustainable fashion design

The definition of "sustainability" is difficult to clarify, even though much of the current literature describes the necessary conditions for "sustainability".

The Oxford English Dictionary (2013) defines 'sustainability' as

1. *"The quality of being sustainable by argument; the capacity to be upheld or defended as valid, correct, or true".*
2. a. *"The quality of being sustainable at a certain rate or level".*
   b. *"The property of being environmentally sustainable; the degree to which a process or enterprise is able to be maintained or continued while avoiding the long-term depletion of natural resources".*

Sustainable design is most commonly considered in the context of "sustainable development"; the World Conservation Strategy (IUCN/ UNEP/ WWF, 1980) first defined "sustainable development" through the following statement:

*"For development to be sustainable, it must take account of social and ecological factors, as well as economic ones; of the living and non-living resource base; and of the long-term as well as the short-term advantages and disadvantages of alternative action"* (IUCN/ UNEP/ WWF, 1980).

However, this definition has been criticised for being concerned predominantly with the environmental aspects rather than providing a holistic view of sustainable development. The Brundtland report (1987) particularly noted that environmental sustainability could not be achieved if the problem of poverty was not successfully addressed around the world. The Brundtland report suggested that sustainable development had to be resolved simultaneously and in a mutual way both integrating environmental issues and the vast and complex issue of human development and poverty (WCED 1987; Robinson, 2004).

After much discussion, the definition of "sustainable development" offered by Brundtland in 'Our Common Future', (UN World Commission on Environment and Development, 1987) has become the most widely accepted, and many sustainable designers use this as a basis of their activity. The fundamental three components of sustainable development consist of environmental protection, economic growth and social equity.

The definition of sustainable development is:

*"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (*WCED, 1987, p43).

Despite the wealth of references to the Brundtland definition, it is not supported by professional consensus. Redclift (2000) pointed out the underlining contradiction and obscure meaning of this definition. He argued that the 'needs' can change overtime and also can be defined differently for each generation and different cultures. For instance, at one particular society level the concept of 'needs'  may prioritise a clean environment and fundamental necessities of life, but other societies

may define 'needs' as the development of material wealth despite the cost of increased environmental footprint (Redclift, 2000).

Lele (1991) has also identified several weaknesses with these current interpretations of sustainable development. He argues that sustainable development can be broken down into the basic concepts of "sustainability" and "development". There are three interpretations of sustainability: current literature explains the concept of sustainability as referring to sustaining anything. However Lele (1991) offers alternative interpretations as ecological sustainability, referring to sustaining the ecological basis of human life, and sustainability as sustenance of human life itself. In the same way, Lele highlighted a weakness in the use of the concept of 'development'. The word can be understood as both a process of growth and/or change as well as the end objective i.e. description of the ultimate human need. Lélé suggests a comprehensive sustainable development meaning as he considers the trinity of economic, social and ecological aspects of sustainability and development which culminates in his definition: (Lele, 1991; Chakrabarti, 2003).

*"Sustainable development is a process of simultaneously ensuring continuation of the economic, social and ecological basis of human life"* (Lele, 1991).

Additionally, another influential concept of sustainability is the 'Triple Bottom Line (TBL)'; the term was first coined by John Elkington in 1994. It has received considerable attention for encouraging sustainable development and a commitment to corporate social responsibility (CSR). He argued that companies should be preparing the three components of the triple bottom line commonly referred to as "people, planet and profit" balancing demands of social, environmental and economic issues.

The first component is "people" that encourages socially and ethically responsible business including the work ethics, human rights, equity, labour, working conditions and political climate in the communities that it functions in. The second is "planet" considering the component of an environmentally responsible business through respecting the capacity of the planet and consideration of resource consumption. It is considered the most important component because human society cannot function without the environment (cited in Bhamra and Lofthouse, 2007, p15). The final

component is "Profit" which accounts for the economic sustainability over long term as well as considering social benefit.

Consequently, incorporating all the triple bottom line (TBL) could reflect in the evaluation of the company's goal of sustainability through measuring the financial, social and environmental performance of the corporation.

The complexity of the term 'sustainable' is mirrored by the difficulty of accurately defining 'design'. The definition of 'sustainable development' is more about the aspirational ideal and the concepts itself are a challenge to interpret in design practices. This makes it difficult to come up with an appropriate description of 'sustainable design'. In order to appreciate the complexity of defining sustainable design, it is important to consider its evolution.

### 2.2.1 The evolution of sustainable design

Academic interest in sustainable design emerged from the global discussions surrounding 'sustainable development'. The question still remains as to what is meant by green, eco and sustainable design. Although the concept of sustainable design is commonly used as a synonym for green product development and how 'green' is conceptualised (as environmental, ecological, sustainable, etc.) in the debate in relation to their context, many consumers and even designers may find it confusing and ambiguous and may not even be aware that there are some differences.

Pauline Madge (1997), in her seminal discussion paper 'Ecological Design: A New Critique', described the semantic evolution of terms: from green, through eco to sustainable, which roughly mirrors the growth in societal understanding of the impact of their actions on the environment and society.

Madge (1997) explained that green design, commonly referred to in the late 1970s and early 1980s, generally dealt with the single-focus of environmental impact and did not employ systems thinking. As design began to embrace the complex systems, the thinking approach already employed in the scientific study of ecology, ecologically or environmentally-sensitive or affirmative design, or more generally 'eco-design', became a more widely accepted term through the 1980s and 90s. Eco-

design dealt with the environmental impact of a product throughout the entire lifecycle from cradle to grave (Madge 1997, p44).

With the emergence of a deeper understanding of the inter-connectedness of the Earth's systems (including societal systems), there followed attempts to capture the ways in which design could be applied to achieve a better balance. The context in which the new discipline of 'sustainable design' was developed was much broader than that previously considered by green and eco-agendas regarding environmental aspects, but also introducing a global perspective to the social and economic issues and product consumption associated in social, cultural and psychological aspects. Design research is now concerned with moving from a "product-based Level" towards looking at lifecycle, systems and services as well as social, psychological, cultural levels of context. Therefore, the definition has been extended beyond concern with the environmental impact of the production cycle, as was the case with green design and eco-design, sustainable design now includes people and the social and ethical impact of production (Knight, 2009).

This broader definition that supports human well-being –such as self-esteem, a sense of identity, participation, and belonging- is not tied directly to the ecological function but would consider long term sustainability through incorporating theories and practices for design that cultivate ecological, economic, and cultural condition (Thorpe, 2007). An important characteristic of sustainable design is future-oriented product and process development aimed at being better to fit human needs, quality of life, equity and environmental harmony in parallel with innovation (Baumann *et al.,* 2002, p413).

This broader definition of sustainable design represents how design can be a positive influence on environmental and social issues as well as economic ones, looking at the interconnection of relationships and context as a whole and a reflection of current patterns of consumption and production. Therefore, sustainable design ideas share the key feature that they are all holistic points of view, future-focused on the maintenance and improvement of quality of life for human wellbeing.

Since this research is focusing on the field of fashion and textile design, it is important to specify why we need to incorporate sustainability in to fashion design

through examination of the historical overview of sustainable fashion and identification of the challenges for the current fashion design field.

## 2.3  A historical perspective of sustainable fashion

### 2.3.1  Early green thinking

The history of environmental concern in most of countries has followed a largely similar pattern; an early period of pioneering, culminating in recent decades in a widespread social movement. This environmental movement has expanded human understanding of 'right' and 'justice', generating more attention to the environment as well as sustainable lifestyles (Guha, 2000, p3).

Before the Industrial Revolution, conserving resources was consistent with the basic way of life. However, the Industrial Revolution significantly affected human relationships with the environment (McLamb, 2008).

The first awareness of environmental impacts of industrialisation emerged in the United Kingdom. The moral and cultural critique started going *"back-to-the-land"* through the recognition of the unsustainability of man's relationship to the earth (Guha, 2000, p5).  During that time, the mainstream of environmentalism was focused on incorporating man back into nature and soon gradually transformed into dynamic social, cultural and intellectual responses (Ibid, 2000, p6).

John Ruskin (1819-1900), William Morris (1834-96) and other activists developed the idea of the environment and its significance for the survival of all life forms. John Ruskin set up a guild and operated farms and craft shops which produced food and weaving cloth for their own use through encouraging self-sufficiency and simplicity of life, recapturing a world rapidly being lost (Ibid, 2000, p13-15).  His disciple William Morris (1834-1896) promoted the revitalisation of handicrafts movement as well as considering environmental and social aspects through his work. He founded the arts and crafts movement, devoting his life for a future socialist world (Ibid, 2000, p15).

### 2.3.2  The negative impact of consumerism

Advances in manufacturing technology in the Industrial Revolution increased the pace of clothing and shoe production, and brought about new approaches to mass-

production of clothing. During the late Nineteenth Century, ready-to-wear apparel production expanded rapidly (Welters, 2008). This mass production raised all kinds of previously unthinkable possibilities, and the new standard of living and life styles encouraged the purchase of more and more goods. As more companies saw the benefit of production, the marketplace became increasingly competitive, gradually giving way to a market in which the norm was stimulating sales through changing styles and packaging (Ewen, 1988).

Whilst the United Kingdom was the home of the First Industrial Revolution, the United States has led the world in the industrial way of life and the associated growth in consumerism, a system which many critics hold responsible for the current environmental and social crisis (Guha, 2000). Roy Sheldon and Egmont Arens epitomised the spirit of the times in their influential 'Consumer Engineering: A New Technique for Prosperity', published in 1932.

Sheldon and Arens suggested 'progressive waste' or 'creative waste' through stimulating 'high mass-consumption' as the indication of wealth (Whiteley, 1993, p14). This phenomenon of market-stimulated waste emerged in design industries through methodically engineering the obsolescence of styling to promote sales (Ibid, 1993, p17-18). It has been argued (see, for example Whiteley, 1993) that this consumerist design system generated overconsumption through the use of 'style obsolescence' without any consciousness of environmental and social impacts. Increasingly, as the basic needs of humanity were being easily satisfied by the productive market, marketers and advertisers sought for ways in which societal wants could be exploited, giving rise in the 1950s and 60s to lifestyle advertising. This development marked a change in the role of products from simple objects to social stimuli (Whiteley, 1993). As the first of the babies born after World War II grew up, the classic styling of the 1950s and early 1960s replaced by youthful fashions took centre stage. New fibres and fabrics appeared with rapidly at the same time, the clothing became cheap, disposable and throwaway fashion start to emerge (Welters, 2008, p20). During the same time in the United Kingdom also evolved a 'consumerist' society, Terence Conran recalls this period,

*"there was a strange moment around the mid-60s when people stopped needing and need changed into want ...Designers became more important in producing 'want'*

*products rather than 'need' products, because you have to create desire"* (Whiteley, 1993, p18).

There have emerged groups of people who define themselves through their rejection of mainstream commercial activities through anti-consumption choices. They can be seen to have integrated sustainability into their identities. The clothing choice of these groups revealed a tendency to reject fashion trends and instead wearing blue collar workers' clothing, specifically blue jeans, T-shirts, and work boots. This anti-fashion movement which has appeared on the horizon, influences modern fashion (Welters, 2008, p19).

### 2.3.3 Growth of sustainable design thinking

As more human production and consumption contributed to significant environmental degradation, the growth of early ecological thinking developed into a global social movement (Guha, 2000). This increasing social concern for the environment had been stimulated by Rachel Carson's book Silent Spring, published in 1962, which is universally agreed to have 'played a vitally important role in stimulating the contemporary environmental movement'(Ibid, 2000).

During the 1960s to 1970s, the global environmental movement and the rise of Non-Governmental Organisations (NGOs) focused on driving change through government policy and regulation such as Friends of the Earth and Greenpeace (Bhamra and Lofthouse, 2007, p1).

At the same time, Victor Papanek, who was a designer and educator, first criticized the ethical and social responsibility of the designer for creating wasteful practice of design and generating consumerist design culture. He advocated the adoption of a morally responsible and holistic approach to design, adapting technology to the individual's needs and utilising the wisdom and experience of other countries. He highlighted fact that designers often placed too much effort on the aesthetic aspects of design rather than considering the real problem and human need. Moreover, he also emphasized the importance of the designer's role as well as design which is the most powerful tool for reshaping our social and environments (Papanek, 1985).

His book "Design for the Real World" influenced many contemporary scholars and designers, even though his new critical attitude was not welcomed by public at that

time. His book was rejected by several publishers during the late1960s and early 1970s and then, when his article was published by one of professional design magazine first time, the public response was *"the Garbage Can Designer"* and *"an attack on Detroit mixed with a utopian concern for minorities"* (Papanek, 1985, p xvi).

However, Papanek's book was slowly accepted after major environmental crises occurred- the first energy crisis, the OPEC oil embargo in 1973, four unusually cold winters, two major droughts leading to water shortages and the global energy shortage alerting people to the dangers of relying on fossil fuels for existence (Papanek, 1985, p xv- xvi).

Throughout that time, the fashion industry also raised an awareness of the environmental impacts of fashion; the culprits included cotton growers, who used large amounts of pesticides and fertilizers in order to achieve greater crop yields as well as the use of chemicals in textile manufacturing, which discharged chemically laden water from their mils into local rivers and streams (Welters, 2008). This public awareness of textile and fashion industries lead the "eco chic" trend of "environment friendly" garments, dominated by natural looking colours and fibres, but did not reflect real sustainability. "Eco chic" was more a "stylized reaction" than a conversion to sustainable design issue or value. Fashion collections and magazines often portrayed sustainability as a natural and pure visual identity and traded on popular notions of environmental responsibility, notably that natural is "good" and artificial, man-made or chemical is "bad" (Fletcher, 2008, p118-119).

Much of this thinking is based on the misinformation in the media and negative perceptions of the chemical industry. However, some processes for making synthetic fibres are more environmentally friendly than making natural fibres, especially when take account energy and water consumption for environmental impacts (Easey, 1995, p37). Furthermore, when we take account the consumer use stage and disposal of product stage, it is much more complicated.

This was reflected in the fact that sales of organic cotton fluctuated, first increasing the response to an emerging "eco chic" trend, and then declining as apparel companies withdrew from the market because of supply problems, higher costs, consumer price resistance and marketing barriers (Lewis *et al.*, 2001, p131).

Even though a growing awareness of environmental issues in the production of fashion led to some improvement, the responsibility of designers in promoting the sustainable message was somewhat lost, with the focus being placed on the improvement of textile and coloration processes which would allow the fashion market to continue to meet the 'needs' of the market.

Throughout the 1990s, design became more intensely focused on recycled materials, and by the late 1990s, "eco-design" emerged considerably involving product to 'product lifecycle approaches' detailed in works such as A Guide to Eco-ReDesign (1997) (Thorpe, 2010). On the other hand, critics of consumerist design emerged; noticeably, Nigel Whiteley (1993) who was questioning and examining consumerist system of design which naturally lead on to the idea of "responsible design and ethical consuming".  Whiteley pointed out that consumer were now able to purchase products which were more appealing and desirable, consequently providing commercial success. In the meantime, positive social change and broader social goals had been largely neglected (Whiteley, 1993).

## 2.4  The challenges of contemporary sustainable fashion

In the early twenty-first century, well designed clothes are available at a wide range of prices; people can easily afford fashionable clothing (Welters, 2008).  As we witness that consumption has been on the increase since the Industrial Revolution and at present the term comes loaded with negativity; fashion is again disposable and generates large environmental and social impacts. The economic success has a considerable number of environmental and social "footprints" across its global lifecycle. These environmental and social impacts occur at every stage of the product life cycle including cultivation and processing of the textiles (manufacturing yarn, fabric, dyeing and finishing), clothing production, distribution, maintaining the product during use or reuse and final disposal. Figure 2.1 shows the typical clothing life cycle associated in environmental and social impacts. Figure 2.2 presents the typical textile and clothing supply chain throughout the clothing life cycle.

| Raw materials growth & fibre production | Fibre to fabric production | Apparel production & packaging | Distribu tion& retail | End use | End of life |
|---|---|---|---|---|---|
| Resource consumption GHG emissions Air/water pollution& toxicity Soil degradation Contaminati on | GHG emission Air/water pollution/ Toxicity Soil degradation biodiversity and use Health and safety Poverty alleviation | Solid and hazardous Waste Worker rights Health and safety Poverty alleviation | Resource consumption GHG emissions | Resource consumption GHG emissions | GHG emissions Solid and Hazardous Waste |

**Figure 2.1: Typical clothing life cycle associated in environmental and social impacts (Adapted from Defra, 2008)**

**INPUT: Natural resources**

```
                    ┌─────────────────────────┐
                    │  Raw materials growth &  │
                    │     fibre production     │
                    └─────────────────────────┘

   ┌────────────────────────┐        ┌────────────────────────┐
   │ Agricultural production │ ◄───── │      Chemical input      │
   └────────────────────────┘        └────────────────────────┘

   ┌──────────────┐   ┌──────────────────┐   ┌──────────────┐
   │ Natural fibres │   │ Regenerated fibres │   │ Manmade Fibres │
   └──────────────┘   └──────────────────┘   └──────────────┘

              ┌─────────────────────────────┐
              │   Fibre to fabric production  │
              └─────────────────────────────┘

   ┌──────────────────┐  ┌──────────┐  ┌──────────────────┐
   │ Spinning & weaving │  │ Nonwoven │  │ Spinning & Knitting │
   └──────────────────┘  └──────────┘  └──────────────────┘

   ┌─────────────────────────────────────────────────────────────┐
   │ Fabric processing: Chemical input: Bleaching, Dyeing, Printing, Finishing │
   └─────────────────────────────────────────────────────────────┘

              ┌─────────────────────────────┐
              │   Apparel production &        │
              │        packaging              │
              └─────────────────────────────┘

        ┌─────────────────────────────────┐
        │   Pattern cutting &stitching      │
        └─────────────────────────────────┘

               ╭───────────────────╮
               │      Design        │
               │    Decision?       │
               ╰───────────────────╯

              ┌─────────────────────────────┐
              │     Distribution & retail     │
              └─────────────────────────────┘

            ┌──────────────────┐
            │  Transportation   │
            └──────────────────┘

              ┌─────────────────────────────┐
              │          End use              │
              └─────────────────────────────┘

        ┌─────────────────────────────────────┐
        │ Ongoing replacement of fast fashion    │
        │            clothing                    │
        └─────────────────────────────────────┘

        ┌─────────────────────────────────────┐
        │ Consumer care:  laundry &detergents use │
        └─────────────────────────────────────┘

              ┌─────────────────────────────┐
              │         End of life           │
              └─────────────────────────────┘
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**Environment & Landfill**

**Figure 2.2: Fashion and textile typical supply chain (Inspired by Farrer and Fraser, 2011)**

As described in Figure 2.2, one of the challenges for incorporating sustainability in the clothing and textile sector is the increasingly complicated industrial chains involving different actors including agricultural, chemical fibre, textile and apparel industries, retail and service sectors, and waste management. The industry is fragmented with various supplies from different stakeholders, dominated by small and medium enterprises (SMEs) which account for more than 80% of the market in the UK. Although consideration of sustainable fashion business is growing, it is still a limited niche market share (Defra, 2011).

Figure 2.2 also indicates that various chemical inputs are required throughout the manufacturing and production process. There are many challenges facing the industry, for example the intensive natural resources used in the textile production process, the use of chemicals during cultivation and textile dyeing and worker exploitation within the supply chain, to name a few. During the use phase, detergents used for washing can be considered as chemical input. Meanwhile, current clothing consumption patterns are unsustainable; in clothing and textile consumption alone, it has been estimated that 2 million tonnes of clothing waste (a value of £38 billion) is produced per annum in the UK and of this, 63% (1.2 million tonnes) end up in landfills (Defra, 2007). Fashion is inherently the most change-intense category of consumer products (Kunz, 2005; Gam and Banning, 2011) and the current fast movement of trends is rapidly spreading in the fashion industry (Birtwistle and Moore, 2007). The dominant fashion industry indicates that the business must embrace trends even if they are unwanted at the beginning. This phenomenon is predominant in the fashion business in order to survive in trend sensitive fashion markets (Farrer and Fraser, 2011). Farrer and Fraser (2011) argued that fashion should be adopted at different speeds with ranges in various retail environments utilising diverse marketing strategies. However current fashion businesses and the consumer market are constructed on the core concept of the 'Fashion Adoption' model (see Figure 2.3) which is separates 'fashion leaders and fashion followers'.
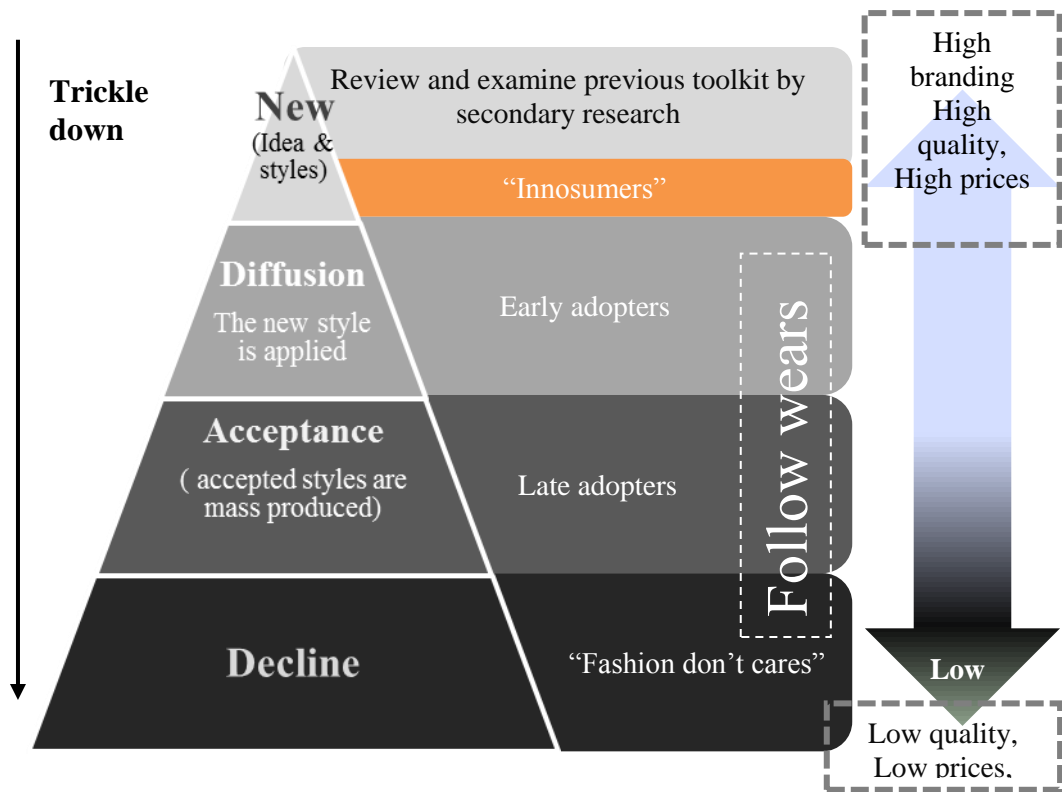
**Figure 2.3: Fashion Innovators and Mass Production (Rogers, 1983; Farrer and Fraser, 2011)**

Most new ideas and styles come from fashion innovators', including couture and designer catwalks, which trickle down to the fashion market. The initial fashion innovators' ideas are commonly applied and accepted as inspiration for design ranges created by high street retailers through mass production. This 'mono-logical' model has three potential consequences for sustainable fashion design. Firstly, the true desires of the consumer may be lost in translation (Van Koppeln and Vaughan, 2003) and secondly, opportunities to enhance the consumer's connection to the product are missed (Vaughan, 2006). Finally, and perhaps most challenging, the relationship between the designer and the product has become disengaged the demand from the consumer for 'newness' shortens the available time for idea generation. This, coupled with the need to reduce the financial risk of missing a key trend, limits the potential for individual creativity which is, ironically, in enormous demand from employers. These various separations pose a challenge for sustainable fashion design.

Furthermore, Farrer and Fraser (2011) argued that the current fashion design system led a reduction in consumers' internal capability of knowledge, making them less able to distinguish what is right and wrong in their choices of clothing. This passive

consumption model also often leads to a loss of their knowledge of how to make and reuse clothing, even to know what to wear (Farrer and Fraser, 2011).

Fashion companies have achieved economic success by reducing production costs through squeezing more output in less time and having less reflection of environmental and social cost with large volumes of production. It has been argued that this approach leads to a reduction in the emotional and symbolic value of a fashion product and to an increase in the level of consumption and resultant volumes of waste (Fletcher, 2008). The increasing consumption volume and disposing of ever-larger quantities of clothing lead to significant amounts of clothing waste that ultimately have a considerable effect on the environment and society at large .

## 2.5  Awareness and attitude to sustainable clothing

Previous research into public understanding of sustainable clothing has been undertaken by various authors and government organisations such as Defra (2008a), Jorgensen *et al.* (2006), Fisher *et al.* (2008), Saicheua *et al.* (2012) and more. Although increasing research into sustainable clothing has been conducted over at least ten years, there is still insufficient awareness of what sustainable clothing is and the impacts of clothing production, use and disposal (Fisher, *et al.*, 2008; Morgan and Birtwistle, 2009; Saicheua *et al.*, 2012).

Furthermore, there is lack of consumer interest in prioritising sustainability in clothing choices, lack of clear communication with consumers regarding the purchase of sustainable clothing and a lack of trust of retailers' claims of sustainability (Saicheua *et al*., 2012).  Jorgensen *et al.* (2006) conducted focus groups in the UK and Germany in order to identify the consumers' beliefs and attitudes regarding ethical issues and consumer purchase behaviour. The research findings identified little evidence of ethical issues affecting consumer behaviour. They found that it is personal needs which motivate consumer consumption. This research suggested that consumers find it difficult to make ethical choices and that effective information and guidance are required to help them make better choices. In addition, it was found that communication between fashion companies and consumers is also considered to be very important (Jorgensen *et al.,* 2006).

Fisher, *et al.* (2008) conducted extensive research regarding public understanding of sustainable clothing. Their research suggested that when people are provided with information, participants tend to reflect upon their behaviour and are willing to change their behaviour, particularly with regarded to the energy impacts of laundry and social impacts of clothing production (2008, p8). Their research also suggested that using the appropriate media with sustainable information would be useful to consumers. Table 2-1 shows a summary of previous research regarding the awareness of and attitudes towards sustainable clothing.

**Table 2-1: The awareness and attitude of 'sustainable clothing' (Adapted from Saicheua *et al.,* 2012)**

| Research | Method | Key finding | Authors |
|---|---|---|---|
| Public understanding towards sustainable clothing and the supply chain | Consumer research via questionnaire Exploratory interviews with global sustainability leaders/ UK retailers | *Not enough interest in sustainable clothing to prioritise sustainability<br>*Lack of communication with consumers<br>*Lack of sustainable supply chain development model | Saicheua *et al.* (2012) |
| The consumer end of the fashion supply chain | Focus groups Survey Interviews, UK | *Lack of awareness of the need for clothing recycling<br>*Lack of knowledge of environmentally friendly clothing disposal methods<br>*Low quality of clothing donation<br>*High quality garment has great potential to be re-used or recycled | Morgan and Birtwistle (2009) |
| Perceptions towards clothes with recycled content and environmental awareness | Questionnaire, Newcastle-upon-Tyne | *Consumers will not pay over £10 more for sustainable clothes<br>*Environmental aspect should not be value added or more expensive<br>*Major campaign needed to raise awareness of recycled clothes | Nakano (2001) |
| Ethical fashion: Myth or Future Trend? | Focus group, Questionnaire, UK and | *Little evidence that ethical issues have any effect on consumer purchasing behaviour<br>*Personal needs motivate | Jorgensen *et al.* (2006) |

| | Germany | sustainable consumption<br>*Need more information and effective communication to allow better choices to be made | |
|---|---|---|---|
| Public understanding of sustainable clothing | Focus groups<br>Diary task<br>Deliberative Workshops, UK | *Lack of knowledge of sustainability impacts of clothing production, use and disposal<br>*Third-party labelling and certification schemes across the European Union are unclear and inconsistent | Fisher, *et al.* (2008) |
| Ethical Clothing UK | Consumer research<br>Trade research<br>Desk research<br>Statistical forecasting | *Ethical fashion is not a priority when consumers buy clothes<br>*Some consumers do not trust that ethical clothing is genuine | Mintel (2009) |
| General Environment Survey | Online questionnaire | *Many consumers concerned about environmental issues<br>*Concern about environmental issues the same as before the recession | ComRes (2010) |
| Do transparent business practices pay? | In-depth semi-structured interviews | *Attitude and purchase intention<br>*Distrust of businesses' transparency<br>*Power of price and/ or quality | Bhaduri *et al.*(2011) |

## 2.6  Drivers for adoption of sustainability in fashion design

The previous section illustrated the historical perspective of sustainable fashion. There are a number of challenges we face in the fashion industry. As environmental concern and sustainable consumption have grown in importance, increasing government and consumer pressures (Morgan and Birtwistle, 2009) have provided an emerging platform for considerate fashion design which raises awareness of the unsustainability of the existing fashion system and its role in social and environmental crises.

The holistic view of sustainable design has stimulated the development of new strategies and new markets and motivated the ethical movement. Furthermore, fashion companies encounter three forms of pressure from their consumers:

shareholder expectation, consumer loyalty for ethical pressure and government environmental regulation. There is a wealth of evidence in the UK of consumer interest in environmental friendly design and ethical products, and so business is moving toward developing and managing Corporate Social Responsibility (CSR) (Allwood *et al.*, 2006, p18). The RMIT Global sustainability Institute (cited in Bhamra and Lofthouse, 2007, p19) has identified the drivers to adopt sustainable design and innovation. It is particularly relevant for initial stage of an innovation.

**Table 2-2: Drivers to adapt sustainable design (Bhamra and Lofthouse, 2007)**

| Drivers to adopt sustainable design | |
|---|---|
| Supply side | -It is triggering economic benefit and business opportunities through increasing productivity, cost saving, creating design innovation and differentiation<br>-Learning new thinking and considering the long term futures, improving the total quality of management, socially responsible investment, corporate social responsibility, reducing risk of consumer boycott, NGO activities |
| Demand side | -Social awareness of needs for sustainable production and consumption concerning the environmental and social crisis: reduction of environmental disasters including climate change, greenhouse gases<br>-Increasing population in developing countries , urbanisation and migration<br>-Market demand from consumers and firms<br>-Enabling technology provides environmentally friendly products, renewable energy |
| Institutional and political influence | -Strict environmental policy and regulation including global, national and local<br>-Global inequality: deep divide: access to clean water, sanitation, trade barriers, free versus fair trade, environmental refugees |

## 2.7 Design for sustainable fashion

Sustainable design and sustainable development were defined at the beginning of the section through reviewing the literature from other design disciplines. This chapter has also considered the challenges and drivers for contemporary sustainable fashion. However, considering sustainability as a design aspiration, can the concept of sustainability meet fashion? Furthermore, how could this goal possibly be achieved through fashion design?

The term sustainable fashion design has not yet been fully defined in literature. One of the main reasons is that both terminologies are complex components within broad

discussion and have different interpretations. Furthermore, the relationship between the concepts of fashion and sustainability seem to contradict each other.

The meaning of fashion commonly implies "a way of behaving or doing something that is accepted and used by the majority of a group of people at a given point in time, regardless of the size of the group" (cited in Yurchisim and Johnson, 2010, p1). The nature of fashion is based fundamentally on the continuous process of change involving multiple facets in different ways at different times, defined as a succession of short-term trends or fads (Easey, 1995, p36). On the other hand, as discussed in the beginning of the section, the term 'sustainable' implies longevity and is derived from the function of ecosystems that assist themselves over periods of time (Thorpe, 2007, p7).

It has been argued that the relationship between fashion and consumption conflicts with sustainable goals. The pressure to constantly reformulate identity instigated by changing fashion trends encourages people toward ever increasing levels of material consumption (Fletcher, 2008). Thus, the current fashion system itself encourages a throw-away society and over-consumption. There are a number of criticisms that fashion has increased environmental and social problems and generates wastes.

However, on the other side, fashion is an important catalyst for cultural change. Fashion can be a powerful medium to transform culture towards sustainable design actions. Fashion is not only referred to as a function of clothing but also creating wellbeing, to express identity, embrace creativity and connecting global communities (Forum for the Future and Levi Strauss & Co, 2010). Similarly, fashion and clothing have become critical within our way of living, assisting us physically, culturally, socially and psychologically and is intrinsically incorporated in to how we live and see ourselves within the world community (Kopplen and Vaughan, 2007).

Kate Fletcher (2008), in her book 'Sustainable Fashion and Textile Design Journeys, provides a useful insight to rethink the role of fashion and cultivate new aspirations for sustainability. According to her interpretation, fashion and clothing are different concepts connected in different ways. Clothing is material production while fashion is symbolic production. Fashion is connecting with humankind and is in the heart of our culture dealing with our emotional needs, dealing with social beings as

individuals and manifesting through garments. It is not just material consumption of clothing (Fletcher, 2008, p120).

Likewise, Chapman and Gant (2007) criticise the dominant notion of current sustainable design. They argued that sustainable design is predominantly rooted in the reduction of environmental and social impacts and that the conclusion of sustainable design is not to consume, not to have and to lead a minimalistic life. They argue that human consumption is a pivotal role in sustaining our life which is the motivational core of our production and consumption cycle and the progress and improvement of our life. The suggestion of considering sustainable design should be more focused on steering people towards alternative approaches for production and consumption, incorporating new thinking and design innovation (Chapman and Gant, 2007, p6).

Fletcher (2007) also offers a similar perspective of a new vision for sustainable fashion. She argues that "*sustainable fashion has to be more than a minimal consumption drive, something more attractive not because we are flippant or fashion junkies but because of the significance of fashion to human culture. A new vision will reconnect us with our clothes, their design concepts, materials and making, this will underline the cultural importance of fashion the terms and metrics of quantity to those of quality-ultimately a more positive, forward-looking and creative place to be*" (Fletcher, 2007, p121).

Indeed, sustainability in fashion design calls for fundamental changes and thinking in relation to the design process and a consideration of how design affects production and consumption.

It is widely recognised that design influences and can transform our material world linking production and consumption (Papanek, 1985; Bhamra and Lofthouse, 2007). Design can have, not only the ability to transform the sustainable consumption patterns by changing products and production, but also by influencing social norms, consumption and lifestyle aspirations. Influencing the psychology of consumption through exciting, innovative and meaningful messages can help create a new vision of how people live their lives (Richardson *et al.*, 2005, p12).

This requires more innovative design strategies that maximise and enhance the environment and quality of life while pursuing sensible economic objectives (Lewis *et al.,* 2001, p186).

## 2.8 Demands for the educational tool and method for design

In order to tackle the environmental and social issues of sustainability, new design tools and methods should be established specifically approaching sustainability in fashion design.

Education is one of most critical elements for facilitating sustainable development and sustainable design which in a broad sense includes improving the quality of basic education, reorienting education to address sustainability, improving public awareness and providing training to many sectors of society (Singh, 2010). Furthermore, it is capable of making people able to address environmental and developmental issues including ethical awareness, values, and attitudes, skills and behaviour consistent with sustainable development (UNCED, 1992). However, the traditional design approach would find it difficult to tackle the sustainable design goal. Typical design education commonly emphasises designing the visual element of new products, highlighting the importance of aesthetics and artistic experimentation, while little consideration is given to the integration of sustainability. Indeed, sustainability is not considered an essential part in design processes or is often regarded as self-examination (Heeley, 1999, p203). We are now faced with the fact that these approaches are not sufficient to encourage sustainable fashion and that a new approach is needed.

Fletcher and Grose (2012, p157) argue that *"in order for sustainability idea and practices to transform the fashion sector, a deeper and a broader communication and education movement has to develop to build 'literacy' in the general population around ecology and natural systems and their interconnections with human systems".*

Fashion and textile designers should rethink the processes of design and incorporate sustainability into the way in which they design the dimensions of products and also shape the culture of design practices. However, how can the industry build sustainability for the future in fashion design and what kind of tools, skills could

amplify this design action? The next chapter will review the existing tools and methods for incorporating sustainability in design processes and identifies the current limitation and barriers of using those approaches.

## 2.9  Chapter summary

This chapter has discussed the fundamental concept of what sustainable fashion is and why design is important to encourage the sustainable development.  Although the definition itself is still under debate in academia, it is useful insight to understand to fundamental disciplines of sustainable design. Looking at the sustainability allows to rethink our way of design, producing and consuming the product and services whilst it require evolutional transformation of our perception, education incorporating the innovative thinking in our ecological and human system. The role of design and designers can be key ability to stimulate sustainable design practice as the same time; it could contribute sustainable development through shaping our design practices of production and influencing the consumption processes.

The origins of sustainable design are in the environmentalism intellectual movement which developed during Industrial Revolution. Since then, there have been many design researchers and educators devoted to the concerns of environmental and social impacts. Victor Papanek in particular (1985) emphasized the importance of the designer's role in reshaping our social and environments; designers directly connect people's needs and objects. Although a growing awareness of environmental issues in the production of fashion has led to some improvement, overconsumption has and its associated negative impacts continue to increase; the current materialistic culture encourages the purchase of more and more goods. It has been increased environmental degradation and depletion of nature that affect unsustainability to the economy as well.

Furthermore, environmental impact and consumption are directly associated with social, cultural, psychological aspects; most early practice focused on limiting the impact of materials or production rather than considering  overall perspective of pattern of consumption and production. With the emergence of a deeper appreciation of the inter-connectedness of the social (human) and environmental systems, now

followed attempts to capture the ways in which design could be applied to achieve a better balance. The context in which the new discipline of 'sustainable design' was developed was much broader than that previously considered by green and eco-design, now looking at product lifecycle, systems, service as well as social and cultural psychological aspects behind consumption.

Therefore, the concept of sustainability in fashion design is underpinned by the meaning of sustainable development as an objective, this would mean that fashion design would influence the production and consumption by facilitating positive change through product, processes, service, system and innovation. It is embodied in the philosophy of a holistic perspective of the entire life-cycle system as well as social system through facilitating alternative solutions for the future and sharing the responsibility starting from the individual, the community as well as throughout the whole society.

Chapter 3: **Approach to Sustainable Fashion Design:**

**Exploring the Existing Methods and Tools**

## 3.1  Introduction

The previous chapter discussed the importance of sustainability in fashion design and problems of production and consumption throughout the clothing life cycle. As discussed, designers can influence the pattern of consumption and production to support sustainability and design plays a critical role in shaping our environmental, social and economic world. Sustainable design tools could assist designers to contribute to sustainable fashion. Thus, this chapter attempts to establish key areas of this study in the literature regarding sustainable design tools and idea generation process for fashion design. The chapter provides an overview of how other fields tackle the challenge of sustainability and examines existing tools in the fashion and textile area. Although technical improvement on the production and manufacturing process leads to a reduction of the environmental footprint, addressing the sustainability issues in fashion industry is extremely challenging and now it has been faced with a critically complex dilemma between sustainable production and consumption. There are still various barriers to overcome to cultivate sustainability. In order to transform from theory to practice, it is not only necessary to consider the ecological sustainability of whole product life cycle but also to look at the social, cultural and economic dimensions of alternative solutions. As a first step, this chapter presents how systems thinking and innovation contribute to sustainable design processes.

## 3.2  Systems thinking and innovation in design

Systems thinking provides a useful framework for understanding the sustainability and design process. Wigal (2004) describes systems thinking as

*"a process of defining a phenomenon holistically—by its contents, objectives, interactions, relationships, and environment—[which] is also integral to the design process. It uses analysis and synthesis to form new conclusions"* (Wigal, 2004).

The understanding of a system provides the relationships between the various paradigms of problem solving and possible solution methods. The fundamental forms of systems thinking consist of 'hard' and 'soft': hard systems thinking is commonly used for well-defined technical problems, whilst soft systems thinking is

more appropriate in "wicked problems" (Rittel and Webber, 1973) or ill-defined situations involving human beings and cultural aspects ( Checkland, 1999, p10).

The essential view of systems thinking is that the interactions between components in a system are as important as the components themselves. As discussed in chapter 2, the fashion industry can be considered as a complex system where raw materials from the environment are transformed via production processes into physical objects to be consumed. The interactions between the production process and the environment, as well as the relationship between the consumer and the fashion system are fundamental to understanding its environmental, social and economic impacts.

It has been argued that in order to achieve sustainable design, systems innovation focused on production and consumption patterns is necessary (Vezzoli and Manzini, 2008). The overall reduction of environmental and social impacts is necessary to sustain our futures. According to population experts, the world population will double in the next forty years. To meet the needs of a growing population with diminishing resources, radical changes to the production and consumption system, including redesigning products, services and systems, is necessary (Fletcher, 1999, p272). The main concept of systems innovation is shown in Figure 3.1 which categories the four distinctive levels of innovation and eco design practices for supporting sustainability (Brezet, 1997; Fletcher, 1999; Bhamra and Lofthouse, 2007).
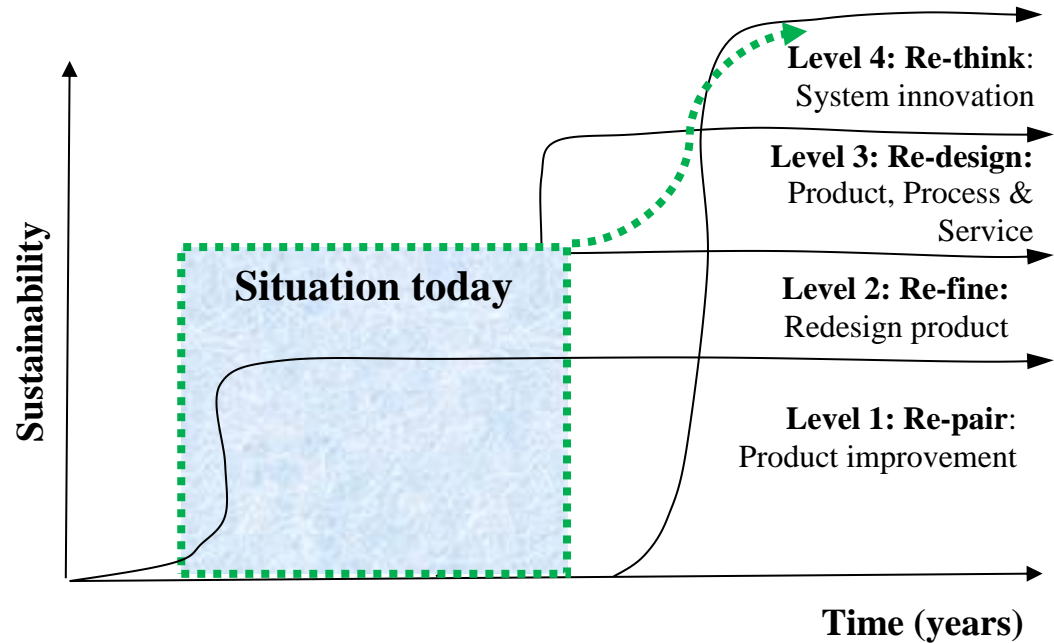
**Figure 3.1: Level of innovation for sustainability**
**(Adapted from Brezet, 1997; Fletcher, 1999; Bhamra and Lofthouse, 2007)**

The first type of sustainable design innovation is product improvement by focusing on reducing the environmental impacts of existing products in order to achieve pollution prevention or environmental care. This can lead to short-term innovation through redesign or product improvements. The second type of innovation is product redesign. In this case, the concept of the product is almost the same but product parts or components are more developed or replaced by others. The typical goal of product redesign is increased reuse of spare parts and raw materials or minimization of the energy used at several stages of a product's life cycle through maximization of eco-efficiency. The third type of innovation for sustainability is functional and design innovation that is involved at company or organizational level and involves designing new products, processes and services. The highest level of innovation defined is systems innovation in which rethinking of the whole system and technology is required using a new system in the related infrastructure and within an organization. It requires radical changes that can be achieved through designing the entire system including pattern of production and consumption and socio-technical innovation (Brezet; 1997; Bhamra and Lofthouse, 2007, p122). The Figure 3.1 indicated that transition from level 1 to level 4 requires more time and involves a greater complexity of input from an organisation i.e. the consideration of incorporating a system level of innovation for sustainability. However, the model

also illustrated that level 4 achieves a significant amount of environmental, social and economic benefits through rethinking the existing system (Bhamra and Lofthouse, 2007, p123).

Systems thinking can support to environmental, social and economic improvements in the long-term. According to the figure 3.1 above, the most common level of sustainable innovation in fashion industry is level 1 and 2 which includes re-pairing, product improvement, end-of-pipe technologies to clean up pollution and recycling waste. These levels, however, convey less benefit to sustainability (Fletcher, 1999). The Figure 3.1 also highlighted that there is a significant lack of level 3 and level 4 innovations. Although it is essential that the industry engages with efforts to reduce environmental impacts through the first and second levels of innovation, when we consider the long-term view, the development of functional and system levels of innovation including socio-technical system are required to make significant difference in order to inspire new social and cultural norms for sustainability.

## 3.3 Design for sustainable production and consumption

Sustainable design requires a holistic view of design and its relationship with production and consumption systems. However, attempting to represent the whole system and all activities would be an enormous task and require the exploration of a number of significant issues in great depth. To overcome this challenge, Checkland (1999) suggested that utilising visual models and making drawings of the various elements in any human situation offers insight into aspects of the whole as well as illuminating the complexity of multiple interacting relationships. This visualised thinking and pictures can help to encourage holistic consideration rather than reductionist thinking about a situation. This offers a mechanism for learning about wicked problems or complex situations through drawing detailed ("rich") representations of them (Checkland, 1999, p16).

- Education/Training
- Ideological factors
- Historical influences
- Professional status and organisation
- Market perception

**Designer**

Product
Processes
Serviecs

**Production** ⟷ **Consumption**

- Materials and technology
- Manufacturing systems
- Marketing
- Advertising
- Product positioning
- Ideological factors
- Distribution channels

- Demography
- Social relations
- Taste
- Cultural geography
- Ethnography
- Psychological response

**Figure 3.2: Domains of design in production and consumption system**

**(Adopted from Julier, 2000, p3)**

Julier (2000, p3) presented the comprehensive production and consumption model and the designer's involvement in the system. Figure 3.2 shows the mapping of the design domain within the system. In this context, production includes not only the design and manufacture of the product but also all forms of conscious intervention in the origination, execution, distribution and circulation of goods and services. These processes address the selection of materials, technologies and manufacturing systems as well as the effects of marketing, advertising and distribution channels (Julier, 2000).

On the other hand, consumption takes place *"when individuals select, purchase, use, or dispose of product service, ideas, or experiences to satisfy needs and desires"* (Solomon & Robolt, 2004, p 23).

It is clearly shown that the meaning of consumption implies not only the exchange of money for products and services but also involves many different behaviours

associated within our lifestyle. Sustainable consumptions in design field has not matured only recently has attentions on the various social issues of lifestyle change. *"Sustainable consumption is not about consuming less, it is about consuming differently, consuming efficiently"* (UNEP, 2003).

How can we address these challenges? Designers are undoubtedly connecting and shaping the production and consumption processes by meditating production and consumption activities through providing the goods and services.

It has been acknowledged that design has the ability to influence the environmental and social aspects of goods, service and systems and facilitate transition towards more sustainable production and consumption. Design has a critical role in developing innovation and new solutions and mediating production and consumption process by providing the bridges between consumers and producers.

Bras (1997, p4) articulated a visualised model of current sustainable design approaches. Depending on the organisation and scope of research and design, the sustainable design approaches can be distinguished, as shown in Figure 3.3. The ultimate goal of design is to move from the current stage of practice (in the lower left corner) to the upper right corner in order to achieve sustainable development.
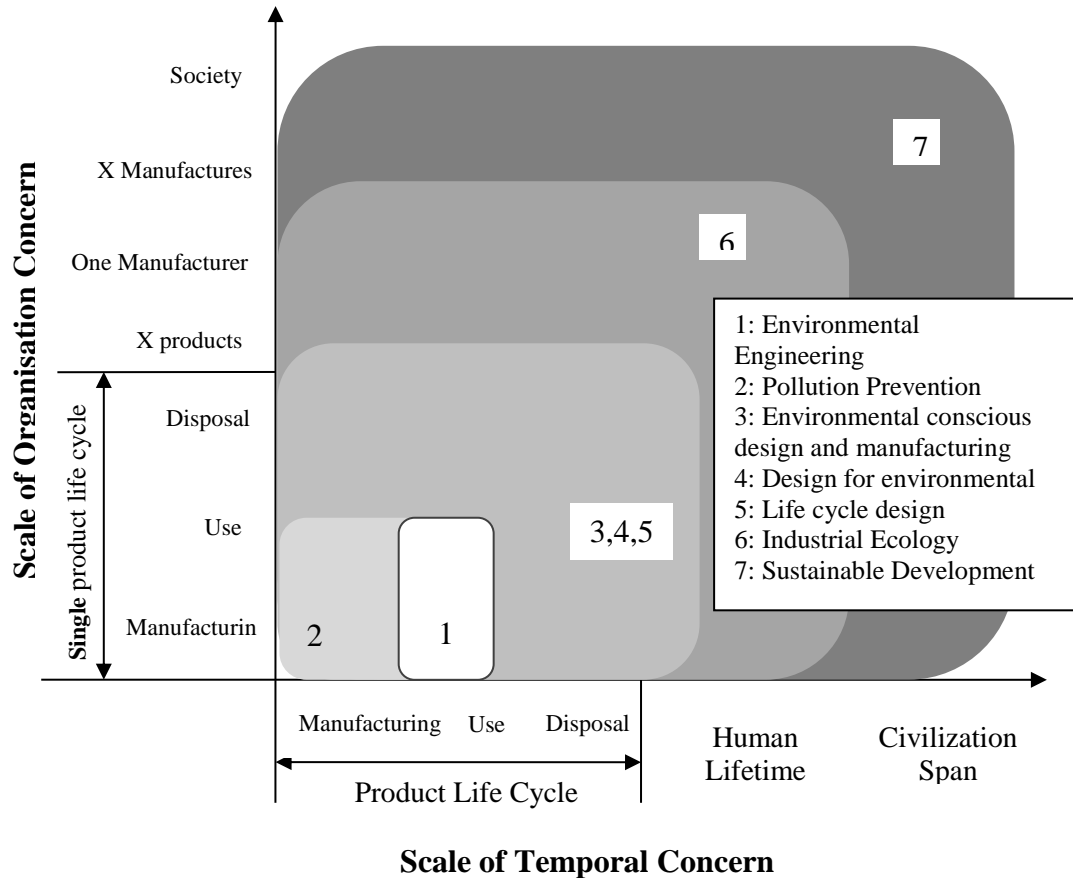
**Figure 3.3: Scale of sustainable design approaches (Bras, 1997, p4)**

According to Bras (1997, p4), the gradations of temporal concern were derived from life spans of products, people, and civilisations. The scale of temporal concern can look at a product a life cycle and product processes related within their impacts and the spatial concern can be a section in production the chain and boundary between environmental and human systems. The scale of sustainable design is not linear. A product life cycle is part of sustainable design which indicates manufacturing, use and disposal as possible lengths of temporal concerns. 'X products indicate the negative environmental impact of a group of products. While, 'one manufacture' implies all the processes and activities of single manufacturing, 'X Manufacturers' means more flexible approach to activities among groups of manufacturers. The Design for X approaches includes 'Design for recycling' and 'Design for Disassembly' considered on a specific aspect of a product's life cycle. However, these single environmental considerations get some criticism of a negative effect on other aspects and make the product less environmentally friendly as a whole. This initial approach has led to the development of approaches that have a centre of

attention on a complete product life-cycle (Bras, 1997, p5). The following approach focuses on the entire product's life cycle, extending beyond the scope of specific pollution prevention. It commonly deals with the hard systems of production and the related supply chains and is relatively well formed as a structured discipline often called 'Life cycle design' or 'eco-design'. Eco-design is closely related to 'cradle to-grave' thinking which considers the gathering of raw materials from the earth, producing the product, using the product and the end of product life and subsequent disposal. Using the basic idea of the lifecycle of a product, designers can evaluate at the design stage how to efficiently use materials or decrease the flow of products through qualitative evaluations. Next level is industrial ecology approach which suggests an incorporating system along with consideration of biological ecosystems in order to maximise positive benefits to industrial ecology, companies, organizations and communities working together in an intelligent manner for creating new products (Bras, 1997 p6). As we discussed in the previous chapter, the ideal goal is transition from the current practice to achieve 'sustainable development' which is why many sustainable designers use this as a basis of their activity. The Bras model (1997) was developed over fifteen years ago. However, the current practices and situation remains the same fifteen years later. Furthermore, as the Brezet model (1997) discussed earlier, there is a significant emphasis on the system level of innovations which needs to be considered very early in the design stages.

## 3.4  Sustainability in the early design stages

The idea generation phase is arguably the most influential in the design development process in addressing sustainability and the total design strategy at the systems level of innovation. The early integration of sustainability is critical in supporting decisions for designers and it is considered the most important part of the development of product, service and system design in order to avoid misleading decisions or strategies. Vezzoli and Manzini (2008) defined the design development stage and related methods and tools for assisting three specific objectives and support for the designer. Figure 3.4 illustrates the design development stages associated within methods and tools for sustainability.
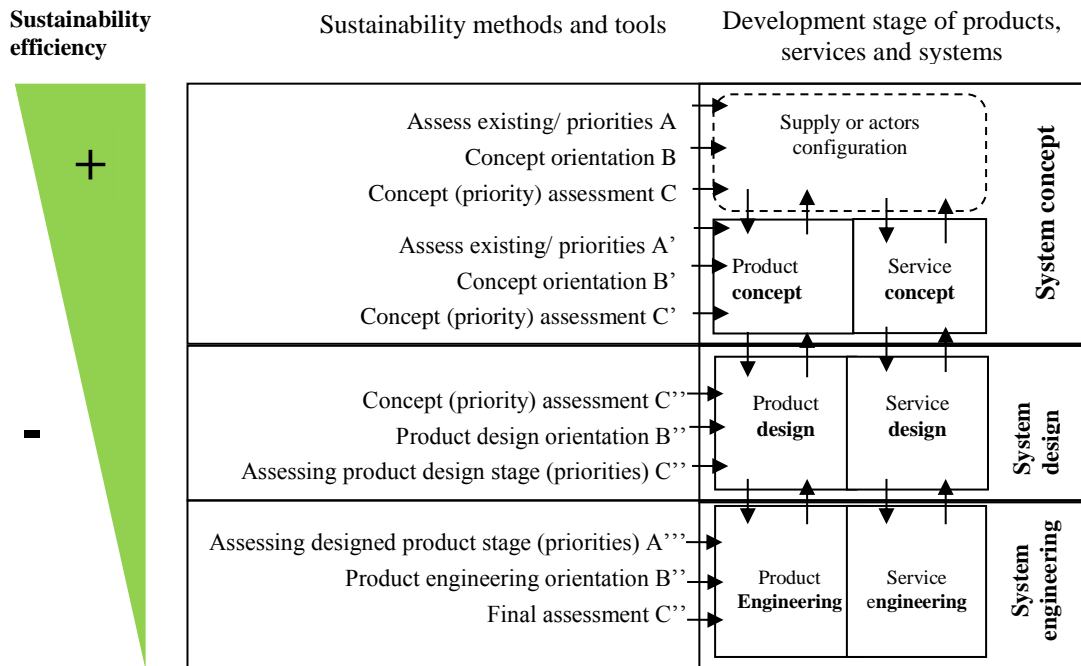
**Figure 3.4: Development stages and related methods and tools for sustainable design (Vezzoli and Manzini , 2008, p217)**

According to the Figure 3.4, the development stage can define the concept, development of detailed design and end of engineering process. The tools can support the specific objectives of problems depending on the different stages of the development process. The capital letter 'A' represents assessment of the existing system and estimating possible improvements for sustainability. 'B' illustrates the design concept which has oriented the design decision towards sustainability. The letter 'C' defines identification of the priorities of design. As figure 3.4 illustrates above, sustainability can be integrated more effectively very early in the design process as well as increasing overall system level of design innovation (Vezzoli and Manzini, 2008).

This process is often referred as the 'pre-design' phase or 'fuzzy front end' of the new product development (NPD). This idea generation phase is a critical phase but is often filled with ambiguity and is chaotic in nature, as it establishes whether the deliverable of the design process will be a tangible product or an intangible service, experience or brief (Sanders and Stappers, 2008).

The objective of the explorations in the front end, which are often described in the design field as 'concept development', is to determine what is to be designed and

sometimes what should not be designed and manufactured. The ideation phase is followed by the traditional design process where the resulting ideas for product, service, interface, etc., are developed first into concepts, and then into prototypes that are refined on the basis of the feedback of future users (Sanders and Stappers, 2008).

Furthermore, this process is directly involved in getting valuable ideas into the innovation value chain or new product development (NPD) processes. The process is also directly integrated in generating and feeding design ideas into the design innovation value chain where decisions are made incorporating economic aspects and the overarching NPD setting (Glassman, 2009). Consequently, when the ideation phase is strongly constructed, a company can have not only less uncertainty, but can also optimise costs and preparations for NPD activities. Indeed, optimisation of the idea process allows designers to create more valuable concepts which are more appropriate with the company's capabilities and strategies (Glassman, 2009). Fashion design is part of the product development process. Regan (2007) describes the typical early design process for fashion design, which is summarised in Figure 3.5.
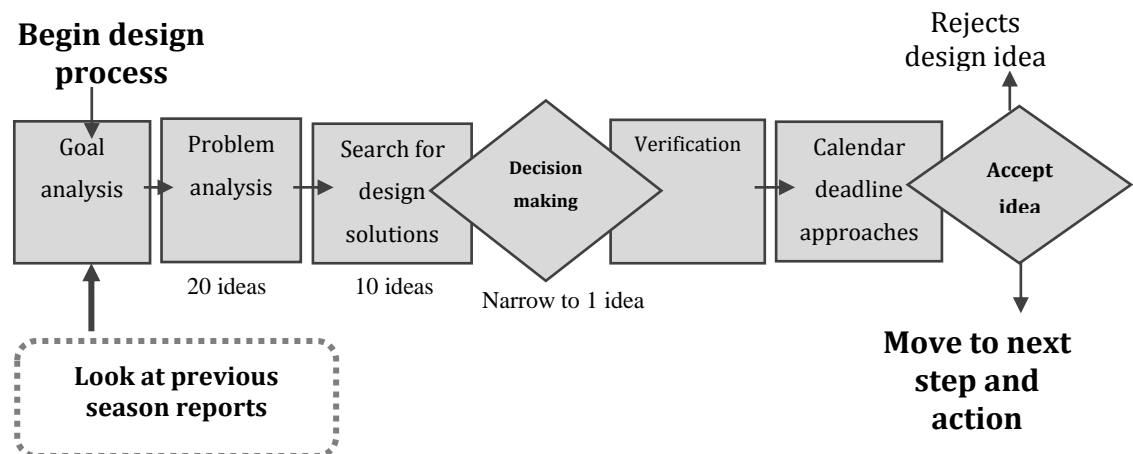


**Figure 3.5: Flowchart of typical idea generation process in fashion design**
**(Regan, 2007, p155)**

According to Regan (2007), solve problems by understanding requirements and using a series of steps to generate a conceptual solution. The phase of goal analysis aims to define goals and to identify the problem in order to solve it. During this process, the design team identifies design tasks and core strategies including

consumer target market identification, product line strategy, an apparel line definition and line fabrication (Regan, 1977; Regan, 2007). Merchandisers or design directors commonly provide direction of the core strategy to designers including product line and fabrication. Design directors set a direction of connections on the product line, core market, consumer purchase trends and product category offerings (Regan, 2003, p159). Designers develop a profile of the user (target consumer) which involves the specification of user needs and wants within the context of a real world use-situation and then establishes the design criteria including functional, expressive and aesthetic elements (Lamb and Kallal, 1992). There have been a number of studies on the idea generation phase as part of NPD process. However, the common consideration in apparel design has emphasised a product's functional, aesthetic, and economic aspects (Gam and Banning, 2011; LaBat and Sokolowski, 1999). Embedding sustainability issues in the idea generation phase has received little attention in sustainable fashion and textile design research. In recent years, the growing interest in environmental and social concerns and the complexity of environmental problems has encouraged the formulation of decision tools aiding the development of design strategy and framework tools ranging from simple checklists to sophisticated technological strategies. Although these are not directly related to the field of fashion design, they have provided useful guidelines and decision-making tools that have been proposed in order to inform sustainable practice through design.

## 3.5 Decision making tools for sustainable design

The designers require a clear design strategy to visualise a core design concept at the idea generation process in order to avoid illusory decision. The common intention of use of these tools is for analysis of environmental impacts; selecting potential environmental improvement, providing assistance for the design process and brainstorming and evaluating environmental aspects with other important criteria (Byggeth and Hochechorner, 2006). The utilisation of appropriate design tool can support a systematic approach and critical components to influence decision-making for environmental and social impacts during the product development process. These decisions are noted as being influenced considerably by patterns of information flow and interaction among organisational units. The tools can be used

in the different phases according to the objectives in the product development process (Baumann *et al.*, 2002).

Baumann *et al.* (2002) systemically examined the existing different types of sustainable design tools based on a cross-disciplinary database in order to identify the roles of the tools and their context (i.e. product system, business process or society) in relation to environmental issues. According to their examination, the tools can be classified four levels according to their scope. The predominant tools are 'level one' tools, the most well-known of which are Life Cycle Assessment (LCA) and LCA-related analysis tools, matrices and guidelines. This level provides relatively incremental innovation through the evaluation of existing products and product lifecycles. Level two tools are integrated with the product development process and other processes within company strategies (e.g. manufacturing, purchasing, environmental management system, business strategy). They provide an interconnection between product development phases in order to radically improve and reshape existing product features. Level three tools are incorporated with the product development processes into the management of the product chain creating alternative new product features or services concepts (e.g. the Eco-Quest tool was designed for suppliers as a self-audit system to help their relative environmental advantage). Level four tools are focused on industry-wide or society-wide interaction through global information networks in order to support life cycle management. This highest level of tools trigger more radical innovation examining social systems through addressing human-centred factors, They have classified the four levels of sustainable design tools and its context and product development.

- **Level 1:** Product development and evaluation of the product life cycle
- **Level 2:** Product development process in a company context including business strategy, management and marketing
- **Level 3:** Product development processes with product chains including suppliers, customers and waste handlers
- **Level 4:** Product development process with society including policy making, social and system innovation

Baumann *et al.* (2002)

Level one and two tools often trigger incremental innovation, which emerges from improvements within existing conventional design knowledge. According to

Popadiuk and Choo (2006), incremental innovation does not necessarily need to involve a high degree of novelty. Step by step improvement can offer immediate gain on a smaller scale of design innovation with a greater certainty of success. However, levels three and four offer more radical innovation but require a significant knowledge of new technologies and design processes. This approach can be initially disruptive to existing practices and unappealing to mainstream ideals (Bocken *et al.*, 2011). However, radical innovation considers design with a more long-term perspective. It is an invitation to transform the culture of unsustainable systems and design practices. Therefore, if designers are willing to change and adopt a more radical approach to innovation they have an opportunity to obtain greater benefits through the creation distinctive product and service features and increased value. The fashion industry, with its associated complex environmental and social impact, is faced with a sizeable challenge. For both incremental and radical innovation strategies it is essential to underpin design philosophy with sustainable processes. The majority of existing tools in the fashion and textiles area are Level one and two tools for the analysis of environmental performance and product improvement. Analysis tools support the user in evaluating the environmental performance of materials, product features and the design process. While, prescribing tools are often referred to as checklists and design guidelines (Bras, 1997; Baumann *et al.*, 2002), which allow users to consider environmental criteria, throughout the product life cycle and design processes through a generally qualitative nature or semi-quantitative approach (Baumann *et al.*, 2002).

### 3.5.1 Life cycle design: Cradle to Grave

#### 3.5.1.1 Life cycle Analysis (LCA)

One of the most important analysis tools is Life Cycle Analysis (LCA), which evaluates and estimates all stages of a product's life cycle. This includes the gathering of raw materials, the production of the product and the disposal stage at the end of the product's life. Figure 3.6 shows the structure of the Life Cycle Assessment.

**Figure 3.6: The structure of the Life Cycle assessment (LCA) source from http://www.scienceinthebox.fr/en_UK/sustainability/lifecycleassessment_en.html**

LCA is a quantitative tool; it is useful in the early stages of the development phase and is considered to be one of the most efficient evaluation methods in setting design priorities and evaluating the entire product life. However, LCA is not without weaknesses. For example, textile specific data is often omitted for cotton cultivation where the use of pesticides and fertilizers varies greatly between locations. Additionally, some manufacturers produce textiles with mixed fibres, complicating the structure of the product life cycle (Dahllöf, 2003). LCA therefore often lacks accuracy in addition to limitations in performance. However, LCA has practical value in its capability to evaluate the potential environmental impacts of product life cycles. LCA requires greater quantities of information which make impossible to conduct the initial stage of design process (design brief and strategy and concept design) (Vezzoli and Manzini, 2008, p238). It is often time consuming to conduct an LCA evaluation, there is often no time for full LCA on every subject and as such it is difficult for small companies to perform this task.

### 3.5.1.2  Textile Eco-Metrics Tool

Specifically designed for use in the fashion and textile sector, the commonly used Textile Eco-Metrics tool calculates the total impact of the different types of textile and the production processes. The Textile Eco-Metrics system adopts the use of Environmental Damage Units (EDUs) for which a high score implies a substantial

environmental impact and a low score indicates the use of more environmentally friendly materials. The results are provided as numerical scores in relation to four areas of impact. These are the impact of production on water and energy consumption, use of non-renewable materials and pollution. As shown in Figure 3.7, the results are summarized in a colour coded grid. This instant visual tool allows users to look at existing product processes and their environmental impacts.
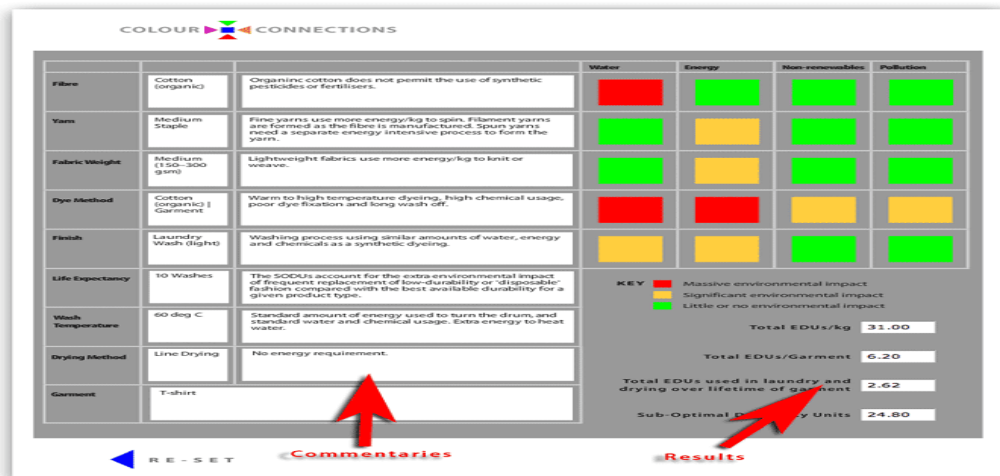


**Figure 3.7: Eco-material tool (Source from www.colour-connections.com)**

The Eco-Metrics tool can immediately estimate the environmental impact as well as Sub-Optimal Durability Units for each section and particular type of garment. However, like LCA, this is based on huge amounts of data and industry knowledge. It is mainly derived from evaluation of existing products or traditional supply model rather than suggesting new idea or possibility for the new innovative solution.

### 3.5.1.3  Environmental Apparel Design Tool (EADT)

 In 2010 Nike launched the Environmental Apparel Design Tool (EADT) for fashion and textile designers. The tool evaluates the lifecycle of apparel and the environmental impact and Nike developed a web-based version of the index for the tool. A product development process can be scored by pre-specified scale categories such as materials (e.g. blends, trims, coating, post-industrial or post-consumer end of life), waste (considering pattern marker efficiency) and garment treatments (considering post assembly garment treatments such as dyeing, laundering and distressing). Users are then able to assess these web-based environmental impact categories. In order to better facilitate material choice, Nike also provided a Material Assessment Tool (MAT). This scores matrix considers the environmental

performance of materials and suggests better solutions for the choice of materials. Figure 3.8 presents details of the Environmental Apparel Design Tool (EADT).



**Figure 3.8: Nike Environmental Design Tool**

**(Source from http://www.nikebiz.com/Default.aspx)**

### 3.5.1.4  The Life-Cycle Design Strategy (LiDS) Wheel

A well-known tool in the field of 'comparing tools' (a term developed by Byggeth and Hochechorner, 2006), is the Life-cycle Design Strategy (LiDS) wheel, which provides an overview of the environmental improvement of products (Van Hemel and Keldmann, 1996). The EcoDesign strategy wheel presents eight EcoDesign strategies:

- New concept development
- Selection of low-impact materials
- Reduction of materials usage
- Optimization of production techniques
- Optimization of distribution system
- Reduction of impact during use
- Optimization of initial lifetime
- Optimization of end-of-life system.

New concept development:
- Dematerialisation
- Shared use of the produc
- Integrations of functions
- Functional optimisation of product (components)

**Product System Level**

7. Optimisation of end-of-life system
- Reuse of product
- Remanufacturing/refurbishing
- Recycling of materials
- Safer incineration

6. Optimisation of initial lifetime
- Reliability and durability
- Easier maintenance and repair
- Modular product structure
- Classic design
- Strong product-user relation

5. Reduction of impact during use
- Lower energy consumption
- Cleaner energy source
- Fewer consumables needed
- Cleaner consumables
- No waste of energy/consumables

**Product Component Level**

1. Selection of low-impact materials
- Cleaner materials
- Renewable materials
- Lower energy content materials
- Recycled materials
- Recyclable materials

2. Reduction of materials usage
- Reduction in weight
- Reduction in (transport) volume

3. Optimisation of production techniques
- Alternative production techniques
- Fewer production steps
- Lower/cleaner energy consumption
- Less production waste
- Fewer/cleaner production consumables

**Product Structure level**

4. Optimisation of distribution system
- Less/ cleaner/ reusable packaging
- Energy-efficient transport mode
- Energy-efficient logistics

priorities for the new product

existing product

**Figure 3.9: The Eco-Design strategy wheel (Brezet and Van Hemel, 1997)**

Unlike previous tools, the LiDS wheel incorporates eight environmental design strategies for new product design and idea generation. The tool provides a map that indicates a product's current areas of environmental weakness in the form of a spider diagram. This is done to allow product feature improvements to be identified with qualitative evaluation. The tool is designed specifically for small and medium sized companies, and is limited in that no scales are defined and no exact correlation between effort and actual environmental consideration is shown (Bras, 1997).

### 3.5.2 Benefits and limitations of Life cycle design

The tools identified previously support designers, allowing them to explore the environmental impacts of products and process. In most cases these tools provide a perspective orientated from the product's life cycle phases. This provides useful insights for users of the tool, allowing them to structure information in a more systematic way and generate results more quickly (Byggeth and Hochshorner, 2006).

Most of life cycle design approaches have similar goals of encouraging a holistic view of product design in order to minimize the environmental impacts involved with the product system. Life cycle thinking provides a bigger picture of the product life cycle and evaluates design decisions throughout the life cycle including materials selection, processing of garments, clothing production, packaging, distribution and end of life until disposal in the earth. Vezzolio and Manzini (2008) observed the common Life cycle design strategies as follows.
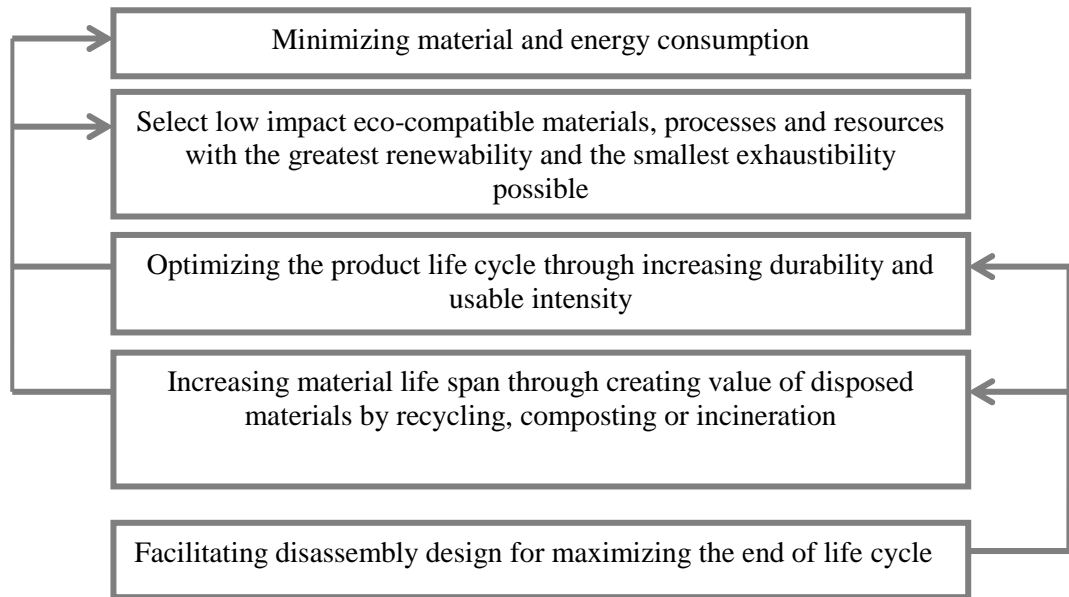


**Figure 3.10: General life cycle design strategies (Vezzolio and Manzini, 2008)**

Reducing the environmental impact for resource use and clothing production is valuable in a practical capacity and essential in the evaluation of environmental performance or optimisation for existing products. The tools identified above support designers by allowing them to explore the environmental impacts of products and process. In most cases, these tools provide a perspective orientated from the product life cycle phases. This provides useful insights for the users of the tool, allowing them to structure information in a more systematic way and generate results quickly (Byggeth and Hochshorner, 2006). However, these tools are commonly intended for more evaluative purposes, primarily the analysis of environmental performance through comparing and prescribing appropriate material selection or production processes for environmental improvement.

According to Vezzoli and Manzini (2008, p243), existing environmental decision tools are generally as a supplementary function. They exist as merely handbooks or guidelines for selecting low impact materials, minimising toxic or hazardous

materials, designing for recycling, disassembly, re-manufacturing, different environmental standards and regulation for environmental benefits. They observed that these tools are useful but they often neglect more important problems or stages within the same product system and culminate in a sustainability concept which is difficult to integrate (Vezzoli and Manzini, 2008). Furthermore, there is some recognition concerning the limitations of the life cycle approach. For example, current fashion supply chains are increasingly complex through using multiple product lines and manufacturers from all over the world. Therefore, it is often difficult evaluate exact environmental impacts and their performance. Going beyond the single product life-cycle, taking account of interactions of several product life cycles and flexible approaches have been facilitated. The one of most renowned approaches is called 'Cradle to Cradle'.

### 3.5.3 **Industrial ecology: Cradle to Cradle**

William McDonough, an environmental architecture designer, and Michael Braungart, a green chemist, have developed a set of environmental design guidelines, named "Cradle to Cradle" (McDonough and Braungart , 2002). The three core principles are:

1) Waste equals food, 2) Employ current solar income, and 3) Respect diversity.

According to cradle to cradle principles, products should not be designed in a way that will drain resources, and hydrocarbon-fueled energy should be replaced by solar energy. Previously, sustainable design was focused on minimizing environmental damage or product focused; however, through adapting metabolism concepts, 'Cradle to Cradle' suggests taking the whole system view of design. This system can classify all materials as either a biological nutrient cycle or a technical nutrient. A biological nutrient refers to products that are designed to return to the biological cycle and can be safely biodegradable. A technical nutrient is a product designed to go back into the technical cycle; for example it may be disassembled and the parts re-used.
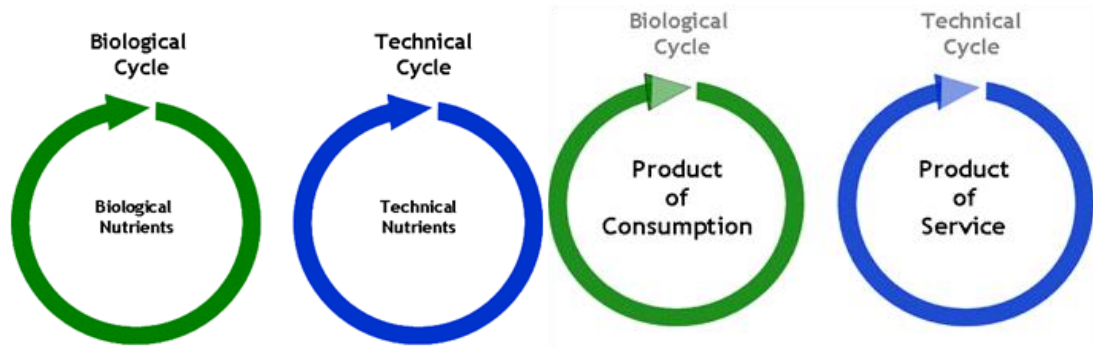
**Figure 3.11 Life cycle thinking approach Cradle to Cradle**

**Source:** http://www.braungart.com/vision.htm

The Cradle to Cradle (C2C) concept has been applied to a considerable number of fashion and textile products although some questions still remain. One of the main challenges is that many materials which might seem to be 'organic nutrients' are contaminated during industrial processing within the current industrial system. For instance, although cotton can safely biodegrade, current practices of cotton production mean that biodegradation leaches toxins into the environment. Moreover, one of the materials alone may contain both organic and technical nutrients, creating what McDonough and Braungart (2002) refer to as 'monstrous hybrids'; this is the case in common blends of fibres such as polyester and cotton.

### 3.5.4  Challenges of the Life cycle design approaches

The lifecycle design approaches, explained in the previous sections, have practical value and enable the reduction of the environmental impact of pollution and resource use for products or systems. The life cycle design approach has shown that it is useful approach to design holistic view of product, service and system despite the fact that it is not enough to tackle sustainable consumption in wider human society. One of the main criticisms of this approach is that if all the products have to be sent back to producers for reuse or remanufacturing, the transportation will be considerably increased.  Another criticism is that remanufacturing activities often cost more than the production of products from virgin raw materials (Mont, 2008). Even more importantly, this approach, and others which have a focus on cleaner production, has limited impact on encouraging positive consumer behaviour or reducing over-consumption (Jorgensen *et al.*, 2006). For example, creating a shirt from organic cotton and sustainably harvested bamboo are essential parts in reducing environmental impacts, but these approaches have limited ability to create

positive consumer behavioural change if consumers do not have any awareness relating to product information or do not understand why they purchase. Similarly, eliminating toxins and reducing water consumption in manufacturing are essential efforts, but these approaches are likely to be missed opportunities if people are not considered in the context of how clothing can be made meaningful or valuable to users (Business for Social Responsibility and IDEO, 2008).

In considering the carbon footprint of most fashion items, life cycle assessment studies have indicated that the major environmental impact of an individual fashion item comes from laundering and aftercare during the consumer use stage, not from growing, processing, and producing the fabric or disposing of it at the end of its life (Cited in Fletcher, 2008, p75). However, this argument has a weakness in that reduction in washing may be associated with an increase in consumption in general consumer behaviour; as such, the lifecycle approach ignores the volume argument inherent in 'fast fashion'. Fletcher and Goggin (2001) do, however, identify the importance of consumer behaviour, in the context of clothes washing, the design, production, and consumption of washing machines. Their research identified that it is difficult to reduce resource consumption through the technological design of the garment. Rather, cleanliness - originally motivated by hygiene purposes – now has complex cultural meanings; it reflects happiness, and success, and is "whiter than white" (Fletcher and Goggin, 2001). Consequently, sustainable production approach alone proves difficult in addressing sustainable fashion and textile, particularly if processes and outcomes are not transparent and meaning to the consumer.

There is growing acknowledgement of the demand to tackle consumption patterns and consumer behaviour in order to address society's impact on the environment (Jackson, 2005; Pettersen and Boks, 2008). The sustainable consumption in the fashion design field has not been actively investigated, only recently has some attention been focused on the various social issues of lifestyle change. A holistic approach is therefore required, including human factors and social systems, in order to address sustainability.

## 3.6 Understanding clothing consumption and consumer behaviour

The term, production and consumption system, entails the complex social and technological system that is related to socio-cultural behaviour as well as natural resources transformed to supply of products, services and system that respond to the needs of well-being in a given society (Vezzoli and Manzini, 2008, p29). As discussed, facilitating system innovation associated with transformation of a large scale infrastructural system would be difficult to achieve through technological innovation alone but requires a mutually reinforcing way for transformation at institutional and socio-cultural levels (Geel, 2005; Lopes et al, 2012, p300). The whole processes are incorporated with social and environmental issues that are not just like a production system. Previously, investigation of sustainable design approaches has been largely focused on the production or supply side. The need for the integration of social and cultural systems requires considering the soft systems which have been briefly discussed through the explanation of systems thinking.

Jacoby *et al.* (1977) defined clothing consumption as pre-purchase, purchase, and disposal of goods, services, time and ideas by decision making units (Jacoby *et al.*, 1977). It involves selection of goods, how consumers can purchase, wear, maintain, mend and dispose of clothing until the end of its life cycle.

They provide a useful framework for influencing consumer behaviour in relation to disposal choice of general product. First, consumer disposal of a product can be categorised by three general choices which includes **'keep the product'**, **'permanently dispose of it'**, and '**temporarily dispose of it'**. When users decide to **'keep the product'**, they can decide between:

a. Continuing to use it for its original purpose
b. Converting it to serve another purpose
c. Storing it, perhaps for later use.

Whereas if users decide to '**permanently dispose of it'**, they can:

a. Throw it away or abandon it
b. Give it away
c. Trade it in.
d. Sell it

For the final decision method, users can decide to '**temporarily dispose if it' by:**

    a)  Renting it to someone else.

    b)  Loaning it

The specific disposal behaviour is classified as nine alternative choices which is described in Figure 3.12.
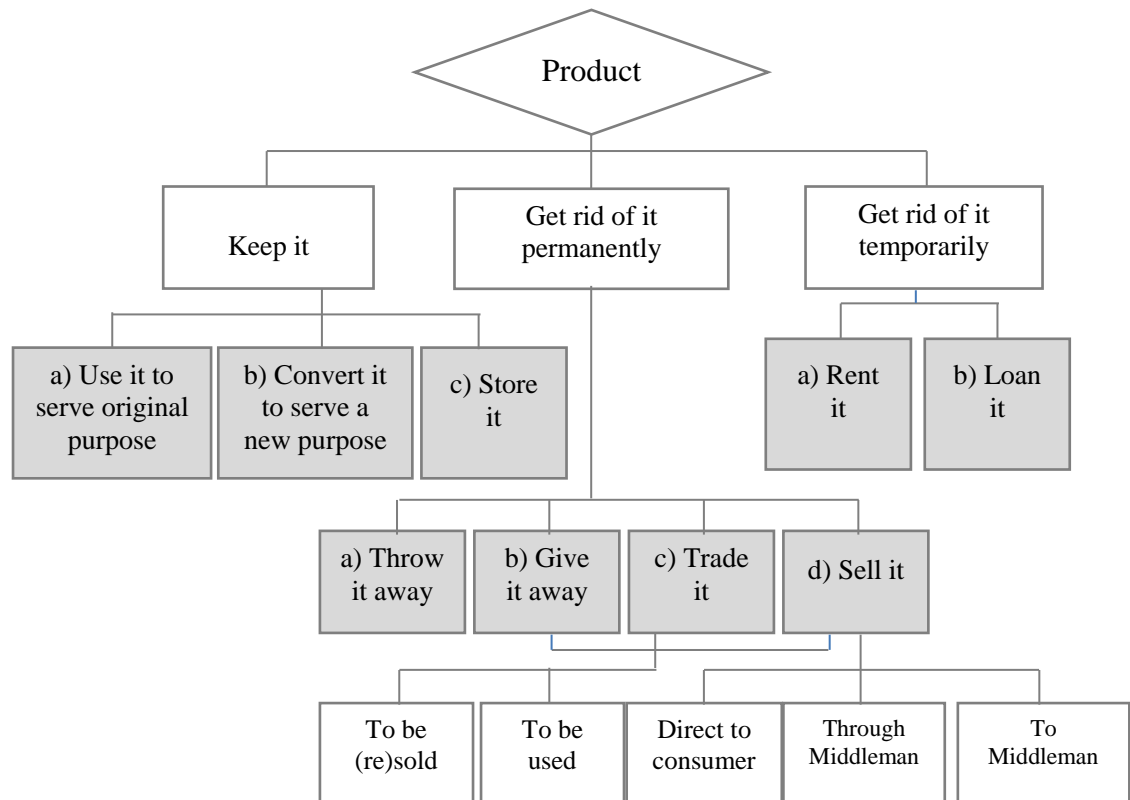


**Figure 3.12: Taxonomy for describing consumer disposition behaviour**

**(Jacoby *et al.,* 1977)**

According to their research, these disposal behaviours can be influenced by many different factors. Jacoby *et al.* (1977) categorise these as three main factors; First, psychological characteristics of the decision maker can be influenced by the personality, attitudes, emotions, perception, learning, creativity, intelligence, social class, level of risk tolerance, peer pressure, social conscience, etc. Second, intrinsic factors of the product involve the condition of product, age, size, style, value, colour, and power source, technological innovations, adaptability, reliability, durability, initial cost, replacement cost, etc. Final situational factors extrinsic to the product involve finances, storage space, urgency, fashion changes, circumstances of acquisition (e.g. gift), functional use, economics (demand and supply), legal considerations (giving to avoid taxes), etc.

These three categories can be overlapping but the framework can assist for developing and structuring decision making toward sustainable consumption and production.   In the area of fashion and textile design, Laitala and Boks (2012) examined clothing use, maintenance routines (washing, drying and ironing), disposal habits, and environmental attitudes through two surveys in Norway. According to their research, clothing disposal behaviour involves a combination of intrinsic factors (technical and quality-related issues, unsuitable fit) and psychological, social and situational reasons. The most common issues are quality related including size and fit issues (too large or small, outgrown, fit at specific areas etc.), and change in the garments (abrasion (pilling and fussing), colour changes, broken zipper, unstable dimension especially on knitted clothing, soiling that does not get clean). Psychological factors involved are fashion or style changes, which can be either a change in individual style or fashion trends resulting in taste-related unsuitability. For example, a clothing owner can become tired of the product and desire a change in style, colour and design. Situational factors include when an  individual has developed new needs, such as changed body size, has several similar clothes, does not fit with other clothes or they have  no occasions to wear it.

It is recognised that a consumption process including disposal behaviour can be highly influenced by the production process. Product related factors (intrinsic factors) can be transformed through design elements which are determined during the design development process. Secondly, design can also affect psychological factors emphasizing on the symbolic value of the clothing through influencing the design process and user experiences.  The context of psychological factors to sustainable design has been explored by other researchers, particularly Jonathan Chapman (2005), who addressed the key issue of lengthening the product lifecycle through examining relationships between users and products. He suggested that a more empathic experience be more inclined to satisfy people's psychological needs. Finally, design could influence situational factors through designing the service and systems related in fashion products and services (e.g. increasing various levels of service and system through renting, sharing, selling and so on).

### 3.6.1 **Design for sustainable behaviour**

The early approach to changing sustainable behaviour has largely been applied through government policy (e.g. Incentive or punishment for energy efficiency). However, many researchers have also identified that this results in relatively short term behaviour change until the incentives are finished. Then people's behaviour dried up and there was not enough to motivate people's behaviour long term (Doppelt, 2008). In recent years, several methodologies and frameworks have been developed from government policy and outside of the field of fashion design to change  user behaviour, particularly in regard to encouraging more sustainable design practices (Defra, 2008b and 2011b; Lilley *et al.*, 2007; Bhamra *et al.*, 2011; Wever *et al*., 2008; Lockton *et al.*, 2008 and 2009). The Department for Environment, Food and Rural Affairs (DEFRA) (2011b) broadly defined two different factors for influencing human behaviour change; situational and behavioural factors. The situational factors consist of the social networks, infrastructure, geography, institutional framework, access to capital, information and social learning. The behavioural factors are involved with the beliefs, norms, experience, attitudes, habits, self-efficacy, values, awareness, altruism, perceptions, leadership, knowledge and identity. According to the Defra report (2011b), there is no single solution to tackle this enormous challenge and we need a multi-dimensional approach, multi-disciplinary analysis. It is suggested that the combination of the theoretical insights with a small scale study, could more effectively and usefully identify what is effective, what does not work and investigate why. It would provide an imperative stepping stone to wider extension and scaling-up, following an action based research design. Figure 3.13 shows Defra's methodological framework (2008b) aiming to move towards a more sustainable pattern of consumption including the purchase use and disposal of products and services (2008, p5).
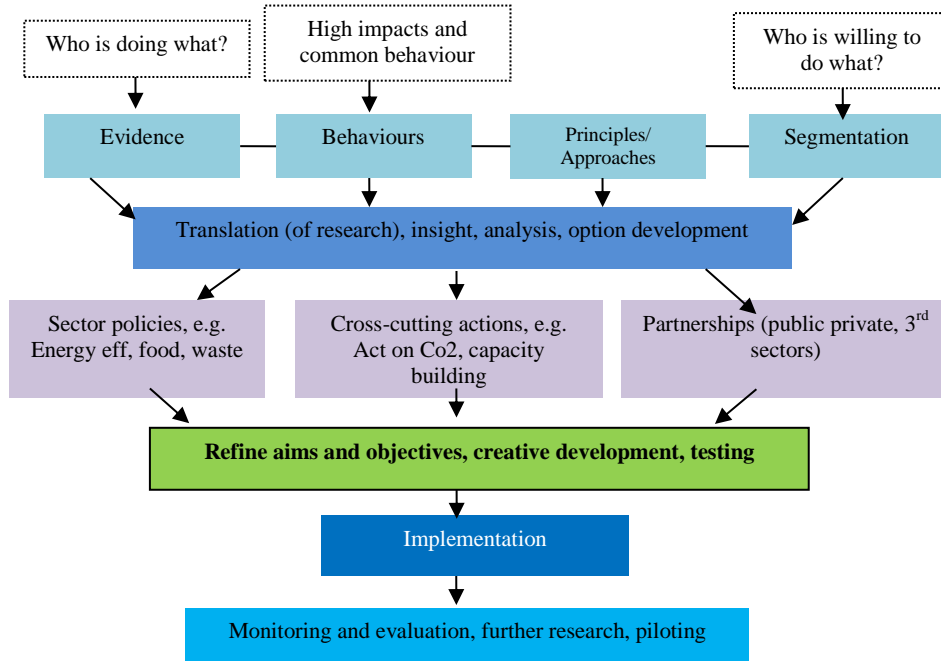
**Figure 3.13: Overview of behaviours framework (Defra, 2008b, p4)**

Although the framework is not specifically targeted to the fashion and textile sector, it does offer a useful insight for designing more sustainable consumption and pro-environmental behaviour. Furthermore, Defra (2008b) suggested a segmentation model which divides the public into seven clusters (see Figure 3.14).
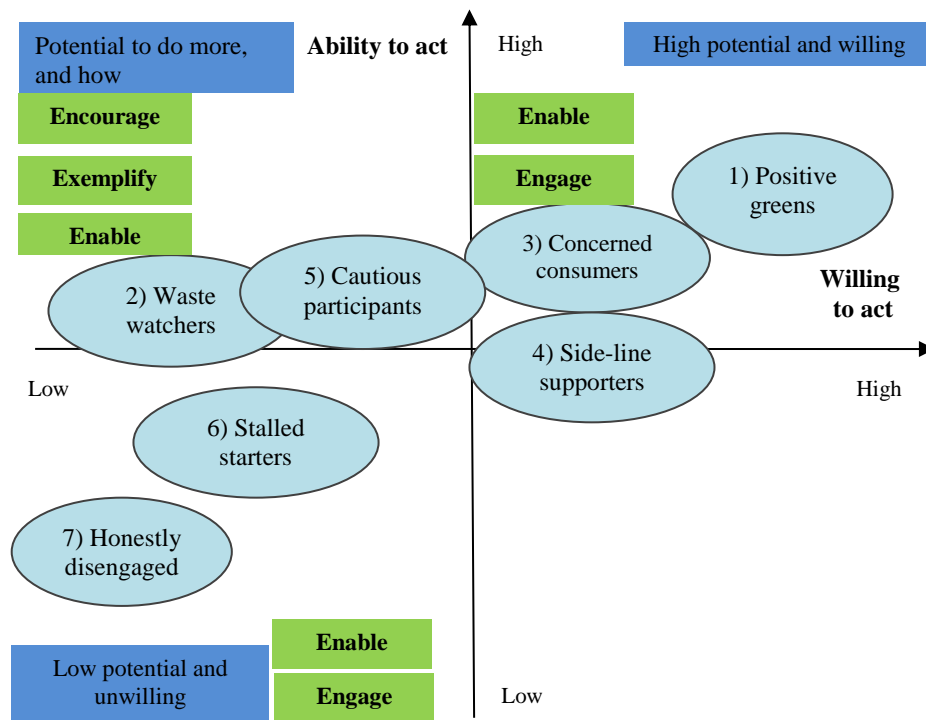


**Figure 3.14: Segmented strategy, showing potential by segment and main emphasis for interventions (Defra, 2008b, p52)**

**Table 3-1: The seven population segments (Defra, 2008b)**

| **The seven population segments** | |
|---|---|
| Segment 1 | **'positive greens' 18% of the population (7.6 million)**<br>*"I think we need to do some things differently to tackle climate change. I do what I can and I feel bad about the rest"* |
| Segment 2 | **'Waste watchers' 12% of the population (5.1 million)**<br>*"'Waste not, want not' that's important, you should live life thinking about what you're doing and using"* |
| Segment 3 | **'Concerned consumers' 14% of the population (5.7 million)**<br>*"I think I do more than a lot of people. Still, going away is important, I'd find that hard to give up..well I wouldn't, so carbon offsetting would make me feel better"* |
| Segment 4 | **'Sideline supporters' 14% of the population (5.6 million)**<br>*"I think climate change is a big problem for us. I suppose I don't think much about how much water or electricity I use, and I forget to turn things off..I'd like to do a bit more"* |
| Segment 5 | **'Cautious participants' 14% of the population (5.6 million)**<br>*"I do a couple of things to help the environment. I'd really like to do more..well as long as I saw others were"* |
| Segment 6 | **Stalled starters' 10% of the population (4.1 million)**<br>*"I don't know much about climate change. I can't afford a car so I use public transport..I'd like a car though"* |
| Segment 7 | **'Honestly disengaged' 18% of the population (7.4 million)**<br>"Maybe there'll be an environmental disaster, maybe not. Makes no difference to me, I'm just living my life the way I want to" |

The seven clusters fall into three broad types: segments 1, 3 and 4 have a relatively high potential to exhibit pro-environmental behaviour. Segment1 have the highest levels of knowledge of sustainability and consider themselves as behaving in a more environmentally friendly way than any other group. Thanks to their strong pro-environmental beliefs, they are prepared to do more (Ibid, 2008b, p12). Segment 3 is less active than segment 1 but link being environmentally concerned with their self-identify; they are therefore willing to do more. Segment 4 is the beginner level of environmental behaviour and willing to act more in their daily life. These groups require interventions that **enable and engage** in order to act and facilitate pro-environmental behaviour through building infrastructures or tools (Ibid, 2008b, p12).

Segments 2 and 5 require different approaches. These groups have environmentally friendly mind-sets but are less willing to act than previous groups. These groups require interventions that **enable, encourage and exemplify** the action points through providing economic incentives or other value chains.

Segments 6 and 7 are less willing to act than any other groups. These groups require interventions that **enable and encourage** them (e.g. choice editing in product availability or regulation)

According to the Defra (2008b) analysis, successful encouragement of segment 1 can help to encourage segments 3 and 4. Motivating segments 1, 3 and 4 can support interventions to encourage segment 5 (Defra, 2008b, p55).

The model indicates that all segment groups need an enabling solution to support their action for pro-environmental behaviour. Although Defra's framework was not particularly targeted at the area of sustainable fashion design, the model provides useful insight of the need of an enabling system in order to encourage action from designers and individuals.

The Figure 3.15 shows the diagrammatic representation of Defra's 4Es model for influencing sustainable behaviour and change.



**Enable**

**Encourage** ⟶ CHANGE ⟵ **Engage**

**Exemplify**
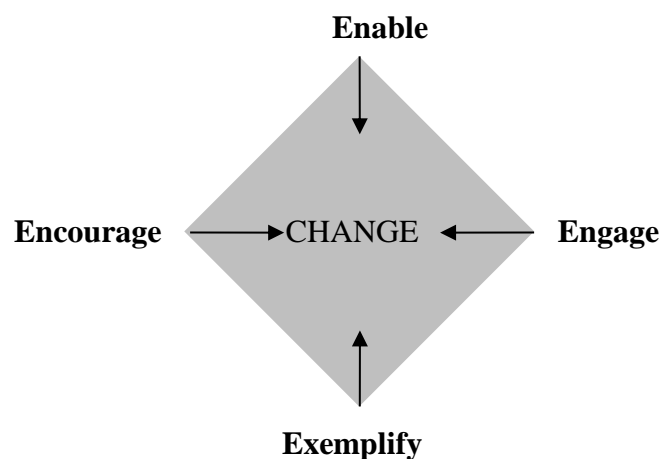
**Figure 3.15: DEFRA's 4E's model (2011b)**

- **Enable: Systems & Capacity-Make it easier to act:** Remove barriers/ Ensure ability to act; Build understanding; Provide facilities/ Viable alternatives; Educate/Train/Provide skills; Provide capacity.

- **Encourage-Provide incentives & disincentives:** Give the right signals, incentives to encourage, and disincentives to ensure your target audience responds; Provide feedback Influencing.

- **Exemplify-Demonstrate shared responsibility**: Lead by example; Consistency in policies; Demonstrate others are acting.

- **Engage- Get people involved:** Work with trusted intermediaries; Use networks; Coproduce; Use insight to mobilise population groups (segment).

Defra (2011b)

## 3.6.2 **Design strategies for behaviour change**

In other disciplinary areas, strategies in design for behaviour change have been developed in order to reshape user behaviour through design. The product use phase associated with human factors is currently neglected in sustainable fashion and there is an increasing need to tackle this challenge.

Lilley (2008) suggested the "design-behaviour" website which was developed to support industrial designers and engineers and to raise awareness of the potential for designers to impact on user behaviour. The key resources provide the user behaviour research and 'seven design strategies' for reducing environmental and social impacts of products and services (Lilley, 2008; Bhamra *et al.*, 2011). Although these strategies have not been widely applied, the framework has shown the potential to influence sustainable behaviour for design strategies (Zachrisson and Boks, 2010). At a later stage Lilley (2009) conducted the empirical research into the use of three strategies including eco-feedback, behaviour steering and persuasive technology for energy consumption and use in electronic products. The framework of the seven strategies is presented in Table 3-2.

**Table 3-2: The seven strategies for behaviour change**
**(Lilley, 2009; Bhamra et al., 2011)**

| Design strategies for behaviour change descriptions | |
| --- | --- |
| Eco-information | Design oriented education through providing understandable and accessible visual and experience resources |
| Eco-Choice | Users rethink their behaviour and take responsibility for their actions by providing different options |

| | |
|---|---|
| Eco-Feedback | Informing user actions in real-time to raise awareness and trigger positive behaviour through tangible aural, visual and tactile reminders to notify their action |
| Eco-Spur | Encourage positive user behaviour through incentives or constraints |
| Eco-Steer | Alleviate negative habits through prescriptions or constraints set in the product design |
| Eco-Technology | Restrict user habits and persuade user behaviour automatically through incorporating advanced technical intervention |
| Clever Design | Enable users to change their behaviour automatically without needing a conscious change through the use of innovative design |

Similarly, the 'Design with Intent' (DwI) toolkit developed by Don Lockton, facilitates sustainable design practices in the field of architectural control in order to reduce environmental and social impact. The tool provides eight different perspectives, or 'lenses' (Lockton *et al.*, 2008; 2009), intended to influence positive behaviour change to sustainable products and services, allowing users to consider beyond the direct frame of reference suggested by the brief. The structure of the eight 'lenses' is shown in Table 3-3.

**Table 3-3: The structure of the eight 'lenses' (Lockton *et al.*, 2008; 2009)**

| Pattern name | Descriptions of pattern |
|---|---|
| Architectural | Influencing user behaviour in architecture and urban planning through effective use of the structure of systems |
| Error proofing | Support to avoid 'errors' through designing to make errors less likely, as a behaviour shaping constraint |
| Interaction | Change attitudes or influence behaviour through contextual information, advice and guidance integrating with persuasive technology |
| Ludic | Influencing positive behaviour derived from playful experiences and games based on the social psychology mechanisms |
| Perceptual | Considering how users interact with the product or system and perceive patterns and meanings |
| Cognitive | Looking at how users make decision which is affected by 'heuristics and 'biases' which was underpinned by behaviour economics and cognitive psychology |

| Machiavellian | Reshaping user behaviour through revealing hidden structures or preventing undesired behaviour |
|---|---|
| Security | Regarding the 'security worldview', this 'lens' restrains undesirable behaviour by taking appropriate 'countermeasures' at the design stage that allow users to control their own behaviour for their own benefit. |

The range of applicable design techniques and visual examples in the strategically constructed DwI toolkit assists in enabling the users reflective approach to design. The DwI method adopts the target behaviour in order to address specific behavioural problem, provoking results through questioning and supporting visual examples of particular principles in action. The toolkit suggested is a card deck which loosely adopts the ideas of TRIZ based innovation (Altshuller, 1998) and the IDEO method card. TRIZ is systematic innovation methods known as the "theory of inventive problem solving" that adopted to number of sustainable design engineering strategies to reduce innovation risk and predicting future design needs. TRIZ tool provides the useful insight into problem solving and new solution for improvement of the 'product-service and system' (Mann and Jones, 2002). Whilst, IDEO is a world famous multidisciplinary design firm focusing on the human-centered, design thinking approach to innovation. Their process is emphasis on the creative design activities and consumer lead design such as prototyping and value of experimentation. Their approach is based on the understanding of human-centered approach that is grounded in business viability and market desirability. The IDEO Method Cards is a collection of 51 cards which are classified as four suits –Ask, Watch, Learn, Try that define the types of activities incorporating various ways of understanding human factors to support design innovation and human-centered design (www.ideo.com). Both methods are considered as one of the famous problem solving tools and techniques for the idea generation and design innovation that combines with the theological knowledge as well as practical design creativity.

**Figure 3.16: Design with Intent Toolkit**   **Figure 3.17: IDEO method cards**

Source from [www.danlockton.com](www.danlockton.com)   Source from [www.ideo.com](www.ideo.com)

### 3.6.3 Process of learning and behaviour change

Other important factor for influencing behaviour is a process of learning. Government policy makers often use the concept of learning in order to tackle challenges of sustainable development. The 'Stages of Change Model' is based on the Trans-Theoretical Model of Change (TTM) which is developed by James Prochaska and his colleagues. It is considered that considered that it is very powerful approach to our thinking and behavioural change. They found that cognitive and experimental change methods are most effective in motivating new thinking and behaviour (Doppelt, 2008, p72). TTM model largely applied in social care and health care sector and Doppelt (2008) adopted this approach into sustainability agenda which is called 5D staged approaches.

The processes of influencing and the stages of changing behaviour are illustrated in the Table 3-4. The stage-theory of behaviour change and learning cycle have similar processes which is not only influenced by individual level of activities but also involving social context that is a critical role in behaviour change (Allen *et al.*, 2002, p19).

**Table 3-4: Processes and 'Stages of changes model'**

**(Adapted from Parnell and Benton, 1999; Allen *et al.*, 2002)**

| Pre-contemplation | Contemplation | Preparation | Action | Maintenance |
|---|---|---|---|---|
| Becoming aware | | | | |
| Emotional response | | | | |
| Environmental analysis | | | | |
| Thinking through the issues | | | | |
| Seeing other options | | | | |
| Self-efficacy | | | | |
| Social support | | | | |
| Helping relationships | | | | |
| Reinforcement | | | | |
| Seeing other options | | | | |
| Being in control | | | | |
| Social support | | | | |
| Unaware of the problem, hasn't thought about change | Thinking about change, in the near future | Making a plane to change plans, setting gradual goals | Implementation of specific action plans | Continuation of desirable actions or repeating |

The stage-theory of behaviour change outlined that behaviour change does not occur immediately rather it can be achieved end point when maintenance is accomplished over the long term. Thus, the process of behaviour change is not a linear model; the process can be repeated several times before changes can be maintained.

Allen *et al.* (2002) observed the several important aspects regarding the process of behaviour change. First, behaviour change is different for every person who takes an action through implementing their own ways and time. Secondly, changing behaviour is associated with the social activities rather just persuading individuals' behaviour. Third, depending on the development of the individual and collective capacity, people can adopt and contribute the environmental action differently.

Furthermore, new learning requires people to adapt to new behaviour that new learning will accelerate changes influenced by the psychological and social impact on behaviour. The suggestion of Allen *et al.*2002 (p14) is shown:

**Behaviour change = Knowing what to do + Imperative + Enabling environment**

Their observation indicated that a component of behaviour change requires the learning and doing environment that provides people to know what they can do and

give them and enabling-platform to create imperative solutions. Particularly, learning is a critical part in understanding the situation in all three parts of behaviour change equation. Therefore, understanding environmental and social issues could help the development of people's motivation (imperative action) for a more environmentally friendly behaviour. An enabling environment builds a bridge between people to people as well as learn and share new insight through social way.

## 3.7  Social innovation and co-design

As has been noted above, it has been emphasised fact that consumer demand and social innovation is one of the essential parts to transform sustainability realisation. However, it will be impossible without educating the designers and consumers as well as providing actual alternative solution. One approach to social innovation for sustainable fashion is that of co-design. The term co-design is used in this study in its broadest sense; the terms participatory design and co-design are often treated synonymously with one another.

Sanders and Stappers (2008) define co-design as *"any act of collective creativity that is shared by two or more people…it is applied across the whole span of a design process. Co-design refers, for some people, to the collective creativity of collaborating designers"*.

The UK Design Council (2012) describes co-design as *"a set of tools used by designers to engage non-designers by asking, listening, learning, communicating and creating solutions collaboratively. A community centred methodology that designers use to enable people who will be served by a designed outcome to participate in designing solutions to their problems"*.
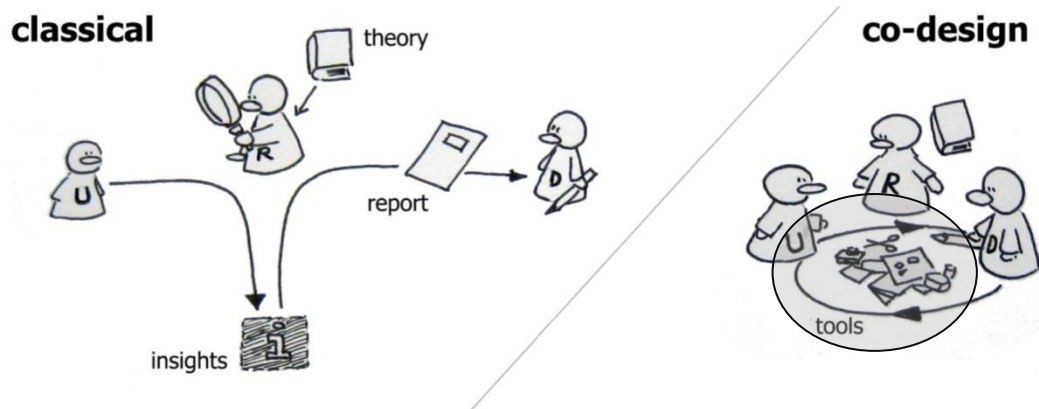


**Figure 3.18: Co-designing process (Sanders and  Stappers, 2008)**

Sanders and Stappers (2008) made several important statements on the role of a participatory design process and the changing role of designers, researchers and user throughout the participatory experiences. According to her argument, traditional design process is where the user is a passive object of study, and the researcher brings knowledge from theories and develops more knowledge through observation and interviews. The designer then passively receives this knowledge in the form of a report. On the other hand, in co-design, the researcher supports the user by providing tools for ideation and design expression. "Users" can play co-creating roles throughout the design process. Therefore, the role of the designer and researcher blurs and the user becomes a critical role in the design process. This rise of interest in co-design activities includes participatory design practices and consumption; Sanders and Simons (2009) have articulated three types of values in the co-design process: monetary (business, commercial and economic value), user experience (personal emotional value) and social value (improving quality of life). Table 3-5 compares these.

**Table 3-5: Comparison of three types of value co-design**

**(Adapted from Sanders and Simons, 2009)**

| Co-creation value | Objective | Mind set | How people are seen | Deliverables | When co-design value occurs | Time frame |
|---|---|---|---|---|---|---|
| **Monetary (Economic value)** | Production Consumption Maximisation of shareholder wealth | Business commercial Economic | Consumer Customer | Marketplace results business advancement Product that sell | Later design development stage Distribution | Short-term |
| **Use/Experience (Emotional value)** | Positive experiences Personalisation Customisation | Experience-driven Service orientation | End-users Empowered | Product & Service that people need and want | Design development process Discovery stage | From life-stage to lifetime |
| **Social value** | Improve quality of life Sustainability | Human-cantered Ecological | Partners Participants Owners | Transformation Ownership Learning Behaviour change Happiness Survival | Idea generation, early design stage (Pre-design) | Over many generations Long-term |

In their analysis, the various drivers influence where the consumer is involved in the design process and how they are viewed by the designer. First, co-design for a

monetary objective is more likely to be realised at a later stage of the design development process, such as marketing, sales and distribution. It usually receives the most attention in business which is commonly stimulated by the aspiration to make money in new ways as well as more effective and efficient ways. However the economic driven co-design approach is focussed on relatively short-term needs based on transactional metrics of exchange between what the company offers and what customer consumes or experiences (Sanders and Simons, 2009, p2).

Secondly, co-design for user-experience value (including emotional value) can occur during the design process through individual discovery. The experience value commonly involves emotional connections which can build not only to the product and services but also to brands and branded environments (Ibide, 2009). Thus, if involvement in the design process can develop empathy with product and services, resultant products are likely to be emotionally connected to consumers.

Finally, social value is developed during the very early 'front end' idea generation stage of the design process in which innovation and opportunities for new developments may be based on individual aspirations regarding more sustainable ways of living (Sanders and Simons, 2009). In this stage, open-ended questions and design briefs allow users to identify true design problems and collectively explore alternative and sustainable design approaches. This model of co-design provides not only use/experience value but may also generate financial reward (Sanders and Simons, 2009). Currently, it is most common to see consumer involvement at the latter stages of the design process; by this time, it is very difficult to address those product and manufacturing features which are detrimental to environment and society (Sherwin and Bhamra, 2001). Equally, whilst monetary value can be gained through approaches such as mass customization, experiential value may forge a deeper brand loyalty. If a brand is considered to be the result of an 'emotional connection' between consumer and producer, this is enhanced when the consumer feels that the product truly addresses their wants and needs. When a product has added social value (so materially improves the quality of the consumer's and others lives) it seems reasonable to suggest that participating in its creation further forges strong emotional relationships between brand and consumer (Sanders and Simons, 2009). To address social and environmental issues relevant to fashion production

and consumption, involvement of the consumer in the idea generation phase should yield greater benefits.

Furthermore, Sanders and Stappers (2008) observed that the nature of 'consumers' has evolved as they are no longer satisfied with a passive role in consumption but they want to be 'co-creator'. The role of the individual is not only just as consumer or user but rather they act as a continuum of diversified characteristics as consumers, active participants, co-designer and co-producers dependant on the degree of engagement, motivations, expertise, passion and individual creativity.

Fisher (2003) proposed the classification of the various levels of considering people as consumers and designers ranging from passive consumer, to active consumer, to end-user, to user, to power users, to domain designer, all the way to meta-designer. The spectrum of consumer and designer in the co-designing process is illustrated in Figure 3.19.
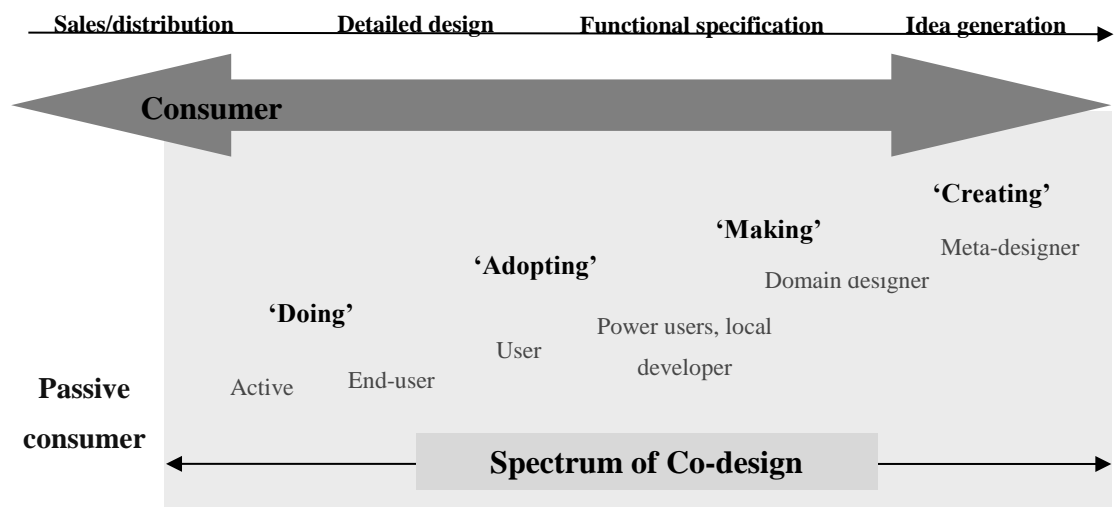


**Figure 3.19: The consumer/designer spectrum in way of co-designing**
**(Adopted from Fisher 2003; Sanders, 2006)**

Sanders (2006) also suggested a similar spectrum in the consuming and designing process including the 'doing', 'adopting', 'making' and 'creating' level in the degree of engagement and motivations depending on their level of expertise, passion and individual creativity. The basic engagement is the 'doing' level that is to get something done productively. It needs minimal interest and knowledge in product and service. The second level of creativity and user engagement is the 'adopting'

level that involves customising an existing design. The 'making' level requires a genuine interest and experience in the making process. It is commonly motivated by the true desire to create a new product. The highest level of creativity and user engagement process is the 'creating' level in which the individual is guided by a high level of experience and knowledge. Sanders (2006) argues that all individuals have the ability to reach the 'creating' level, provided they have the desire to do so; however, traditional design approaches in which the designers and production team have control of the process do not provide support for the creative consumer.

She suggests a range of 'design spaces' which enable each type of creativity, where designers provide tools which match the degree of engagement the individual desires in the process.  At the highest level, Sanders proposes that co-design/ co-creation spaces allow makers and users to work collaboratively and explore their creativity together.

When we reflect the adoption of co-designing in fashion, the design practices have been largely explored through the 'doing' and 'adopting' level. This activity commonly takes place at the latter stages in design development through design component customization such as colour, fabric, size, pattern design.   For example, a number of T-shirt and shoe companies offer various customized products for consumers; for example the NiKEID online tool lets users personalize their own style and design components.  The product configurations involve consumers in the design process so that there is no leftover inventory on the shelves for markdown and eventual disposal. However, the major disadvantage of user engagement in online design is that ordinary people cannot try real products and there is a restriction in tactility (Loker, 2008, p107).

The spectrum of the 'making' level of activity is beginning to emerge, there are a number of DIY (do yourself) product and fashion micro-producers who are embracing co-design practices at the making level of users.  This category of consumers can be considered as 'power users', or 'domain designers' as termed by Fisher (2003). An example of the making level can be seen at a local level of community engagement which is utilised a combination of collaborative design, personalised fit and hands-on tailoring. One important activist designer in this field is Otto von Busch, a researcher and fashion designer. Von Busch has explored a method for questioning the forces at play between the global fashion system and

small-scale local production using collaborative design practices. This co-design method was an open approach to fashion design, rethinking the roles of designer and producer and linear or sequential modes of assembly in industrial production. This would mean co-design and co-authorship throughout the design process and creating a multiplicity of interfaces for design interventions during the production (Von Busch, 2006). He explores various collaborative projects with local companies or designers and suggests reform projects from old garments.  His project emphasized the distribution of "chef power" in the current high street fashion system and reinforces the opinion that system level innovation is required to make a real change. Van Busch contests that perhaps we are used to undertaking passive consumption through formulized global fashion brands.

Perhaps one of the most extensive craft micro-production networks is www.ponoko.com which brings together creators, material suppliers, digital fabricators, DIYers & buyers in a collaborative design environment.  The Ponoko platform allows users to select the creative level at which they wish to work.  For individuals satisfied with the doing/adapting levels, one 'making app' involves the selection and customisation of readily available designs; for more experienced designers/craftsmen an alternative 'making app' allows for products to be designed based on templates or from scratch, providing scope for them to interact and the making and creating levels.  There is also the potential for designers to contribute their own 'making apps' to facilitate others' creativity.  Thousands of user generated products have been created through online platform and made locally, building close connections between the consumer and other stakeholders.  The Ponoko model facilitates micro-manufacture and reduces the impact of the transportation stage of the product lifecycle.

Whilst there is a plethora of excellent tools for developing craft skills and facilitating distributed production, there are still very few which encourage these skills to be employed in the context of a deeper understanding of sustainability; few question the fundamental design concepts and associated issues. Figure 3.20 illustrates the relationship between the design development stage and co-design tool availability for sustainability.  Unfortunately, there are not many tools available for sustainable fashion design and there are almost absent for the specific support of

sustainable fashion design practices at the idea generation phase through co-design process.
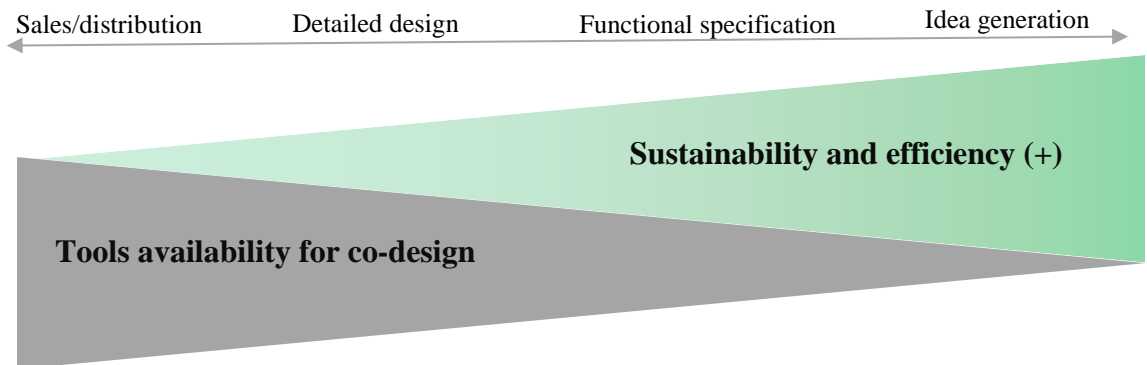


**Figure 3.20: The relationship between the design development stages and co-design tools for sustainable design**

As discussed in previous section, there are several tools for eco and sustainable design, although few of them are specific to fashion.  Rather than 'reinvent the wheel', future tools require a new emphasis on innovation and education in order to raise awareness, generate understanding and develop new solutions for sustainable fashion and textile designers and potential co-designers. Looking at sustainability can be a great opportunity for designers to rethink the design process, the designer's intention and suggest new directions. It is also important to consider what the designer's role is in the co-design process for sustainable design, how an individual can contribute in design process through interactive communication and how potential stakeholders can symbiotically participate in the fashion design development process.

### 3.7.1  Co-design in the fashion design development process

In beginning of the section, a typical idea generation process in fashion design is presented in figure 3.6. Many approaches and frameworks for the fashion design development process have been developed by fashion and textile design academics (Dejonge, 1984; Watkins, 1988; Lamb and Kallal, 1992; Regan *et al.*, 1998).  Labat and Sokolowski (1999) provided a useful summary of some of the key models as shown in Figure 3.21.

Fuzzy Front End (FFE)

**Regan et al (1998)**

| Problem recognition | Problem definition | Exploring problem | Search for alternative | Evaluation & decisions | Specification | Communication |
|---|---|---|---|---|---|---|

**Watkins (1988)**

| Problem accept | Analyse problem | Define problem | Idea generation | Select solution | Implement | Evaluate |
|---|---|---|---|---|---|---|

**Lamb & Kallal (1994)**

| Problem accept | Preliminary idea | Design refineme | Analysis | Prototype develop | Evaluation | Implement |
|---|---|---|---|---|---|---|

**Dejonge (1984)**

| Request made | Situation Explored | Problem Perceive | Specs Describe | Criteria established | Prototype Development | Evaluate |
|---|---|---|---|---|---|---|

**Figure 3.21: Summary of fashion design development processes**

**(Adapted from Labat and Sokolowski, 1999)**

The Figure 3.21 indicates that fashion design development process is a linear, although designers may reiterate stages many times in order to find appropriate design solutions. Whereas the co-design process differs from this model by allowing various stakeholders the opportunity to participate in the design process and share their knowledge and experience in a more active way. Spinuzzi (2005) presented three general stages of participatory design methods and techniques. In the first stage, "at the initial exploration of work", designers meet users (e.g. stakeholders or consumers) to work together through discussion about their current activities, practices and routines, allowing designers to understand the wants and needs of them. This initial exploration may use ethnographic methods such as observation, interviews, organizational visits and examinations of artefacts.

In the second stage, the "discovery process", designers and participants clarify the goals and values to agree on the desired outcome of a project. In this stage, designers and users are dynamically involved in a co-operative process. Common methods used may be organizational games, toolkits, storyboarding, workflow models and interpretation sessions (Spinuzzi, 2005). Finally, at the "prototyping stage", designers and participants interactively work together at a site or in a lab

engaging one or more users in using the techniques for shaping artefacts. Prototypes can be mock-ups and paper prototyping or visualized sketches or diagrams (Spinuzzi, 2005). In this stage, designers can share knowledge and experience in an active way through rapid prototyping technologies or existing micro-production services can be used. Spinuzzi's approach is mainly focused on design research; however, fashion designers may facilitate co-design practice by involving users through similar tools, with workshops as the most familiar. The adoption of Spinuzzi's three stages of participatory methods and techniques in the fashion design is shown in Figure 3.22.
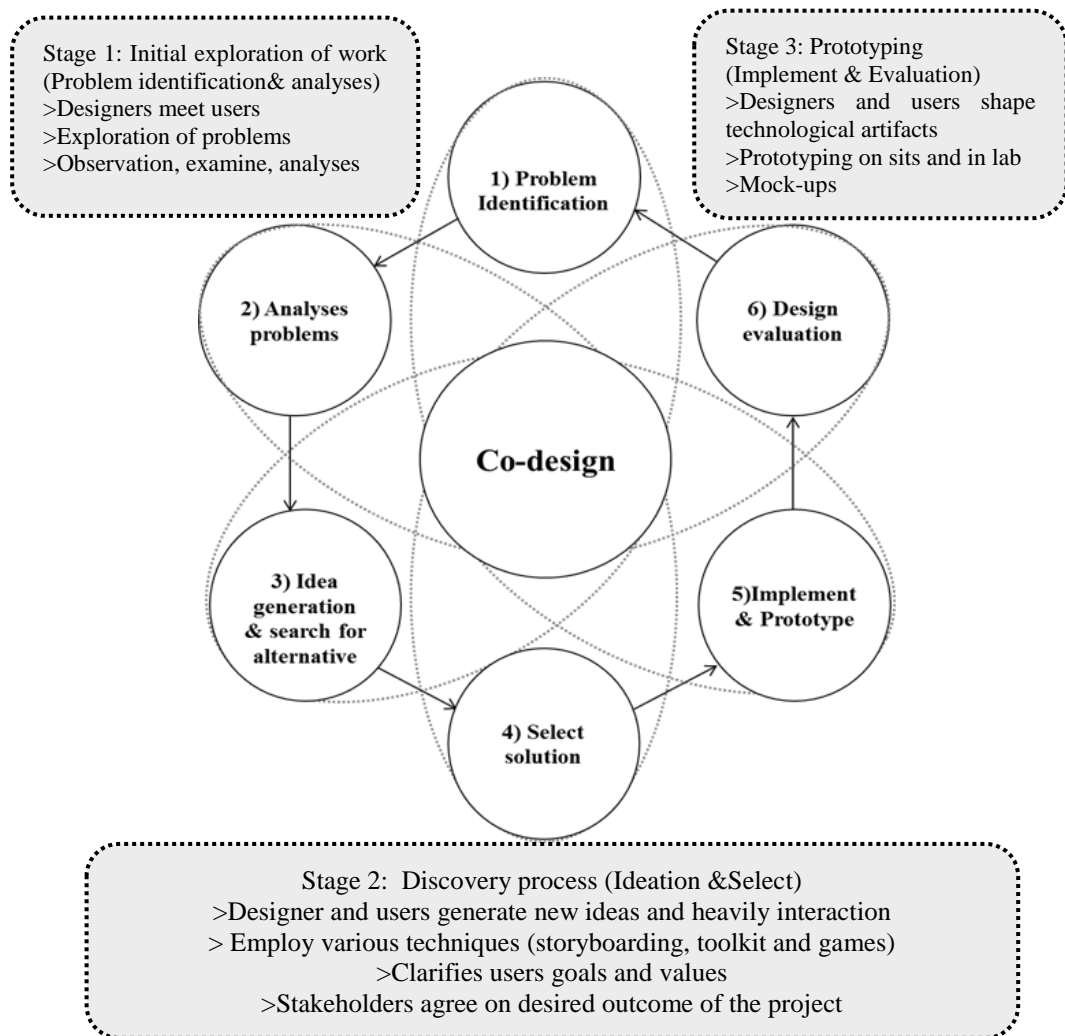


**Figure 3.22: Co-design in the fashion design development process**

Figure 3.22 shows how designers and users may participate in various stages of the fashion design development process. It is posited that such a framework will enable designers to move away from their accepted practice and explore new ideas derived through collaborative and social design. Thus, the 'learning, making, sharing' process encouraged by the framework is beneficial to designers and users alike, and

allows them to progress from the surface to a deep engagement with the real questions of sustainable design.

Despite a range of co-design values and benefits explained above, this is not to say that the approach is without its weaknesses. Co-design is currently more of a movement or research orientation and it is not practical to involve everyone in workshops or prototyping sessions (Spinuzzi, 2005). Furthermore, without appropriate tools, common goals (e.g. sustainable fashion) and appropriate platforms, it is difficult to achieve the benefits outlined. Indeed, the early integration of sustainability in fashion design is critical in supporting decisions for designers, as well as potential co-designers, for sustainable fashion. It encourages them to create new solutions which will ultimately contribute to sustainable fashion and innovation.

## 3.8 Chapter summary

This chapter has examined how existing tools and methods tackle sustainable production and consumption, addresses the idea of system thinking and offers understanding of the relevant background of the research. Although incorporating sustainability issues into fashion design is very complex and it is almost impossible define precisely, system thinking allows understanding of hard and soft systems associated in production and consumption. Throughout the literature review, this chapter identified the gaps between sustainable production and consumption approaches. A number of research projects have focused on the supply side of production of the artefact or the supply chain within the production system. However, as we noted in the literature review, without incorporating the sustainable consumption approach, it will be hard to achieve real sustainability. Various sustainable production and consumption approaches have been reviewed from other industries (e.g. industrial design, architecture, engineering, multidisciplinary theories and government design framework) in order to provide useful insight for potential development of a sustainable design tool for fashion and textile design.

The decision making tools are helping practitioners to make better decisions through defining the problem, evaluating environmental and social impacts and selecting better options. Various researchers emphasised that integrating sustainability at the

idea generation stage, is more influential and effective to encourage the consideration of sustainability in the design practices. Despite this, a knowledge gap exists between engineering design processes and apparel design processes. The differing contexts make the methodologies challenging for fashion and textile designers to directly engage with and as a result there is still insufficient guidance and tools available for the specific support of sustainable fashion design practices at the idea generation stage.

Through an in-depth analysis of tools and methods, including the production approach of the life cycle design tools and consumption approach for sustainable design for behaviour change tools, each strategy was reviewed for their strengths and weaknesses. The areas of sustainable consumption research especially highlight the potential for design intervention to encourage sustainable behaviour, particularly with consideration to encouraging more sustainable practices. However, the context of the research is unrelated to the fashion design processes making it challenging for fashion and textile designers to engage with directly. In studies of encouraging sustainable behaviour, facilitating simpler assessment methods makes it easier for them to be accepted by designers in their current day-to-day activities. Furthermore, for fashion and textile design sectors, there appears to be a lack of cross-fertilisation between different fields of design, in order to address the user behaviour problems of integration of sustainable design. Other issues were identified by Lofthouse (2006). Namely, that existing tools commonly focus on the evaluation of existing products, and designers consider them irrelevant and time consuming to use. According to Lofthouse's observation, information should be more appropriate to a specific target group. His finding suggests that designers need flexible eco-design support mechanisms that address their individual or group needs. They prefer highly visual and interactive processes that integrate it easily into their practices. Indeed, it is important to consider whether developed tools can fit into specific target groups (e.g. fashion/textile designers) and how fashion/textile designers consider whether the tools can be effectively used in the time sensitive fashion design sector.

Furthermore, sustainable fashion design research rarely considers the behaviour change and the infrastructure of innovation at system level, including soft system at social level. The bridge between theory and practice is not always easy for fashion

design practitioners and consumers to implement without the appropriate tools, audiences, environment to practices.

Whilst, it has been argued that complex design problems and the transition towards sustainable design require a radical social innovation, enabling a system that engages with diverse social actors can facilitate discussion as a process of social learning (Manzini, 2008). The concept of co-design represents a new paradigm for fashion and textile design, involving participatory activity and consumption and encouraging action towards social change. A co-design approach places the opportunity of engagement with the user, potentially creating more sustainable consumption linked with the production process. This approach involves communication with the user, combining reflection about the product and social inclusion in the design process. However, the adoption of co-design for sustainable fashion is still in its early stages and there has been limited study into a systemic level of co-design processes for sustainable fashion. Moreover, co-design practices in the fashion industry are mostly focused on the economic value drivers rather than embracing sustainability issues. There is a big gap between co-design practice and sustainable design practice in the fashion industry. There is need for alternative co-design processes and systems in order to provide new solutions and generate new ideas for fashion designers and potential co-designers. Incorporating the co-design at idea generation stage is relatively new in sustainable fashion design. This process potentially provides various opportunities to address social and environmental issues where the enabling tool is critical, but little guidance has been provided for designers and other stakeholders to bring knowledge and awareness of sustainable fashion. This research aims to remedy this by providing an appropriate tool which can be applied to influence sustainable production and consumption in fashion design.

Chapter 4: **Research Methodology**

## 4.1  Introduction

Chapters two and three have clarified the demand for support to address sustainability in the fashion design field through discussion of the cross-disciplinary literature review.  This chapter provides an overview of research strategies and establishes the key research methodology which was adopted in this study. The purpose of this chapter is to develop a suitable research methodology in order to develop an appropriate and effective design tool to assist designers and any potential users to address sustainable design practices. The research combined an adapted Soft Systems Methodology (SSM) with Participatory Action Research (PAR) in order to solve the real world problems associated with in fashion and textile design articulated in the literature review.

## 4.2  Development of a Soft Systems Method (SSM)

Soft Systems Methodology (SSM) was briefly discussed in the explanation of systems thinking in Chapter 1 and 3. Soft Systems Methodology was adopted as a guide for this study and combined with Participatory Action Research (PAR). This section outlines the overall research methodology which is illustrated in Figure 4.1.

**SSM stage 1 and 2: Define research boundaries and identify the problem**

**1): Entering the problem situation: unstructured**

Secondary research data collection: Literature review

Study 1: primary data collection

Online Survey 1

Online survey2

**2)**

**Problem situation expressed**

**Rich Picture**

**SSM stage 3 and 4: Establish research strategies and development of model**

**3) Root definition of relevant activity systems**

Establish Research Strategies & criteria

CATWOE

Refine requirement

**4) Building a conceptual model**

**(Framework for inputs and outputs)**

Review and examine previous toolkit by secondary research

**Development of toolkit design**

**SSM stage 5 and 6: Evaluation of toolkit and workshop process**

**5) Systems world comparison**

Evaluation of Sustainable Fashion Bridges Model Workshop: toolkit evaluation and test model

**6) Changes: evaluation feasible or desirable**

Pilot test

Main study1: Evaluation of toolkit contents

Main study 2: toolkit process

**SSM stage 7: Action to improve the problem situation & system intervention**

**Figure 4.1: Overall research methodology with SSM**

## 4.2.1  SSM in Actions (Stage 1 and 2): Entering the problem situation

The initial investigation of the problem situation came from the secondary research (literature review presented in Chapters two and three) which supported the understanding of sustainable fashion design, discussed its importance and identified the need for its facilitation in the fashion and textile design sector. Throughout the literature review, the research identified the challenges of sustainable design and the limitations for linking sustainable production and consumption with current practice, particularly with regard to the lack of systems thinking and human-centred design approaches in fashion and textile design.  To highlight this, sustainable design tools were reviewed and evaluated for their strengths and weaknesses, in order to suggest better solutions for future direction.

As part of entering the problem situation, two online surveys were conducted in order to identify how a fashion design involved group and a public group regard sustainable fashion design, as well the challenges for action. The purpose of this research was to identify the initial perception of sustainable design and the challenges to be overcome in order integrate sustainability into current design practices.

### 4.2.1.1  Sample selection

The initial stage of this research was conducted through two surveys to identify the prior understanding of sustainable fashion and their attitudes, what are the challenging points to facilitate sustainable design practices. Since this research focuses on sustainable fashion through linking sustainable production and consumption it is critical to gather the perceptions of the people involved in production and consumption. As described in the literature review, several studies have been made on consumer perspectives on sustainable clothing (Jorgensen *et al.* 2006; Defra, 2008; Fisher *et al.*, 2008; Saicheua *et al.*, 2012). However, little is known about perspectives from fashion design involved people regarding their perceptions toward sustainable fashion. This study explored both public and designers' views in order to better understand research problems and build a clear research objective.

For the public perspectives, several authors have already observed there is a lack of

awareness of sustainable clothing among the public. As a result, this study is more focused on identification of the barriers to the adoption of sustainable fashion in daily actions and how the public perceive sustainable consumption.

A more thorough investigation was carried out with the fashion design-involved people. The second questionnaire investigated fashion design-involved people's understanding of sustainability and their attitudes towards it. Furthermore, the study examined their awareness of existing sustainable tools and what kind of tools or methods would be useful for design activities. The essential exploration of this phase was to identify initial perceptions of sustainable design and the challenges to integrating sustainability into design practices. Table 4-1 below shows the main purpose of the two studies.

**Table 4-1: Main purpose of two studies**

|  | Questionnaire A (Public) | Questionnaire B (design involved group) |
|---|---|---|
| Purpose of survey | -To understand public attitudes of sustainable fashion.<br>- To examine the public perception of sustainable consumption and the challenges for pro-environmental action | -To understand and identify fashion design involved peoples' perception of sustainable fashion.<br>-To identify the challenges to practicing sustainable fashion design<br>-To examine the extent of use of existing sustainable design tools |
| Target | General public | Specifically fashion design-involved people |
| Hypothesis | Public has lack of awareness of and involvement in sustainable fashion | Fashion design involved people have a lack of awareness of sustainable fashion and its implementation strategies |

### 4.2.1.2  Questionnaire design and data collection methods

The data collection for the primary research was gathered through both qualitative and quantitative methods. Quantitative methods are typically influenced by the researcher's perspective and support insight into structural aspects of social life such as attitudes, values, beliefs and motivations. Collected data can be evaluated through statistics. Meanwhile, qualitative methods are considered to be more effective in representing participant perspectives and thereby allow the development of a deeper understanding of complex problems, particularly when a range of stakeholder views are sought (Robson, 2002). According to Creswell (2003), a mixed methods

approach is useful for collecting data to best understand the research problem. Combining both approaches allows the establishment of a relationship between variables using fixed designs and qualitative methods can help in developing explanations. Such a combination of both qualitative (inquiry) and quantitative (validation) data is called mixed methods which were applied in this study through corresponding fixed and flexible design strategies. In particular, an embedded design method was utilised in order to offer comprehensive investigation of the research problem through gathering both numeric information and text information (Creswell, 2003). The overall research combined qualitative and quantitative methods using both open-end and closed-end questions in order to acquire an in-depth and rich investigation of key problem points and participants' perceptions of sustainable fashion.

Most of these questions were Likert-scale based on the five rating scales. This is the most frequently utilised tool in survey questionnaire research (Cook *et al.*, 1981; Hinkin, 1998), and is considered useful for investigating behaviour research and factor analysis (cited in Hinkin, 1998). Other questions attempted to specify information by selecting one answer or multiple choice answers. All questions contained comment sections which allowed respondents to express their opinions freely. The summary of questionnaire A and B is shown in Table 4-2.

**Table 4-2: Summary of survey questions for questionnaire A and B**

| Questionnaire design A (Public) | Questionnaire design B (Fashion design involved group) |
|---|---|
| QA1~QA3: Profile of respondents | QB1: Profile of respondents |
| QA4: Periods of respondents' interest in sustainable fashion | QB2: Respondents' overall attitudes towards sustainable fashion |
| QA5: Understanding respondents' familiarity levels with sustainable fashion | QB3: Understanding degree of awareness and practicing area |
| QA6: Degree of attitudes and actions for sustainable fashion | QB4: Degree of attitudes and actions for sustainable fashion |
| QA7: Disposal decision after use | QB5: Challenges or barriers adopting sustainable fashion |
| QA8: Factors for disposal behaviours | QB6: Previous experiences of sustainable design tool use |
| QA9: Individual responsibility for sustainable consumption | QB7: Useful resources for sustainable design practices |

| | QB8: Respondents' definition of sustainable fashion |
|---|---|

QA1 to QA4 were aimed at obtaining respondents' demographic information and gauging the periods of respondents' interest in sustainable fashion design. QA5 used the five rating Likert-scale to measure the respondents' familiarity level. A list of sustainability issues in fashion was drawn based on the previous studies (Fletcher, 2008; Fisher *et al.*, 2008; Defra, 2008; De Eyto, 2010). QA6 was designed for further investigation of QA5 in order to identify respondents' specific area of interest, importance, expectation, their personal responsibility and involvement through open-ended questions. At the same time, a Likert-scale was used to evaluate the degree of respondents' attitudes and actions for sustainable fashion for each category.

QA7 and QA8 were focused on disposal methods and factors for the disposal decision. The list of disposal options was designed based on previous studies (Jacoby *et al.* 1977; Domina and Koch, 2002; Bristwistle and Moore, 2007) and researcher insight. This question was also intended to investigate whether their attitudes (previous question QA6) can be linked to their real actions (QA7) for disposal decisions. Finally question QA8 was designed to examine the degree of respondents' personal responsibility for sustainable consumption in everyday life.

For the fashion design involved group, QB1 were intended to obtain respondents' profession and specific background of fashion design. Similar to questionnaire A, QB2 to QB4 were investigating the fashion involved group's overall attitudes, degree of awareness and practicing areas for sustainable fashion. QB5 was particularly designed for the fashion design involved group, to measure the barriers to adoption of a sustainable fashion approach in their practices. Five rating Likert-scales were utilised for the measurement of each category and the list of various barriers drawn based on the literature review (Fletcher, 2008; Jorgensen *et al.* 2006; Defra, 2008; Fisher *et al.*, 2008; Doeringer and Crean, 2006).

QB7 allowed the selection of multiple answers to investigate the respondents' options for useful resources for their sustainable design practices. The lists are designed based on the overall literature review and researcher insight. Additional opinions were also obtained through the use of a comments section. QB8 acquired

the respondents' definition of sustainable fashion through utilisation of an open-end comment section in order to understand an overview of their perceptions towards sustainable fashion.

For the data collection method, online surveys were utilised and self-administered for both public and fashion design involved groups. This was useful for obtaining various opinions from large audiences.  For the public group study, the questionnaire was posted on Facebook online and convenience samples of online users were asked to complete the questionnaire. On the other hand, questionnaire B used a specified sample population of fashion design involved people. The survey was sent to members of 'the sustainable fashion network' in LinkedIn and was also distributed by email to professional designers, fashion design academic staff and undergraduate fashion design students. The academic staff and undergraduate students were from a variety of educational institutions in UK. Details of the results from the two surveys, including respondents' feedback and interpreted results will be presented in chapter 5.

## 4.2.2  SSM in Actions (Stage 3 and 4): System oriented exploration

After expressing the problem in stages 1 and 2, this study addressed the questions regarding the type of system required to improve the situation and how apparel design may incorporate sustainability at in the early stages of design). The final outcomes of both data were integrated and compared using soft systems methodology phases 2 and 3 in order to articulate the key task of 'root definition' and setting a main design strategy with all the requirements including key elements of system, user activity, environment and other criteria. Chapter 5 contains the 'root definition' of the activity system, which defines the requirements for the input as well as the relationship with the design process and structure. In this stage, the research attempts to develop a systems model for inputs and output for the transformation process of integrating sustainability in design processes. These stages established the key strategies to be used in the development of model and tool.  The central input into the transformation model is the design 'ideation' toolkit to support conceptual sustainable fashion design. The specific content and structure of toolkit is described in chapter 6.

### 4.2.3 SSM in Actions (Stages 5 and 6): Evaluation of toolkit and workshop process

The ideation tool and their performance were evaluated by fashion design students and postgraduate design students to identify its feasibility and desirability for these stakeholders.

As noted above, Soft Systems Method (SSM) is also associated with Participatory Action Research (PAR) in the real world stages. PAR is commonly aimed at understanding and transforming situations to achieve a desired action. It is a collective, self-reflective investigation that researcher and participants conduct together, so participants can understand the process better and find alternative solutions. This reflective process is directly connected to action, and is influenced by understanding of the real world situation and social relationships (Baum *et al.*, 2006).

In PAR process, the stakeholders (defined as Client, Actors and Owner using SSM) are engaged in design guided by facilitators (in this case, the researcher but potentially can be actors and owners). It is considered as a powerful strategy for human-centred design in both social science and design practices. This process allows designers and various users to work collaboratively and explore their creativity together. This process inevitably transforms the role of designers, researchers and users throughout the participatory experience. Participatory action research (PAR) is a systematic enquiry through a continuous cycle of plan, action, observe and reflect on the process of transformation (Baum *et al.*, 2006).

Stage 5s and 6 explore and evaluate the toolkit and workshop process in the real word with participants: a series of participatory action research activities were undertaken with design students and feedback from professionals via interviews with professional fashion designers and lecturers and attending international conferences.

#### 4.2.3.1 Data collection methods

The toolkit and workshop process was evaluated at a number of levels with both quantitative and qualitative methods at each stage of the process which conducted a series of four participatory workshops and discussions with participants. In each

workshop session, participants were provided with an evaluation form for both toolkit information and the workshop process. The specific evaluation methods were performed by mix-methods strategies including questionnaires, analysis of workshop processes and observations. The participants assessed the SFB cards and then they were asked to create new solutions for sustainable fashion. Participants' generated outcomes and workshop processes were analysed as a descriptive qualitative research. Each workshop process was documented through photography, field notes and video-records in order to capture different contents.

For the questionnaire design, an embedded mixed methods design was applied to collect data to construct quantitative and qualitative results. The questionnaire was administered at the end of workshop session and participants were asked to answer the questions including effectiveness of the toolkit, the workshop process and their overall feeling about the co-design workshop activities.

The survey consisted of four sections including demographic information, previous understanding of sustainable fashion and co-design process and SFB toolkit and workshop process evaluation. These questions assessed participants' awareness levels after the workshop, levels of agreement with statements (e.g. effectiveness, enjoyable, informative and clearness). The results were recorded using a five-point Likert scale ranking and quantified as mean (M) and standard deviation (SD). Open-ended questions were also used to encourage more flexible explanations in order to collect and include the respondents' aspirations and additional suggestions. The table 4-3 shows the summary of survey questions for evaluating the SFB toolkit and workshop process.

**Table 4-3: Summary of survey questions for SFB toolkit and workshop process**

| Survey for SFB toolkit and workshop process | |
|---|---|
| **Demographic information** | Gender/ Age/ Occupation |
| **Previous understanding experiences** | The degree of previous understanding of sustainable fashion and co-design process |
| **SFB toolkit evaluation** | Degree of awareness increase after the toolkit use |
| | Overall feeling and impression about the toolkit ( How clear/ effective/ informative and enjoyable ) |

| | The most useful section of the toolkit |
|---|---|
| | The most confusing part or less useful section of the toolkit |
| | The usage and usability of the SFB toolkit |
| | Future intention for toolkit use |
| | Required improvement or suggestion |
| **SFB workshop process evaluation** | Overall feeling and impression about the workshop ( Effectiveness/ comfortable/ enjoyable/ clearness) |
| | The most useful section of the workshop process (Brainstorming/Scenario building/ Group sketch/Discussion) |
| | The most confusing part or less useful section of the workshop process |
| | Problem encountered section |
| | Process is useful |
| | Benefit or negative aspect about the co-design workshop |
| | Creative or adorable process? |
| | Required improvement or suggestion |

### 4.2.3.2  Overview of evaluation process

Prior to the large-scale workshop study, the toolkit had been evaluated through a pilot workshop. The pilot study used a convenience sample of three participants from the Design school and three participants from second year Modern languages and Economics students.

The large-scale three co-design workshops were conducted with a designer group including third year Fashion design students (N=35), Design Masters students (N=17) in the Department of School of Design at the University of Leeds in 2011 from October to November. The workshop took place three times and participants were formed into teams with five people in each group.  A total of 52 undergraduate and postgraduate participants were invited to take part in a workshop to evaluate the toolkit in order to solve specific target problems and to generate possible concepts to integrate sustainability in the early stage of the fashion design development process. The specific large scale of the workshop process and observations of the user generated outcomes are described later.

The final stage of data gathering was carried out with five design educators and two professional fashion designers in order to evaluate the final outcome of the toolkit, process and user generated concepts. Explanation of the purpose of the project was given and the overall contents of the toolkit were examined. Perceptions about sustainable fashion were also given and whether a co-design process could be suitable for educational purposes for designers and various other potential users was questioned. Interviews were audio recorded for later transcription. An open-ended questionnaire was provided to each participant in order to obtain flexible feedback and suggestions. Figure 4.2 illustrates the overview of the evaluation process for the main study.
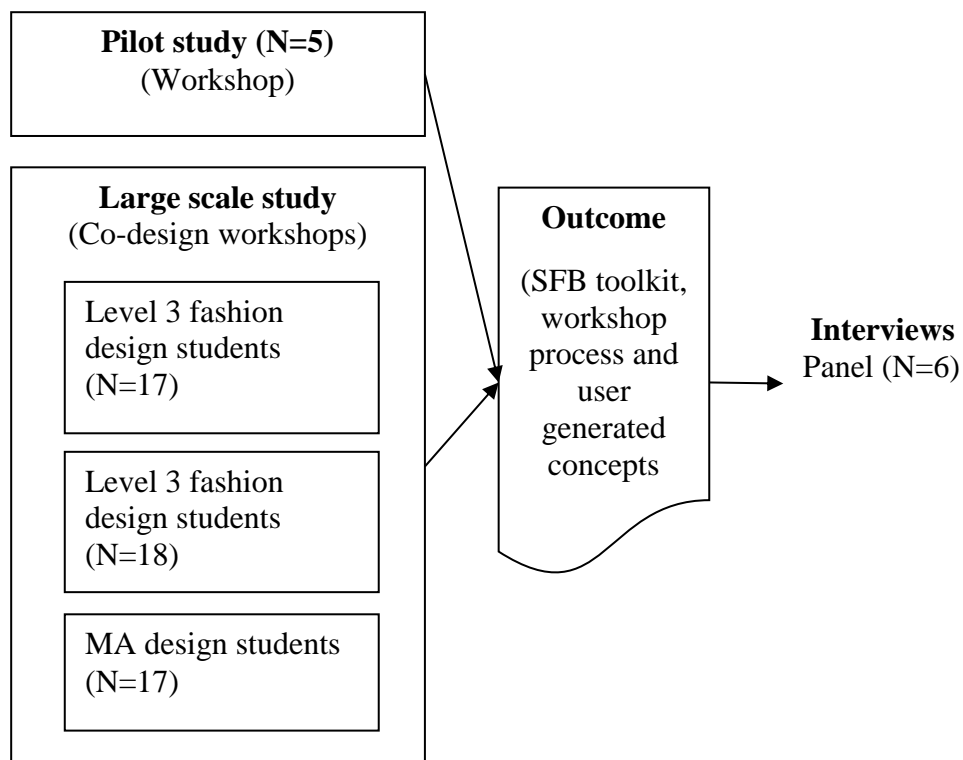


**Figure 4.2: Overview of evaluation process**

Chapter 7 discusses how the participatory process empowers people and how individuals generate their own design solutions using the suggested toolkit. This is followed by a discussion regarding the emotional responses to the workshop procedure. The analysis explores how the suggested toolkit and workshops can systemically facilitate sustainable apparel design and encourage users to rethink their design process and get inspiration to integrate sustainability in their design. The ultimate goal for this research study is to encourage designers to be part of

sustainable design action, as well as aiming to provide designers (including design students) with a new system for design engagement, inspiring positive behaviour in people and improving the awareness of sustainable issues. The discussion will be followed with how new systems and processes could facilitate comparisons of traditional design process. The specific description of the developed conceptual ideal model, processing analysis of data, the co-relationship between decision making tool and design process and synthesis of research findings are discussed in chapter 7.

### 4.2.4  SSM in Action (Stage 7): Intervention into the real world

 The new model and tool are discussed for both potential impacts and limitations. Finally, through planning the new system intervention into the real world, the final main study follows the development of an online co-design platform (environment). The discussion also clovers potential impacts and limitations of the new system and its implementation for sustainable fashion design.

## 4.3  Summary of overall research methodology

This chapter provided an overview of research methodology adoption of Soft Systems Methodology (SSM) and Participatory Action Research (PAR). Table 4-4 presents the description of SSM procedures which illustrate specific research objectives and methods for the overall research methodology. The sequences of research activities were not conducted in chronological order. It is rather, a flexible adoption of sequence of plan, action, observe and reflection of the process of change. A detailed research methods overview and analysis techniques will be explained for each chapter in chapters 5, 6, 7 and 8.

**Table 4-4: Overview of research methods with SSM**

| SSM procedures | Objectives | Specific Methods | Specific description |
|---|---|---|---|
| Entering the problem situation | -To understand and identify the attitudes of sustainable fashion<br>-To examine challenges for adoption of sustainability and prior tool use | -Exploratory research: Two online surveys using embedded design questionnaire (Quantitative & Qualitative research) | Chapter 5 |

| | experiences | | |
|---|---|---|---|
| The problem situation expressed | -To evaluate the problem situation and build the richest picture of circumstances within relevant systems | -Rich pictures illustrated with the problem situation based on analysis of the survey results and literature review | Chapter 5 |
| Root definition of relevant activity systems Building conceptual models | -To describe nature of new system through formulating the 'Root definition and clarifying the CATWOE. -To build conceptual models that underpinned the Root Definition | -Defined the key input and output of the system through building a root definition of relevant activity systems and conceptual model | Chapter 5 |
| Comparison of 4 with 2 | -To compare actual problem situation and conceptual model for demonstrating the transformation is meaningful | -Specific description of input system (the toolkit development) including information, layout of contents and relevant activity system through combining of the theoretical insights. | Chapter 6 |
| Deciding Feasible, desirable changes | -To evaluate whether new model is culturally feasible or symmetrically desirable for key users. | -Empirical research through participatory workshops and interviews which tests the feasibility: Mixed design research using task analysis, survey and participants' workshop activity observation. Interviews with professionals and educators | Chapter 7 |
| Action to improve the problem situation | -To prepare and improve for the implementation of changes | -Based on the feedback from participatory workshops and interviews, the toolkit was improved and prepared for distribution in the real world. | Chapter 8 |

Chapter 5: **Soft System Methodology (SSM) In Actions:**

**Stage One to Four**

## 5.1 Introduction

Chapters 2 and 3 offered useful insight for understanding the current status of sustainable fashion and how other research has addressed the challenges of this area. In this chapter, two preliminary studies were conducted to identify and understand the problem situation in the real world, involving novice designers (undergraduate fashion design students), professional fashion and textile designers, design consultants and researchers and the general public. This primary research was used to build a clear research objective which allowed elucidation of how different actors considered sustainable fashion and identified the challenges of sustainable production and consumption in their daily activities. The data was collected using two online surveys from both a public group and a fashion design involved group. The findings of the results facilitated the development of 'Rich Pictures' in order to clearly identify the problem situation. The results were also used to build a root definition for the activity system. The structure of chapter five is shown in Figure 5.1.
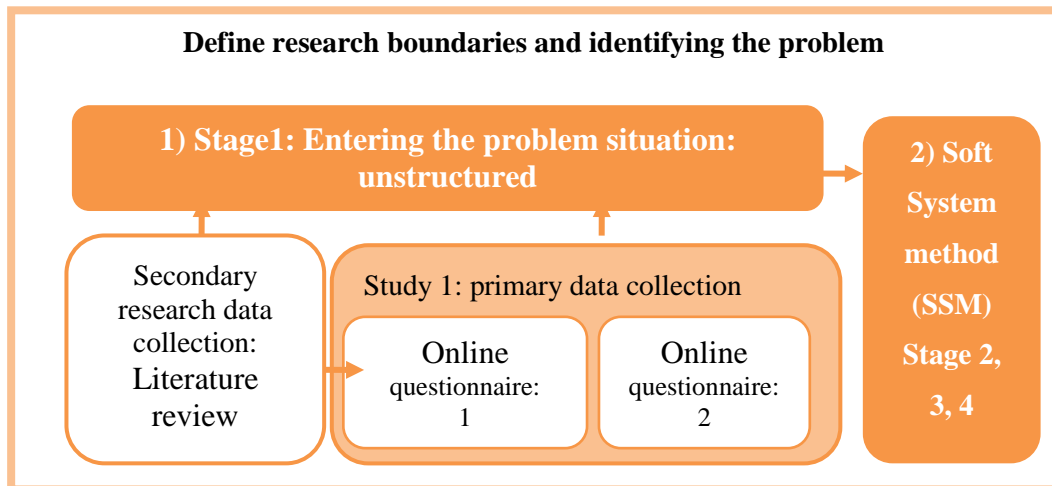


**Figure 5.1: Structure of chapter five**

## 5.2 Study 1: Public views for sustainable fashion

### 5.2.1 Profile of respondents

A total of sixty-seven people responded to the online survey. Of these, fifteen were not fully answered and were therefore not included in the analysis. It appeared that the more environmentally conscious public tend to provide their opinions. The profile of the respondents in this survey is shown in Table 5-1.

**Table 5-1: Profile of respondents**

| Profile of respondents | |
|---|---|
| Age range | 18~20- 2,  21~29-23,  30~39-27 |
| Gender | 32 Female, 20 male |
| Profession | Business associate professionals (finance and marketing etc.):10 |
| | Education associated profession also  including students:32 |
| | Government organisations and service sectors:4 |
| | Art and creative sectors (photographer, florist and interface designer):5 |
| | Unemployed:1 |

From the profile of respondents illustrated in Table 5-1, the participants included 32 females and 20 males. Respondents' occupations varied ranging from business associate professions to government organisations and service sectors. However, most respondents were students and from education associated professions. Their ages ranged from 18 to 38. Respondents took part in this survey voluntarily. Therefore, most of the participants had a tendency to have some interest in sustainability.

Participants were asked the question 'How many years have you been interested in sustainability in the area of fashion and textile design?'
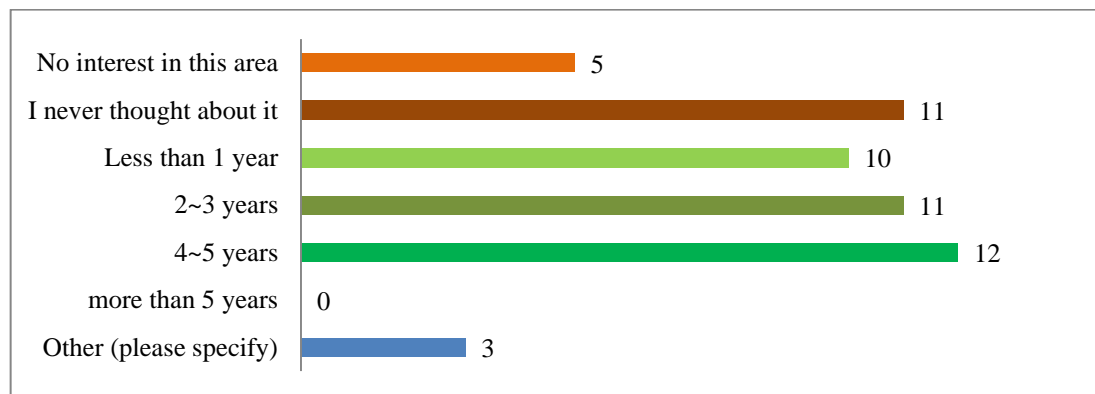


**Figure 5.2: Periods of respondents' interest**

According to the results, 5 respondents replied 'No interest in this area', 11 people were 'Never thought about it', 10 for 'Less than 1 year', 11 for '2-3 years', 12 people indicated '4-5 years' and no one responded 'more than 5 years interest'.

3 people indicated that they had no particular interest in fashion and textiles but a broad interest in sustainability as a whole. Overall, the results indicated that there is

high interest in sustainability; a total of 36 respondents (69%) showed their interest in sustainability and 16 people (31%) indicated no interest or not much thought about this area. The period of interest in sustainability in fashion design was mostly less than 5 years. It is recognised that the respondents' level of interests has peaked in sustainability in fashion in the last five years.

## 5.2.2 Understanding respondents' familiarity levels with sustainable fashion

The next section was intended to identify the sustainable fashion familiarity level amongst respondents. The specific question was 'Please indicate your familiarity level in the following environmental and social impacts of textiles and clothing'. Five-level Likert- scales were applied to measure the degree of familiarity: 1 for 'Less familiar, 2 for 'Slightly', 3 for 'Moderately', 4 for 'Familiar' and 5 for 'Very Familiar'. Figure 5.3 shows the respondents' degree of familiarity regarding a list of sustainability issues in fashion design.
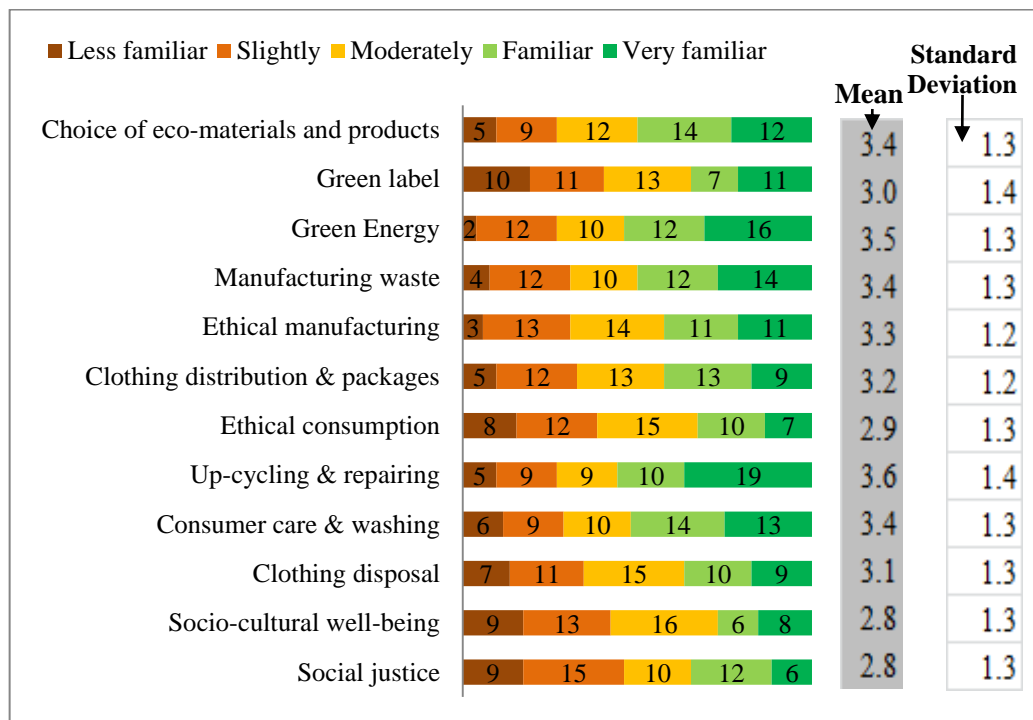


**Figure 5.3: Respondents' level of familiarity to sustainable fashion**

The measure of the central tendency of a familiarity level indicated that there is high familiarity ranking in 'Up-cycling & repairing', followed by 'Green Energy' with the third highest ranking being 'Manufacturing waste' and 'Consumer care &

washing'. There is low level familiarity with 'Social justice' and 'Socio-cultural well-being'. The next lowest ranking was ethical consumption. It recognised that there is relatively low level familiarity on the social side of sustainability and ethical consumption.

There is high standard deviation on the lists such as, 'Green label' and 'Up-cycling & repairing'. It appeared that the degree of spread of answers from the respondents is large. Some people were 'very familiar' about these lists and others were 'less familiar' or 'slightly familiar' and respondents' perspectives were relatively spread out.

### 5.2.3  Degree of attitudes and actions for sustainable fashion

The next question was 'How do you regard sustainability in the area of fashion and textile design?'
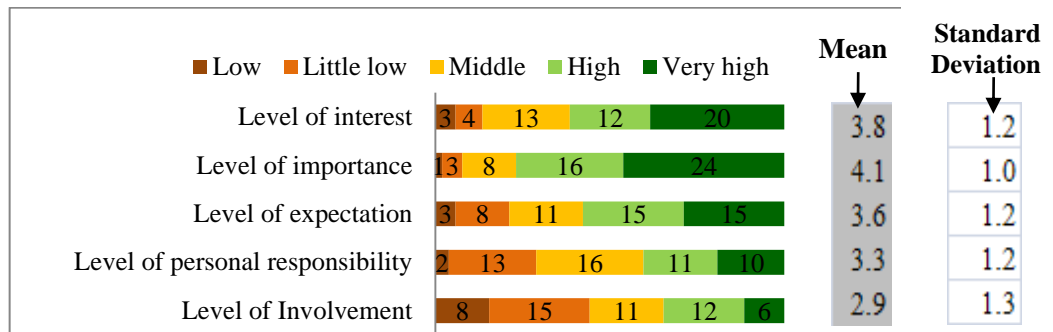


**Figure 5.4: Level of respondents' attitudes towards sustainable fashion**

As the Figure 5.4 shows, there is a high level of importance attached to sustainable fashion by respondents, followed by their interest level in the area. By contrast, the level of involvement and personal responsibility were relatively low compared with their considerations of importance and interest levels. Accordingly, it was indicated that even if respondents consider sustainability as an important issue, their involvement and action could differ. Regarding standard deviation, 'Level of involvement' had relatively higher standard deviation, which indicated the involvement level is much more variable than the level of importance. While, there is low standard deviation in 'Level of importance' that reflected a higher degree of respondents agreement with one another.

In order to obtain a more detailed perspective, open-ended options were integrated at each section which showed their specific area of interest, importance, expectation, personal responsibility, involvement and design implementation.

- **Respondents' areas of interests**

Open-ended responses revealed that respondents' interests varied depending on their awareness of specific areas. For example, one respondent commented that '*My understanding of sustainable clothing was whether it is recycling fabrics or materials or whether products are made from recycled goods.*

Most respondents showed their interest in the production side of sustainability such as recycled materials, waste, toxins and chemicals from factories and eco-friendly ways of manufacturing and production, child labour and hanger recycling.

- **Specified areas of importance**

Consideration of specified importance had similar comments to their specified interest areas, as shown above. Some respondents reported emphasis of business sustainability. One respondent reported importance of fashion company involvement in sustainability. *'I think sustainability is often unconsidered by big fashion companies'* Likewise, other interests were reported like initiation of fashion brand sustainability such as 'Brand sustainability rating and sustainability initiation, such as Plan A by Marks and Spencer.

- **Specified areas of expectation**

Regarding specified expected areas, many respondents reported the initiation of government regulation, fashion brand sustainability, versatile product sustainability, process of design sustainability, trustworthiness and safety and reducing environmental impact. Table 5-2 illustrates respondents' specified areas of expectation.

**Table 5-2: Respondents' specified expected area of sustainable fashion**

| Category | Specific area of expectation |
|---|---|
| Government support and business sustainability | *'I would expect all companies to take ethical interest in the environment and sustainability, build t a strong law in the area of government and business for a sustainable world'* |
| Sustainable product design | *'Versatility, fashionable design but does not quickly degrade'.* <br> *'Things lasting a long time'* |
| Process of design sustainability | *'Designers may be aware of the "green label" but may not understand the full extent of material selection'* <br> *'Local textile makers need to acknowledge what the modern market wants, otherwise demand & supply cannot be matched'* |
| Trustworthy | *'Sustainable design companies fulfil their promises'* <br> *'I see sustainability as important but I don't see the industry changing'* <br> *'I have high expectations of sustainability in fashion/textiles but I think we are a long way off'* |

| Safety and environmental protection | *'I wish there was more awareness to what is safe'*<br>*'global warming'* |
| --- | --- |

- **Specified areas of involvement and personal responsibility**

For the specified 'personal involved areas' and their 'personal responsibility' there were similar comments.  As shown in figure 5.4, the level of involvement and responsibility were relatively low, as not many respondents described their specified area of involvement or responsibility. However, respondents reported challenges and barriers for integrating sustainability in their daily life.

One respondent claimed that there are limited choices for sustainable clothing. *'I would like to involve sustainability; however there are many limitations for sustainable clothing. So I do not make an effort.'*

Similarly, other respondent made a comment about the lack of sustainable product choices. *'I try to buy sustainable products but sometimes there is no choice.* This reflected the importance of various options for sustainable design products. Participants considered that sustainable products are often dull and not very attractive. A further challenging point appeared as even though respondents considered sustainability as an important issue and want to purchase sustainable products as much as they can, their actual behaviour can be led by economic benefit. One respondent commented that *'I recycle as much as I can as an individual contribution even at the household level but unfortunately led by price often'.*

Nevertheless, some respondents also reported their contribution for sustainability such as buying second hand clothing, recycling old clothes and purchasing of green products.

Some respondents showed their future intention for involvement.

*'Not very involved at the moment but with more education and awareness about this matter, I would like to'.*

On the other hand, one respondent portrayed the current situation of sustainability and overall responsibility.

*'Designers may not be concerned with the source of the material; the manufacturers may not feel pressurised to use ethical products while the consumer will know very little about the sustainability of the product'*

## 5.2.4 Disposal decision after use

The next question was to identify respondents' disposal behaviour after use. The list of disposing methods was provided to respondents and some respondents indicated their specific clothing disposal decision. The question was 'How do you dispose of your unwanted clothing after use? (Please specify your frequency)'.
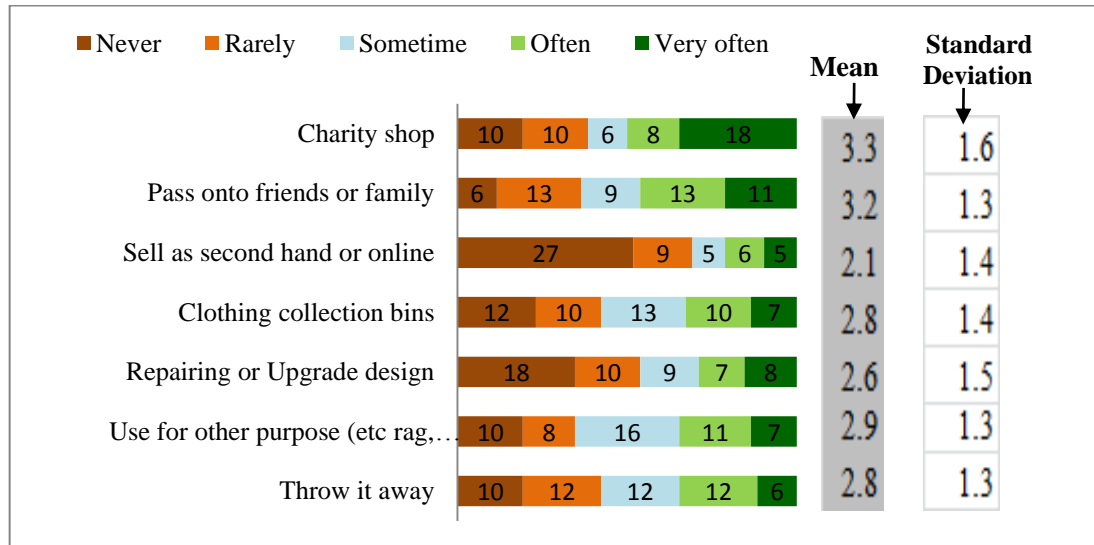


**Figure 5.5: Respondents' clothing disposal decision after use**

The mean value and standard deviation of each disposing method is shown in the Figure 5.5. The charity shop was reported as respondents' preferred clothing disposal method; however, the result showed there is a relatively high deviation value. It appears that respondents' viewpoints were spread out over a broad range.

The next disposal method was 'Pass onto friends or family'; third was 'Use for other purpose' and fourth was 'Clothing collection bins'. 'Sell as second hand' and 'repairing or up-grade design' are relatively low ranking.

Among 52 respondents, 6 reported 'very often' disposing of clothing in rubbish bins, 12 admitted 'often', 12 said 'sometimes', 12 showed 'rarely', 10 reported 'never'.

Considering their interest levels (Q3; Figure), respondents' actions do not always follow their level of stated interest. Some respondents showed strong interest in sustainability in question 3; however their disposal method of throwing fashion items into rubbish bins was selected as 'often'. This result shows the respondents' 'attitude and behaviour gap' in this question.

Some respondents provided valuable information for other specified methods for clothing disposal decisions such as '*I store a lot of clothes*', '*Clothes Swap Events' and donation.*

## 5.2.5 Factors for disposal behaviours

What kinds of reasons influence you when disposing of your clothing?
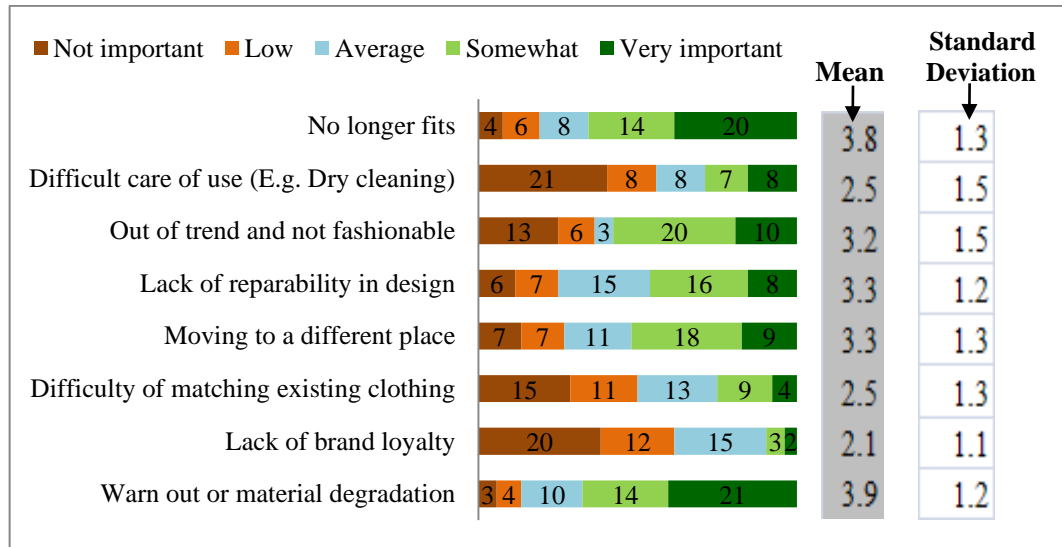


**Figure 5.6: Respondents' motives for disposal behaviours**

As shown in the Figure 5.6, respondents claimed that the distinctive influences for disposing clothes were 'Worn out or material degradation' and 'No longer fits'. As many respondents were relatively environmentally conscious, it seemed that functional factors are very important to them. There is lower ranking on the 'Lack of brand loyalty' and the next two most cited reasons were 'Difficult care of use' and 'Difficulty of matching existing clothing'. Accordingly, these factors had lower agreement from respondents and these did not much affect respondents' disposal behaviour in this survey. 'Lack of repair-ability in design' and 'Moving to a different place' also had reasonably high ranking for disposal behaviour. Both categories had the same value but 'Moving to a different place' had a slightly higher standard deviation. This result indicated that the each value is relatively spread and respondents had more varied perspectives than elsewhere. Comparatively, the 'Out of trend or not fashionable' option had high value of meaning but standard deviation had a higher ranking. It implied that some people considered 'Out of trend or not fashionable' clothing would be very important factors for disposal behaviour while others did not. Meanwhile, not many respondents suggested other factors for disposal behaviour but one respondent stated the other reason for disposal behaviour as *'Stained or damaged beyond repair'*.

## 5.2.6  **Individual responsibility for sustainable consumption**

The final question was 'Have you considered your individual responsibilities regarding sustainable consumption?'
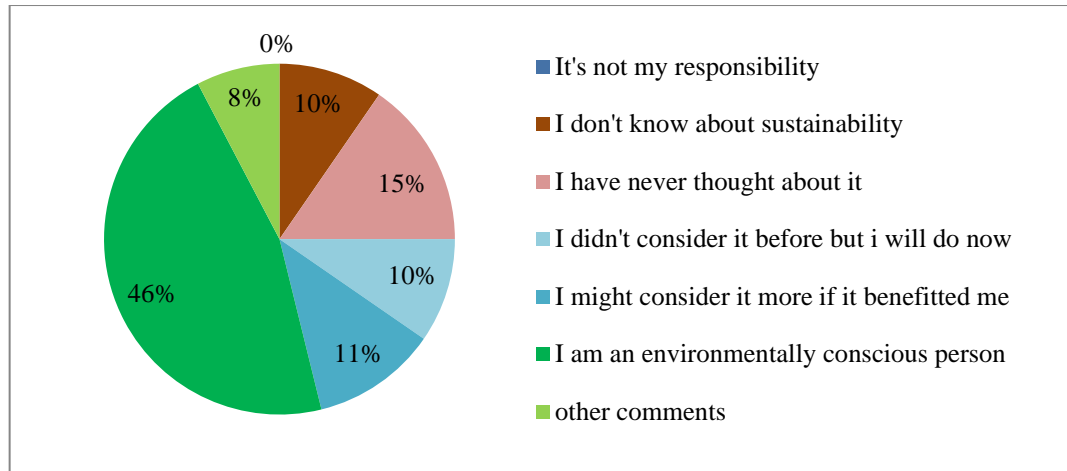


**Figure 5.7: Degree of respondents' individual responsibility for sustainable consumption**

46% of respondents reported that they are 'An environmentally conscious person', 11% stated 'Might consider it more if it benefitted me', 10% marked 'I didn't consider it before but I will do now', 15% indicated 'I have never thought about it' and 10% stated 'I don't know about sustainability'. No one claimed 'It's not my responsibility'. It appeared that there is potential inclination for practicing more sustainable consumption by respondents if a benefit is provided to them. Another interesting point is that 10% of respondents did not consider sustainable consumption before but are willing to act after taking part in this survey. Although the survey was intended to gather perspectives from the public, it seemed that some respondents had some motivation for sustainable consumption when information was provided. Thus, an effective information and communication method could motivate people more to be involved in their own actions. Similarly, there is some willingness for individual contribution to sustainable consumption as long as some organisation supports public daily activities. One respondent reported that *'I would like to be more responsible if there were any cooperation campaigns, but still these seems few in my culture and society. Just in my personal view'*

Meanwhile, other respondents provided a viewpoint that personal life style could be more involved in sustainable consumption even if they were not a particularly environmentally conscious person. One respondent commented that

*'I wouldn't say I am an environmentally conscious person but I don't like wasting resources so I tend not to have anything in excessive amount or dispose of anything*

*before they are worn out or broken anyway'.*

## 5.3  Summary of results from study 1

In summary, it was shown that there is apparent recognition amongst respondents of the significance of sustainable fashion. It also identified some of the challenges that exist to facilitate sustainable production and consumption.  One obstacle found was that although respondents were concerned about the sustainable issue, this was not translated to their actual involvement and daily activities. This 'attitude and behaviour gap' could lead to potentially significant impacts on their decision for overall consumption including the purchase, use and disposal process.

Further major barriers indicated that there are limited options for sustainable fashion. Some respondents considered green products are often not attractive or have limited options and other respondents reported that their actual decision was often led by cost.  Expectation of sustainability was relatively high and emphasis was placed in supply side roles such as the initiation of strong government regulation, fashion brand sustainability, engagement of stakeholder sustainability, trustworthy and versatile sustainable products from fashion companies.

Although respondents showed high interest in sustainable fashion, overall the level of agreement with sustainability issues in fashion were found to be low. This is likely to be because of a lack of awareness and specific knowledge of sustainable fashion.

The disposal decision after use for clothing indicated that donating to a charity shop was the respondents' preferred method. Other studies (Domina and Koch, 2002; Bristwistle and Moore, 2007) showed that the decision to donate clothes to charity was often determined by convenience (e.g. location of clothing collection bins) which plays a significant role in influencing environmentally friendly behaviour. The second most popular option was to ''pass onto friends or family'. Previous studies (Mintel, 2007; Bristwistle and Moore, 2007) demonstrated that high quality clothes are often more likely to be retained, although they may no longer be worn. Young people tend to purchase fashion garments more frequently than older people and prefer to purchase several cheaper fashion items than one more expensive piece. Equally, females are more trend sensitive than males. Older consumers have a tendency to wear clothes that are no longer wearable and that may be thrown into

the rubbish bin or used as rags or for other purposes (Bristwistle and Moore, 2007). As supported by other studies, high quality clothes tend to be utilised in other options such as being passed onto friends or family, given away to clothing collection bins for recycling, sold as second hand and repairing or up-grading the design. The repairing or up-grade design option could be influenced by cost related issues and personal skill level for mending and upgrading.

Factors for disposing garments are significantly involved in 'intrinsic factors' such as quality-related issues and unsuitable fitting, which influence the disposal decision. This evidence is supported by the Domina and Koch (2002) study which showed that the consumer tends to discard clothing because of wear and tear. Consumers have a tendency not to discard garments if alternative methods are provided. Damaged clothing is usually utilised for different purposes such as rags or repairing or up-grading for the same purpose (cited in Laitala and Boks, 2012).

Psychological factors (out of trend or not fashionable and taste-related unsuitability issues) also considerably influence the disposal behaviour. Young respondents tend to be more influenced by psychological factors than older. Similarly, females are more fashion oriented than men.

Situational factors (moving to a different place, changed body size, difficulty of matching existing clothing) are also regarded as relatively important issues for influencing the disposal decision. These factors could be affected by a user's personal life style or situational change.

Overall, consumer disposal factors can be moderated in the design and production stages. Although sustainable consumption activities, including use and disposal processes, are more related to consumer behaviour, the survey results have shown that consumer disposal activities are also significantly related to the design and production processes.

As discussed in chapter 3, consumption and production processes are not completely isolated. The intrinsic factors (quality related issues and functional values) could be resolved in the design stage through selecting quality controlled materials. The problems of fitting could be addressed by designers and pattern makers in order to increase the lifespan of clothes (Laitala and Boks, 2012).

Furthermore, designers could extensively support the psychological factors and symbolic values including emotional, aesthetic, expressive qualities through improvement of physical, technical and symbolic value of clothes. The use phase can be extended by harvesting environmental and social benefits (Fletcher, 2008; Laitala and Boks, 2012).

Situational factors can be resolved through utilising the swap and share events, development of up-datable or repairable design and services and increasing flexibility of design (e.g. utilisation of minimum inventory and maximum diversity of styling combination). The survey result shows that the updating and repairing options were not actively facilitated by respondents. However, development of infrastructure of user engagement in the design process could be encouraged by designer.

Overall, the consumption process can be supported by the designer to move towards a more sustainable way. However, without consumer awareness, consideration and engagement in sustainability, sustainable consumption would not be realised. The survey result showed that respondents were less familiar with ethical consumption and the social side of sustainability, but it also appeared that there is a potential inclination for practicing more sustainable consumption. Designers could significantly support overall sustainable consumption and consumer decision through providing alternative values, design options and persuasive information, in order to cultivate co-creative sustainable actions by the general public. This could be achieved by observing consumer behaviour and identifying their challenges and then providing better values and options.

## 5.4 Study 2: Fashion involved peoples' perceptions

### 5.4.1 Respondents' professions

A total of fifty eight people responded to the second survey. Eight people did not fully answer the survey and these were excluded from analysis. Survey respondents were involved in fashion design, including designers and managers from the fashion industry, fashion design scholars, sustainable design researchers and fashion design

students. The sample was collected from members of 'the sustainable fashion network' in LinkedIn and a convenience sample from professional designers and educators and fashion design students. Similar to the previous questionnaire A, respondents participated in the survey voluntarily. Therefore, respondents were more environmentally conscious people than the general population who are involved in the fashion and textile design sector.

Figure 5.8 illustrates the respondents' specific professions. Among 50 respondents, 26% were professional designers from the fashion industry, 36% were fashion and textile design students or relevant fields, 10% were scholars in the area of sustainable design, 16% were from the academic or educational area in fashion and textile design, 6% from manufacturing and production side and 6% from the marketing side.
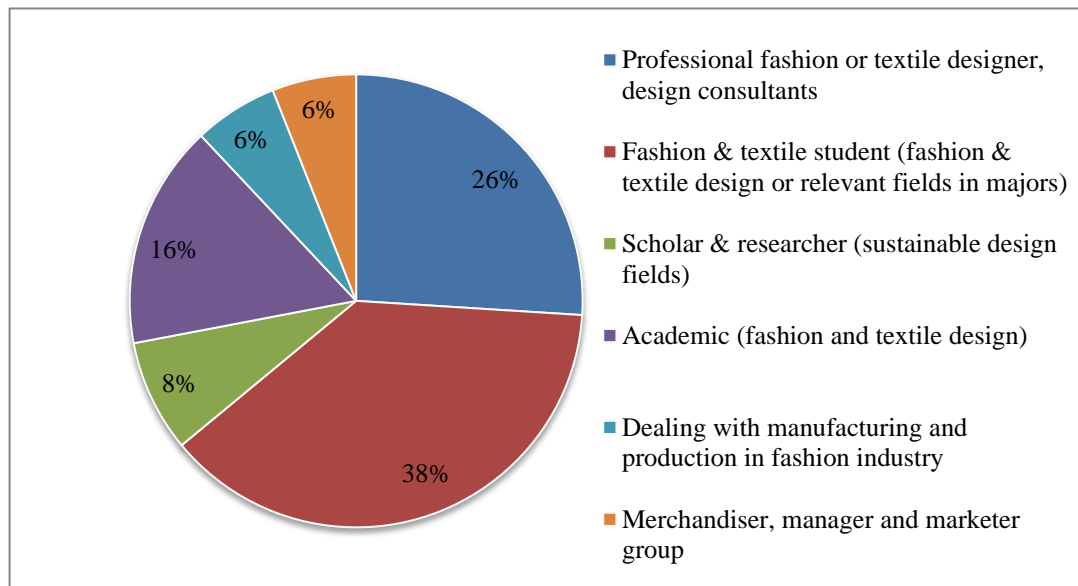


**Figure 5.8: Questionnaire 2: Participants' professions**

## 5.4.2 **Respondents' attitudes towards sustainable fashion**

The next section contains seven different statements regarding participants' attitudes towards sustainable fashion. The objective of this question was to identify the landscape of sustainable fashion design activities among respondents.
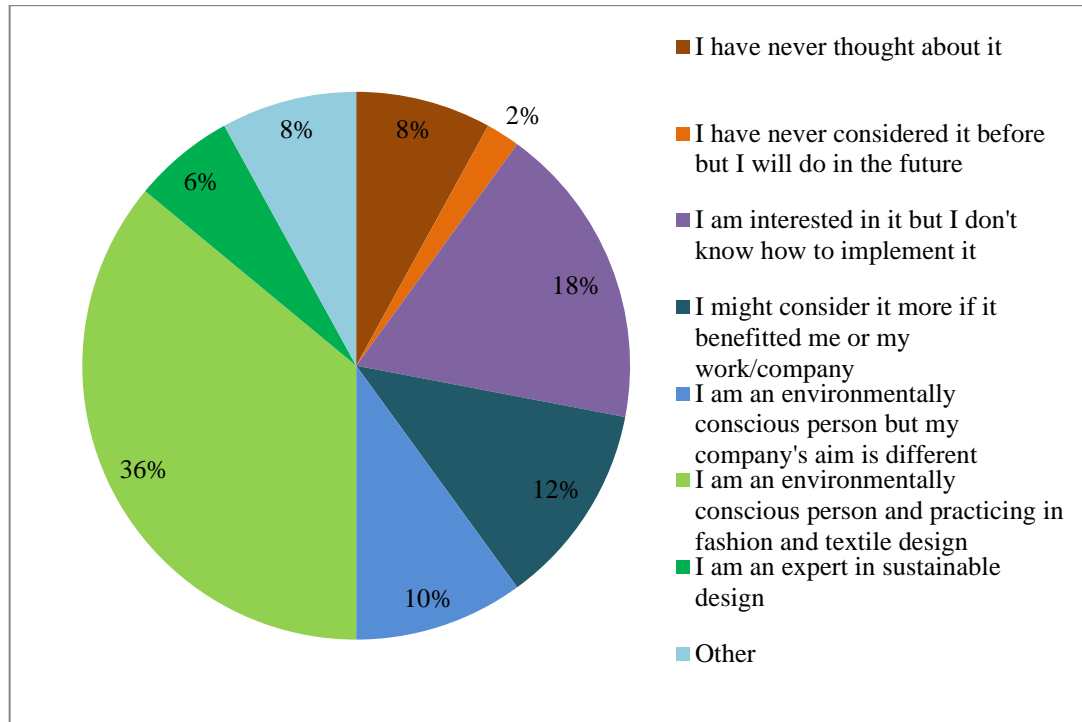
**Figure 5.9: Respondents' attitudes towards sustainable fashion**

The results (see Figure 5.9) showed that 36% self-declared as environmentally conscious and practicing in their designs. 6% responded they are expert in sustainable design. 10% were environmentally conscious people but the aims of their companies were different.8% of participants indicated that they had never thought about sustainability in fashion and textiles and 2% replied had never considered it before but they would do in the future. 18% responded that they were interested in it but unsure of how to implement it. 12% were willing to adopt it if it benefited them. 8% commented in 'other' which indicated the consideration of environmental issues when they purchase fashion products'.

### 5.4.3 Understanding degree of awareness and practicing area

The next question was aimed to discover participants' degrees of awareness and their practicing area of sustainability. This question provided 17 different sustainability issues in fashion design.
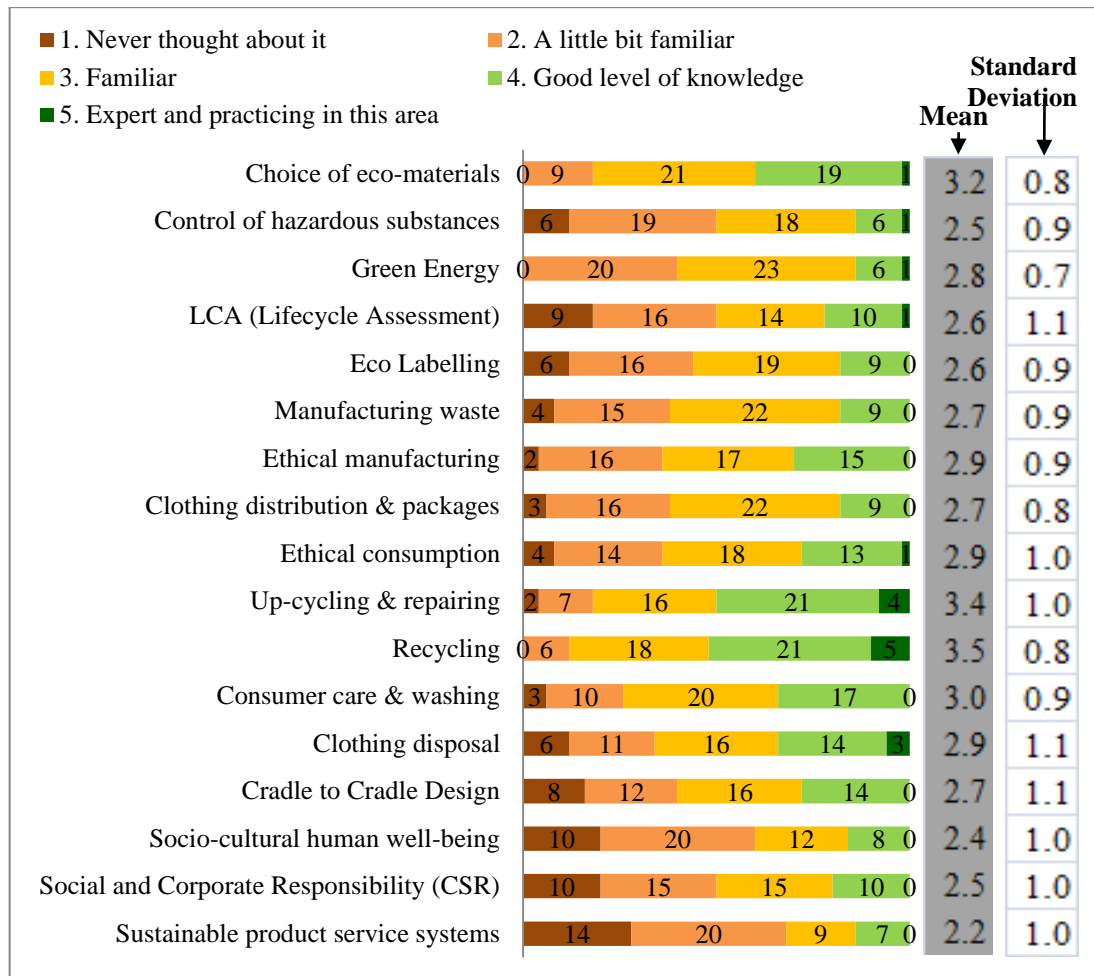
**Figure 5.10: Awareness level of sustainability in fashion from participants**

As the data shows above in Figure 5.10, recycling, up-cycling & repairing and choice of eco-materials ranked the top three of the higher awareness levels. The lowest awareness level in this category was 'Sustainable product service systems' followed by 'Socio-cultural human well-being'. It was indicated that these categories had a relativity low level of awareness and were not being performed much by respondents. With regard to standard deviation, Life cycle assessment, clothing disposal and cradle to cradle design were higher ranking. This indicated that some people are well aware of these lists and other people have 'never thought about it' or were not familiar with these categories. On the other hand, 'Green Energy' and clothing distribution & packages were in high agreement for relatively low level of awareness and practice. 'Choice of eco-materials' and' Recycling' had low standard deviation as high level of awareness and performing fields. In the previous question, fifty percent of respondents considered themselves as sustainable designers who practice in sustainable fashion. However, their specific implementations and current performances appeared relatively low.

### 5.4.4 **Degree of attitudes and actions for sustainable fashion**

In the second section, participants were asked about the level of importance in sustainability amongst fashion and textile designers. As we can see in Figure 5.11, sustainability in fashion and textile design was considered very important and also the interest level was also relatively high, however their involvement level and priority in design implementation were relatively low compared with their considerations of importance and interest levels.
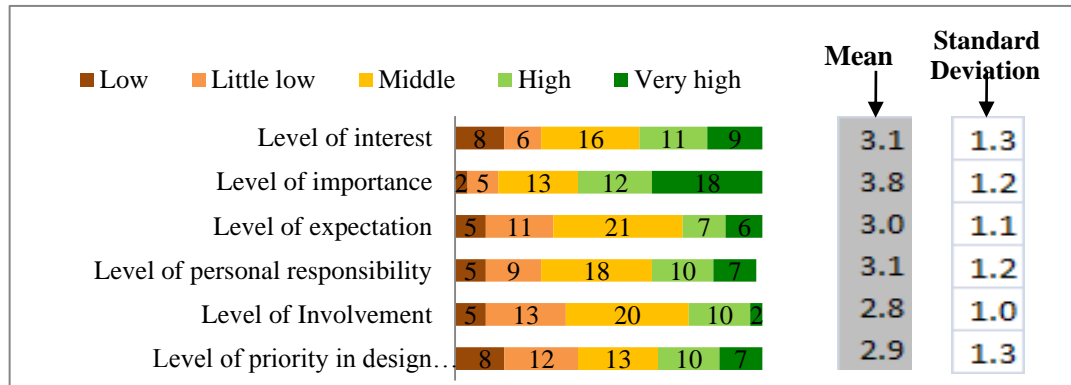


**Figure 5.11: Degree of attitudes and actions for sustainable fashion**

Among all participants (N=50), 18 people marked very important and 12 respondents reported important. Only 2 participants indicated a low level of importance about sustainable fashion. Most of the respondents had a very high level of concern about the issues. Whilst, it was recognised that respondents marked a relatively lower level of involvement, in comparison to their importance in sustainable fashion. 2 people were involved at a very high level, 10 people indicated the high involvement level, and 20 respondents chose neutral attitudes. There are high standard deviations in the level of interest and priority in design section. Some respondents have high agreement of interest and implement on their design process and others do not.

The same procedure was used as the previous study; an open-ended comments section was integrated to gather more in-depth perspectives. Open-ended responding showed that, depending on their background knowledge and their position at work, their interests and importance of the area of sustainable fashion varied. For example, designers are relatively more considerate about material choice (e.g. recycled materials and renewable materials), eco-friendly ways of manufacturing, up-cycling of old clothes, child labour and the throwaway fashion culture. On the other hand, managers and manufacturers are considered to expend energy such as

water and toxic materials, wastes and chemicals from the factories and consider the sustainable manufacturing of textiles. Further consideration was the importance of economic benefits and the implementation of sustainability in the marketing sector.

Respondents from the academic group gave emphasis to the importance of integration of sustainability at the very beginning of the design process, systems thinking and design action on sustainable fashion design practices from a holistic viewpoint. One participant reported that *'Design is the usual basis upon which the processes of the manufacturing chain and marketing can be brought together to think and respond in a harmonious way using the same framework or system of thinking and action'*. Another respondent from the academic group stated that *'Textiles and fashion are of high level importance in terms of economy and environmental impact and this needs to be addressed across all nations involved in these related activities and practices'*.

Regarding the involvement level in sustainable fashion, respondents also made comments on the significance of involvement in sustainable design actions. One participant reported that *'people are happy to talk but less happy to actually do'*.

Other respondents claimed the importance of designers' involvement for sustainable design practices. *'For some designers it is more important than others! Many companies (particularly large companies) are not set up to incorporate sustainability into their product manufacture and life cycle'*.

While, although levels of personal responsibility were not of high rank in comparison to their interest levels, some participants reported critical viewpoints for individual responsibility in personal daily action. For example, one respondent stated that *'Without some level of personal responsibility and consciousness then it is likely not to be taken on board by large organisations with beneficial effect'*.

## 5.4.5 Challenges for sustainability in fashion design

The next section was to identify the barriers and challenges to the adoption of sustainability in fashion and textile design. The question was 'What barriers and challenges have you faced in adopting sustainability in relation to fashion and textile design?' Although a previous question was linked to the challenging viewpoint of incorporating sustainability into fashion design, the question was particularly to identify and measure the degree of their view point and collected their personal

experiences through using open-ended comment sections. Figure 5.12 illustrates the degree of respondents' challenges and barriers to adopt sustainable fashion. A five pint scale from strongly disagree to strongly agree was applied to gauge a degree of challenging points from each category.
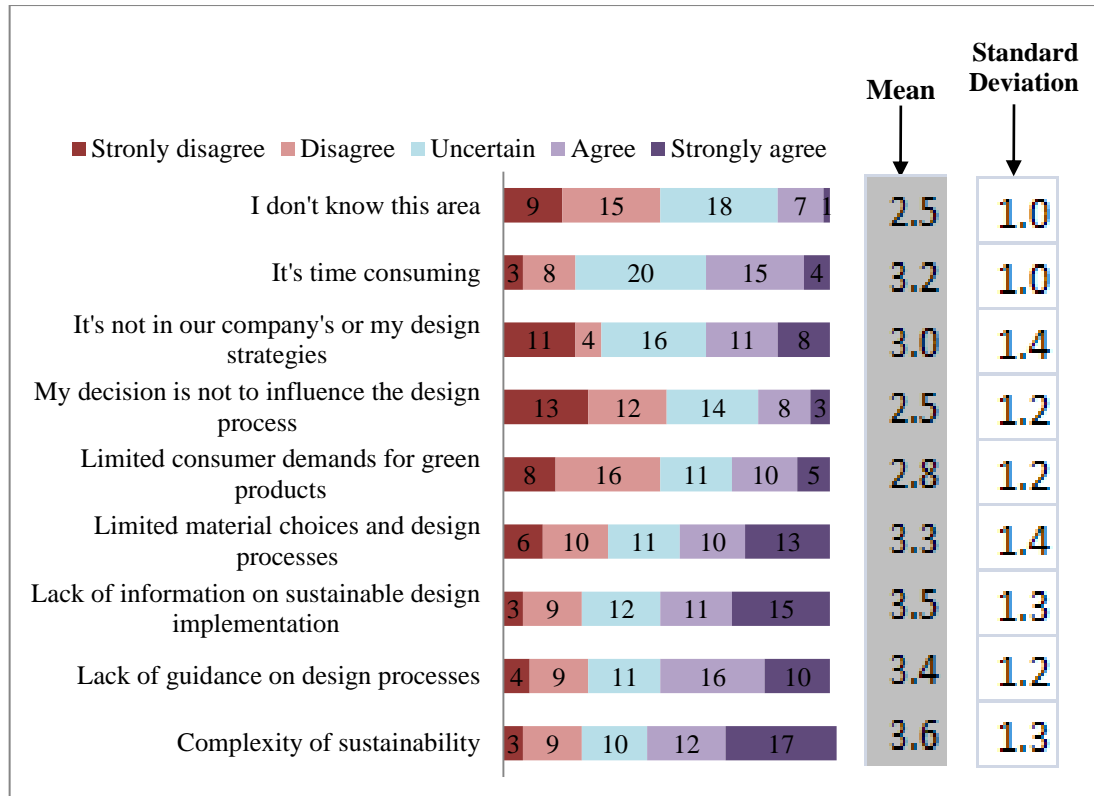


**Figure 5.12: Level of challenges adopting sustainable fashion**

According to figure 5.12, the complexity of sustainability was indicated. The highest agreement was on the challenge to integrate sustainability into design practice. Second highest rank was lack of information on sustainable design implementation. Third was the lack of guidance on design processes and next followed the limited material choices and design processes. As figure 5.14 described a number of people disagreed 'My decision is not to influence the design processes and 'I don't know this area'. The interesting point was recognised that although respondents tend to be aware of sustainable fashion design, the complexity of sustainability makes it a challenge for them to tackle appropriate solutions. While, almost half of respondents indicated disagreement of 'My decision is not to influence the design process', which showed that 13 people strongly disagreed and 12 people disagreed. Limited consumer demands for green products also indicated disagreement showing that 8 people strongly disagree and 16 disagree.

There are high standard deviations on categories of 'limited material choice and

process' and 'not my company or my design strategy'. Both results indicated that many respondents have different perspectives on these statements. Some respondents consider it as a challenging point while others do not.

To acquire rich viewpoints for these challenging points, opened-responses were integrated in this section. It is recognised that there is internal and external obstacles the adoption of sustainability in fashion design.

One respondent from the fashion industry reported on a lack of consumers' awareness for sustainable design or products.

*'I owned a shop last year that sold quality British made garments, that where all one offs and made from up-cycled materials. Most of our customers thought our clothes because they liked the design and a lot of the times were not even aware of the importance of sustainable design. Awareness needs to be increased'.*

Similarly, other respondents also made comments about insufficient awareness of sustainability from consumers and challenging points for demand and supply issues. *'In industry production tends to be consumer driven and cost based'.*

On the other hand, internal barriers also were indicated. In previous section, the majority of respondents considered that their decision is important and influences the design process however some respondents reported some internal barriers for sustainability in fashion design. One respondent from the professional fashion designer group commented that *"Sustainability is not high priority in fashion design. Real design practices are mostly influenced by fashion trends related to aesthetics such as colour and shape'* Other participants also commented *'In design practice, designers respond to design briefs from clients and have very limited space for sustainability if the company do not ask for this".*

Indeed, these challenging points illustrated that sustainability issues need to be addressed by both consumers and industry. If consumers have more awareness of it, they would ask for more green products and the fashion industry could adopt more sustainability in their design processes. Although this survey was collected from a non-consumer group it still reinforced the view that fashion design involved people desire increased awareness of sustainability among the consumer group.

Furthermore, there is tendency to burden designers when they want to adopt

sustainability into design practices. Especially if a company's ethos does not target sustainability in design, it is hard to implement into design practices.

### 5.4.6 Sustainable design tool use

In the next section, participants were asked the question 'have you used any sustainable design tools previously when integrating sustainability in your design process?' Amongst 50 respondents, 70% (28 people) replied 'No' and 30% (12) replied 'Yes'.

30% of tool users were mostly from the academic area including sustainable design researchers, fashion design teachers, while most of design practitioners replied NO. Many practitioners were not much aware of existing sustainable design tools or relevant resources. Among 30% of tool users asked to specify what kind of tools they used for design implementation. Depending on the role of their job, their experiences of existing tool use were different. For example, one sustainable design researcher indicated tools such as product lifecycle analysis, eco-indicator, good design checklist, Eco-design Web, Design Abacus. While fashion design educators often used case studies, life cycle framework, new materials analysis in order to provide mixture of theory into practices. One participant from academia commented that *'In teaching we design briefs with sustainability in mind if it is relevant and to make students more aware'*

Although not many design practitioners revealed their experiences of tool use, some respondents commented on the use of eco-materials and different design technologies such as laser cutting, digital printing and sonic bonding. Design practitioners commented that a sustainable design tool could be a practical solution to integrate sustainability in their design implementation. They tended to not have much awareness of existing sustainable design tools.

### 5.4.7 Useful resources for sustainable design practices

The next question was 'What can be a useful resource for you when you adopt sustainability in apparel design practices? (Tick all that apply)
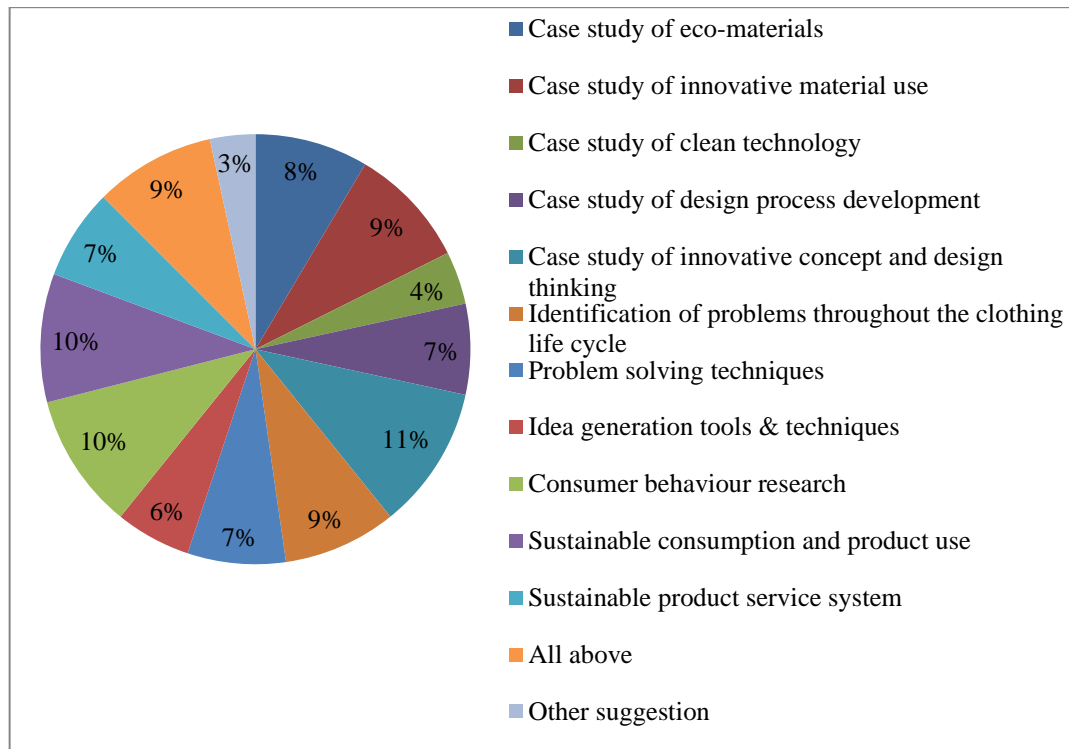
**Figure 5.13: Useful resources for sustainable fashion design from respondents**

There was no distinct preferred resource for specific areas; respondents considered that most sections can be equally useful for integrating sustainability in apparel design practices. The higher ranking was 'Case study of innovative concept and design thinking' and next section was 'consumer behaviour research' and 'sustainable consumption and product use'. As discussed in the literature review, not many design strategies or implementation exist for sustainable consumption. For this reason, it appeared that there is slightly higher ranking for 'consumer behaviour research' and 'sustainable consumption and product use'.

Other suggestions indicated the need for:

*'Very strong & keen knowledge about sustainable fashion and textile development as well as giving a very clear & easy understanding of the concept'*

*'Easy understandable and practical solutions for sustainable fashion'*

*'Enjoyable process or tool to apply in design'*

## 5.4.8  Respondents' definition of sustainable fashion

The final question was to identify how respondents define sustainable fashion. The question was 'How do you define sustainability and what is your current understanding of sustainability in fashion and textile design?' Among 50 survey respondents, 10 respondents commented 'not sure', 18 respondents provided short

sentences such as 'environmentally conscious design' 'No more waste and everlasting materials', 'extend life', 'eco-friendly products'. Another 22 respondents provided rich interpretations of their meaning of sustainable fashion regarding their own sustainability and goals. In the previous literature review in chapter 2, sustainability is considered as the inter-connection of environmental, economic and social elements. Most respondents from the designer group had the tendency to focus on the environmental sphere through reducing environmental foot printing and its practical actions.

On the other hand, some other participants from the sustainable design researcher or design manager groups tended to emphasise on the management side and interconnection of performance of environmental, social and economic aspects. It appeared that the interpretations of sustainable fashion varied depending on the area of certain roles.

Some definitions from designers were presented here;

- *I really don't have any clear concept about this but only understand one thing this is the thing which links textile & fashion design with eco-friendly lifestyle through using upgraded technology & techniques of the green concept'* -Fashion or textile designer

- *'My understanding of sustainable design was strongly influenced by books such as Cradle to Cradle and Emotionally Durable Design and also organisations such as Fab Lab'.* -Freelance designer and consultant

- *'To think about the life cycle of the textile and consider the recycling/waste management of the product while designing it'.*
  -Fashion or textile designer

- *'Fabrics/fibres produced in a sustainable manner printing fabrics in a sustainable manner washing fabrics disposing of garments correctly'*
  -Fashion & textile designer, design consultant

- *The garment is created without a trace and leaves without a trace. Everything that goes into it can be replaced for all eternity*- Fashion & textile student

- *Sustainability in design is when you are creating a product in a way that has the least negative impact on the environment, and produces a product that won't have a negative impact on the environment throughout the rest of its life cycle.* **-** Fashion & textile student

While, academic group or researchers tend to perceive the definition of The Brundtalnd Commission report (1987) and their interpretations of sustainability in fashion were;

- *'I tend to agree with the Bruntland report's definition of sustainability in 1987. There is a growing interest in sustainability in fashion and textile design in practice. However, there is a lack of tools to help designers to understand and implement it.*-Sustainable design researcher

- *A complex holistic framework to assist in providing guidance and measures in practice from design through manufacture to life cycle of products and recycle/up cycle at end of 1st life cycle. It's a way of thinking.* –Sustainable design researcher in fashion design

- *In its purest form it would necessitate that no process or resource used is detrimental to the environment or the people involved in the manufacturing / life cycle. Also, the product would have the lowest possible carbon footprint and would be 'invisible' after use, i.e. would be used up entirely, would be biodegradable etc.*-Academic from fashion design

- *'Meeting the needs of the economy, environment and society so that future generations will be no worse off than ourselves'*-MPhil PhD researcher

## 5.5 Summary of study 2

The survey result shows that although respondents considered sustainability as important issues, their specific implementation and main activities are predominately focused on the recycling and up-cycling area. It would need to widen to cover more effectively and also provide clearer problem points for designers in order to implement various strategies beyond the 'outside of box' approach. While a sustainable consumption approach was not actively incorporated by respondents they appeared, due to lack of implementation strategies, to tackle consumer behaviour by design led approach. There is higher demand for useful resources for 'consumer research' and 'sustainable consumption and product use strategies while, there is need for directions connected to design innovation and new strategies combined with design thinking.

Most of the respondents considered sustainability as an important issue but their design involvement and design implementation were relatively low. It required more

engagement in design practices and a need to provide practical benefits in order for practitioners to integrate sustainability in their daily design practices more.

Regarding experiences of existing sustainable tools, design practitioners were not much aware of them and had not actively used them. Designer led tools would be more effective. It also recognised that the complexity of sustainability make them challenges the incorporation of an appropriate solution. It required a simple and very clear way to understand the sustainable concept. Furthermore, the tool needs to integrate with the creative design process and trigger design innovation beyond measurement of clothing environmental impacts.

Finally, overall understanding of sustainable fashion was mostly considered as environmentally conscious design or environmental focused design considering the overall clothing life cycle. There is an emphasis placed on the interconnection of social and economic elements in order to create synergy for design implementation.

## 5.6 Discussion through use of SSM (phase 2)

The overall findings of qualitative and quantitative studies indicated that both the public group and the fashion design group involved revealed their lack of action and involvement in sustainability although both groups declared a high degree of importance of sustainability in fashion design. Table 5-3 presents a summarised classification of both the public and fashion design groups involved that express both positive and challenging aspects toward sustainable fashion.

**Table 5-3: Positive and challenging points for sustainable fashion**

| | Positive perceptions for sustainable fashion | Challenging perceptions for sustainable fashion |
|---|---|---|
| Public (Not involved in fashion) | -Considered as an important issue<br>-Preserving environment and resources are important for future<br>-Expectation is high to both business and government for sustainable world<br>-Green minded consumers are rising and many respondents considered themselves as 'environmentally conscious person'<br>-Willingness for active involvement in sustainable consumption | -Considered not as great an impact as other environmental issues<br>-Considered as mostly business side role<br>-Considered big fashion companies are not much involved<br>-Considered as long way to reach<br>-Not much aware of specific environmental impacts of clothing<br>-Choice limitation for green products<br>-Actual consumption activities are led by economic benefits<br>-Not much involved in sustainable behaviour in real life |
| Fashion design involved people | -Considered an important issue in fashion and textile design<br>-Rethinking design activities and improve way of thinking<br><br>-Sustainable fashion is considered as an emerging area and opportunity for new enterprise and innovation<br>-Sustainability is a critical part in business now, environmentally friendly, more eco-friendly designers are emerging<br>-Economic benefit and business opportunities through increasing productivity, creating design innovation and differentiation. | -Considered as often too complex area to tackle the challenges<br>-Considered as insufficient consumer awareness of sustainable fashion design<br>-Challenge to incorporate sustainability in fashion design due to balancing other design criteria and fast movement of fashion trends.<br>-Lack of awareness for the sustainable consumption in fashion and not much focusing on the consumption strategies<br>-Not sufficient implementation strategies for both sustainable production and consumption<br>-Not much aware of existing tools for sustainable design<br>-Sustainability is not a priority in process of design and fashion<br>-Not much involved in their real design practices |

As previously stated, although participants considered that sustainability issues are important aspects for our future life, there is also the challenging part that public groups tend to not be specifically aware of environmental and social impacts of clothing. As environmentally concerned public are also emerging, some participants revealed that they are trying to contribute sustainable consumption at household levels such as reusing clothing, donation of clothing and purchasing of green products. It was also indicated that their motivation is often led by economic benefits. One participant pointed out his view that he cared about what he chose,

used and made the most of value for money and tried to buy sustainable products but sometimes there were not much choice and limited sustainable product design options.

Overall, designers tended to be concerned about the sustainability in fashion design, particularly in selecting eco-friendly materials or up-cycling design. However, it appeared that design strategies need be extended towards more innovative solutions beyond the 'outside of box' approach in order to suggest various options for sustainable products. Further challenges were identified as the wide range of issues in sustainable fashion which made it challenging to focus on specific problems.

Furthermore, participations tended to perceive different boundaries of sustainable fashion and different priorities in sustainability issues. It appeared that defined issues or problem points in relation to fashion and textile design would be beneficial to the both public group and the designer group in order to communicate shared problem points and narrow down specific problems to find rich solutions during workshop processes.

Similar to the results from the public group, most respondents from fashion design involved people who showed their interest in sustainability and considered that it is an important issue for design. However, their actions in practice relatively did not reflect this. There is positive indication also recognised that they were willing to adopt sustainability in their practices as long as the process is easy to adopt and beneficial for their work.

As we discussed in chapter 4, the 'Rich picture' which utilises visual thinking allows users to understand the current situations but also the actors involved in the fashion design process. The findings can be illustrated by means of a rich picture as used in soft systems to identify the problem situation. Figure 5.14 shows the views made by respondents regarding sustainability in fashion and textile design and both positive and negative perspectives toward sustainable fashion. This rich picture is underpinned from the findings of the literature review and the primary studies
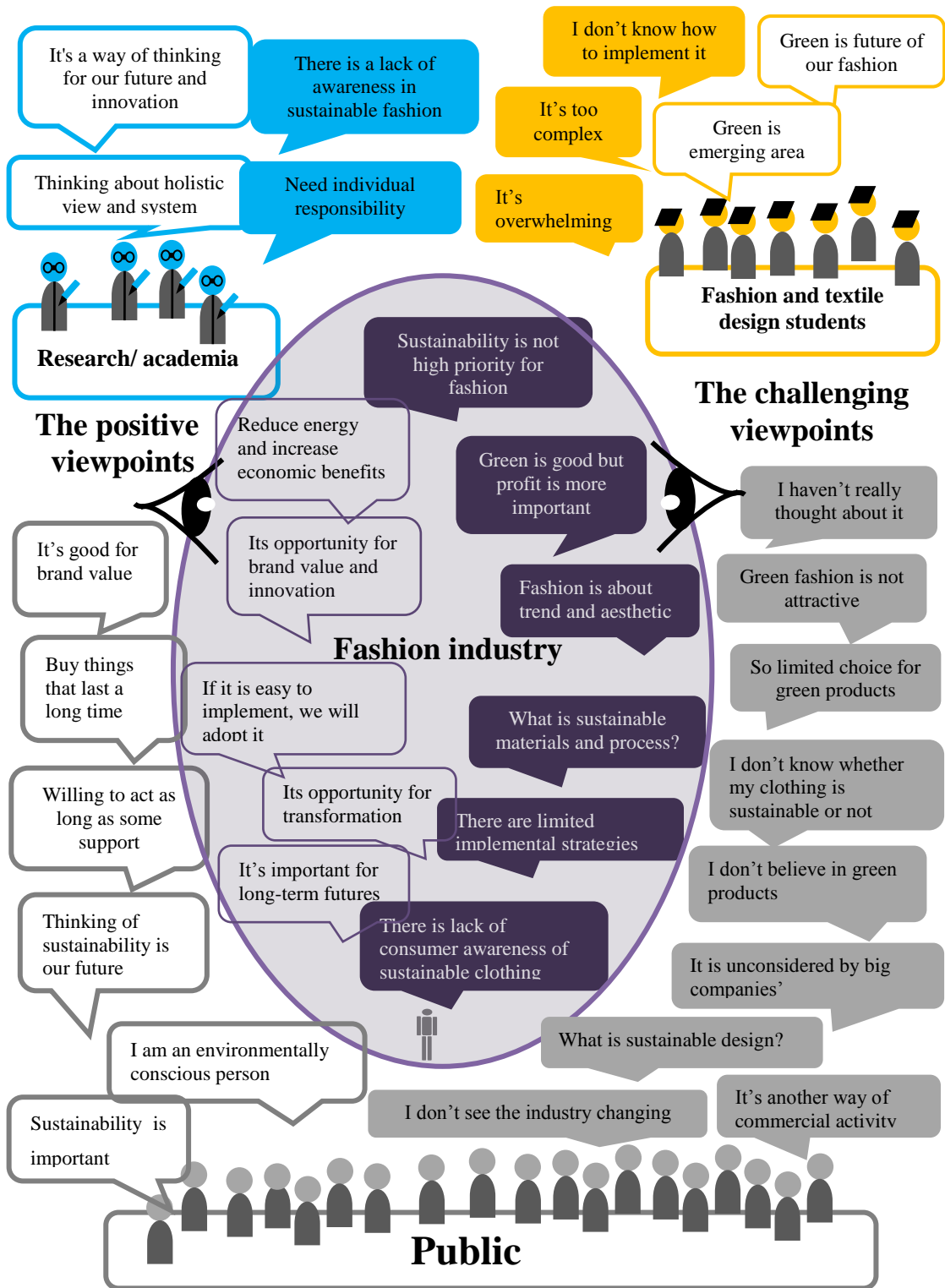
**Figure 5.14: Perceptions of the sustainable design**

In order to clarify the problem situation in the real world, Patching (1990) suggested that considering the 'problem owner' and 'problem solver' can be useful for the SSM in each of the first two stages. In practical terms, Patching (1990) proposed that *'the problem owner can be considered as a person employing the analyst, being responsible for a situation where there seems to be potential for improvement and*

*who would be instrumental in implementing any change'* (Patching, p44).

During clothing production processes, a complex clothing supply chain, stakeholders, manufacturers, suppliers and retailers can be involved in the fashion business. Each of the raw materials comes from different suppliers and manufacturers and fashion companies closely cooperate with various stakeholders. Therefore, it is considered that the problem owner is all the fashion design involved people and they have a responsibility for sustainable production. On the other hand, every individual involved in consumption activities including ways of purchasing, maintaining and disposal stage are also problem owners. However, as we discussed in chapter three, the production and consumption process are closely interlinked and influenced by each other. During the production process, products and designs can be influenced by various factors of consumption activities and on how the products are purchased, used and disposed. Whilst, consumption activities are also influenced by how products and processes are designed. Instead of spreading the problem owner over production and consumption, a co-designing process could provide synergy to facilitate both sustainable production and consumption.

Using the SSM methodology, the relevant system can be identified within the clothing consumption and production system. Figure 5.15 shows the clothing production and consumption process expressed through a rich picture.
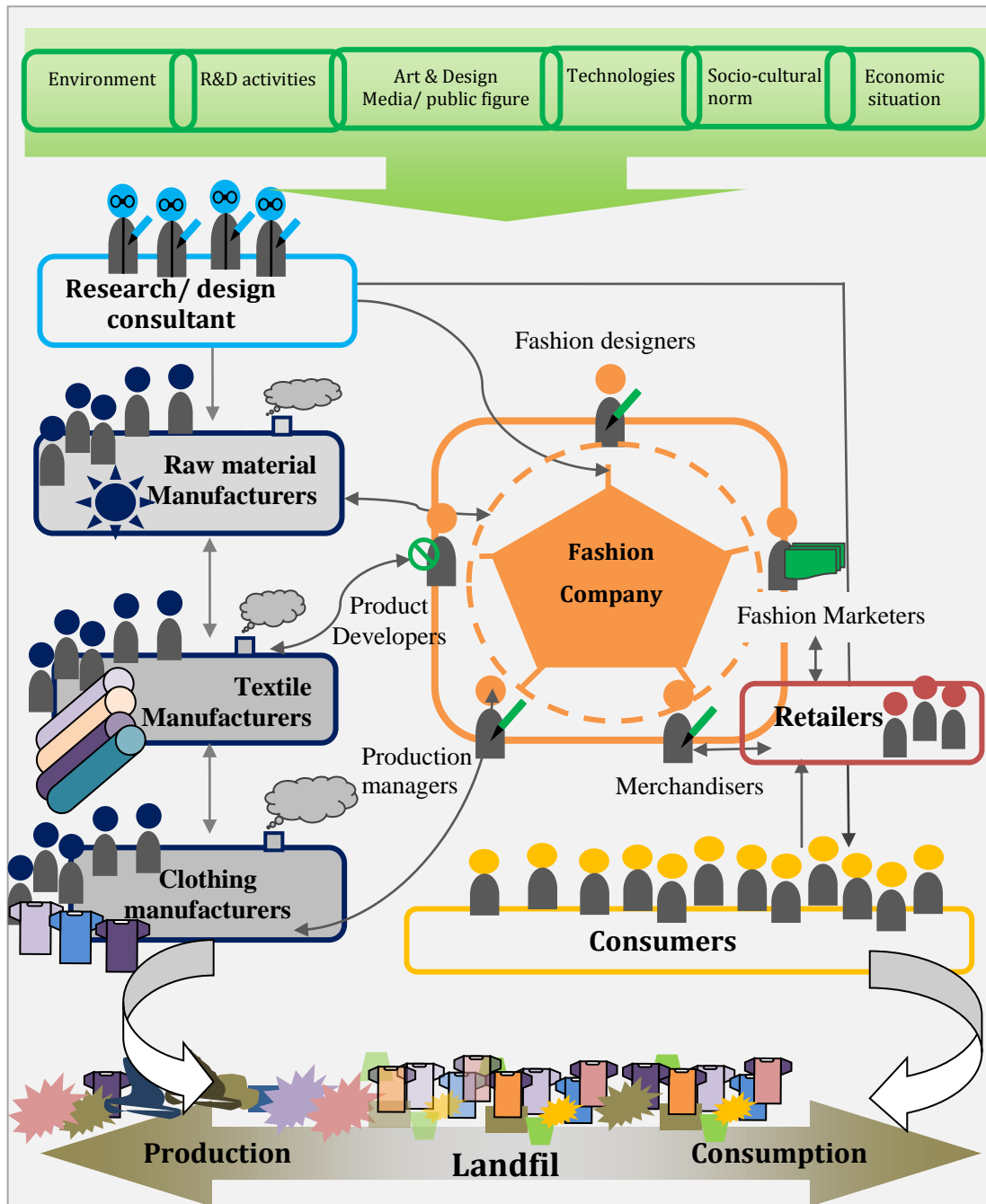
**Figure 5.15: Rich picture: Actor model in fashion design system**

The findings of the literature review and the primary studies were made to identify different actors' needs in order to encourage action to more sustainable production and consumption. The results of the primary studies indicated that from the professional designers and fashion design students; they are not actively using the sustainable design tools explained in the literature. It is apparent that there is a need for appropriate sustainable design activities or tool specific to fashion design. Previous tools are mainly used for the scientific evaluation purposes and a design lead approach would be more beneficial to fashion and textile designers. Reflecting

on the results of two surveys, the key points for research action are summarised below;

### 5.6.1 Aspirations & ideas about transformation

#### 5.6.1.1 Public aspirations

- Make available to the consumer more informed apparel product choices.
- Benefits of awareness of issues needs more varied sustainable design options and products for influencing their real decisions.
- General people have not enough skills and need appropriate effective guidance and required communicational tools.
- Clarification is required as to who can be involved and how to involve the public with designers.
- Need to create shared understanding themes during co-design workshop.

#### 5.6.1.2 Design involved people' aspirations

- A designer based tool is required, designers are not much aware of existing sustainable design tools and these are not actively used. Need to provide environmental and social issues or problem points and present examples of design led strategies beyond 'outside of box' approaches.
- Integrate with creative design process and trigger design innovation beyond measurement of clothing environmental impacts.
- Need to identify consumption strategies information for fashion design by providing benefits of awareness of consumption issues and need directions connected to design innovation and new strategies.
- Require a sustainable fashion engagement tool which needs to be very clear and simple and easy ways of assessment tool for designers.
- Valuing of experiences of sustainable design activities by providing practical solutions.
- Planning a systems model considering resources content and process as well as potential for key actors and users.

## 5.7 Formulate root definition (Phase 3)

Before the construction of the systems model, it is necessary to decide the specific perspectives of the problem or situation and define the most appropriate system for the problem. The CATWOE test is used in the development of a root definition which can be defined a number of times in order to achieve a clearly identified problem situation. The following root definition is presented for sustainable fashion design development.

- **Root Definition: A system which offers enabling support and decision making, allowing individuals and organizations to engage to different extents with the system that considers sustainable production and consumption during participatory workshops at the concept development stage.**

- **C (Customers);** Clothing producers and consumers. Taking a long term view, it is beneficial to society as a whole.
- **A (Actors):** Design students, professional designers, fashion design agencies or organisations, any collective consumers
- **T (Transformation):** Need informed decision at a concept generation stage and engagement on sustainable fashion production and consumption
- **W (Weltanschauung or Worldview):** Attention to both sustainable production and consumption is vital for the future of our society and the world. Although this is understood by many people not many designers and consumers are engaged thoroughly.
- **O (Owners) :** Fashion industry and educational organisations, some actors
- **E (Environment):** Competitive fast-moving and trend-driven fashion industry whereby sustainability is often neglected in the pursuit of profit.

### 5.7.1 Description of CATWOE components

- **T (Transformation)**

The T (Transformation process) and W (Worldview or Weltanschauung) are both critical components of the CATWOE test in order to successfully complete systems activities. The Transformation process (T) is 'the conversion of input and output' which is considered a most challenging task at the initial abstract notion of system

thinking (Checkland and Scholes, 1990). According to Patching (1990), there are inevitably different levels of inputs and outputs which may not be obvious until the modelling activity is further accomplished. Nevertheless, the initial transformation process and its inputs and outputs are described as follows;

**Input:** Assisting informed decision at a concept generation stage and engagement on with sustainable fashion production and consumption.

**Output:** Need possibly met via a development of a decision making tool and enabling support for sustainable fashion design.



| Inputs | Process of transformation | Outputs |
|---|---|---|
| Information about sustainability in fashion at all stages including production and consumption | | Informed decision/ making tool for sustainable design innovation |
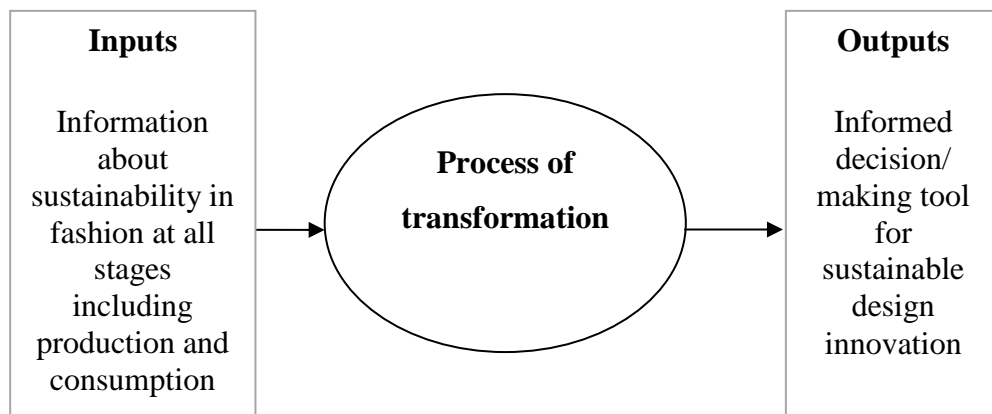
**Figure 5.16: Transformation in the sustainable fashion process**

Further description regarding the transformation process will be described at the conceptual model development stage.

- **W (Worldview or Weltanschaung)**

The W (Worldview or Weltanschauung) makes the transformation process meaningful in context. Patching (1990) pointed out that human activity can be perceived from different viewpoints depending on background, experience and particular interest in the situation. After consideration of whose or what viewpoint is being taken, the idea of a transformation and system can be formulated accordingly. A starting point can be the researcher's assumptions or early investigation of the problem situations. In earlier discussion, the point was made that there is a lack of involvement in sustainable fashion from both designers and consumers although consideration of both sustainable production and consumption is essential for our society. While there are plenty of tools for eco and sustainable design, few of them are specific to fashion and a design led approach. Rather than 'reinvent the wheel', future tools require a new emphasis on innovation and education in order to raise awareness, generate understanding and develop new solutions for sustainable

fashion and textile designers. Looking at sustainability can be a great opportunity for designers to rethink the design process, the designer's intention and suggest new directions. It is also important to consider what the designer's role is in the co-design process for sustainable design, how an individual can contribute in the design process through interactive communication.

- **Environment**

The environment is referred as 'elements outside the system which it takes as given' (Checkland and Scholes, 1990). This environment influences the system without control over it and stays outside the boundary of the system. As noted in the literature review, there are many constraints and challenges for sustainable fashion: for instance, fashion is inherently amongst the most change-intense categories of consumer product (Kunz, 2005; Gam and Banning, 2011) and in fast-moving and trend-driven fashion industry sustainability is often neglected in the pursuit of profit. These factors influence the system but do not directly control it. It is inevitable that pursuing economic profit is an essential element to any industry in order to sustain companies' existence. Consequently, rather than a one size fits all approach, various innovative sustainable design strategies are required incorporating environmental, social and economic benefits to facilitate long term sustainable future.

- **Customers or Clients**

The customers as referred as 'the victims or beneficiaries' who can receive the outputs from the transformation process in the system. The clients can be part of the transformation process or components of the sub-systems of the model through interacting and receiving inputs such as information, resources and so on (Patching, 1990). In this system, customers are defined as 'any collective users' who are willing to use sustainable fashion design tool and support sustainable production and consumption activities. More specifically, the user group can be divided into a clothing producer group and a consumer group. First, any collective consumer who is not involved in the fashion industry has an opportunity to learn and engage in design practices and contribute their pro-environmental consumption activities. Defra (2008) classified the current consumer behaviour in which seven levels of consumers are categorised according to their willingness and abilities to engaging more pro-environmental behaviour.
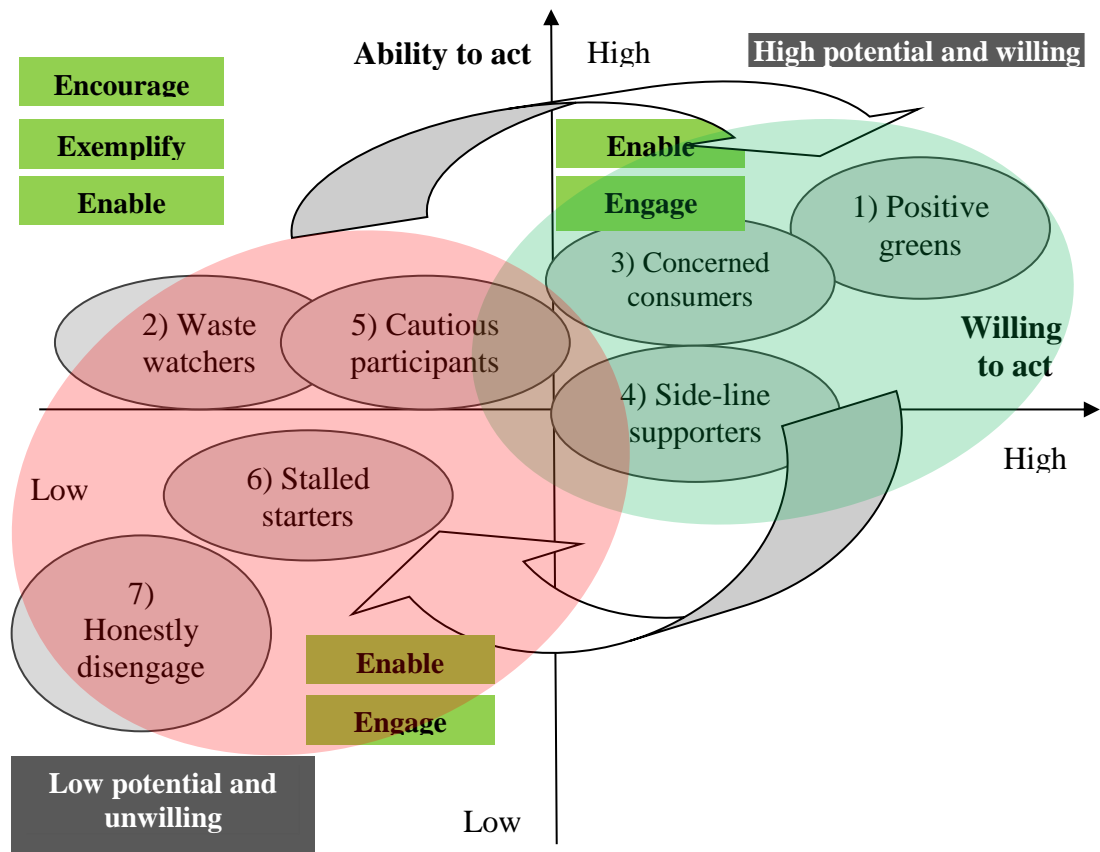
**Figure 5.17: Segmentation of consumers' willingness and ability of sustainable fashion (Adopted from Defra, 2008)**

It is likely that initial customers can be any clothing consumers who are interested in sustainability and high potential willingness groups including positive green, concerned consumers, side-line supports. However, using the sustainable fashion tool, other consumers also can potentially get involved with sustainable consumption and production processes engaging with designers or various other actors. Second, clothing producers or the fashion industry can obtain benefits from enabling support from the new sustainable fashion design system. If other actors and consumer groups need more sustainable products, services and systems, overall the fashion industry could potentially move toward sustainable design activities. It can be a symbiotic relationship: if consumers demand more sustainable design approaches, producers will supply these in order to meet consumers' needs. Therefore, both the fashion industry and consumers can ultimately benefit from sustainable design activities.

- **Actors**

Unlike customers' activities, actors carry out a more active role in the co-design system and facilitate sustainable fashion design practices by providing benefit to the

customers. Checkland (1999) defined the actors as 'a person who carries out one or more of the activities in the system'. Actors and customers can be distinguished by the degree of expertise, experiences, and willingness to practice sustainable fashion design. Patching (1990) pointed out that the actors can be considered customers or even the owners of the system itself. In this system, the actors can be viewed as design students, professional fashion and textile designers, sustainable design agencies or organisations as well as some consumers (in this system, refer to as co-designers). However, it is important to clarify key actors and different roles between customers and actors in a co-design system.

First, key actors are fashion and textile design students or multidisciplinary design students, who can utilise the co-design system and the sustainable fashion design tool and receive benefit from it. Design students have the opportunity to become aware of sustainable design issues and increase their knowledge regarding the sustainable fashion design. They are primary users in this system because they consider not only the future of the fashion and textile industries but also bridge the fashion, academic and business sectors. Accordingly, it is decisive to educate students to integrate sustainability for their future design practices.

Second, important actors can be professional fashion and textile designers who can also utilise the sustainable fashion design tool in the same ways as other customers, depending on their level of understanding of sustainable design. Many designers are still not aware of the wide range of sustainable design issues and potential tools and methods. They can rethink and reflect on their current design practices and create new solutions, developing both their understanding and their skills as sustainable designers. However, professional designers can be role actors when they are fully trained as sustainable designers. In this case, their creativity and knowledge of sustainability is used to amplify that of customers. With the requisite knowledge and understanding, expert sustainable fashion design practitioners can engage customers in the development of more sustainable solutions by providing encouragement and guidance to people at all the different levels of creativity.

The third co-design actors can be existing sustainable fashion and textile design communities or educational organisations which can acquire benefit from networking with the wider design community and consumers. If fashion conscious

consumers are encouraged to participate in sustainable design activities, they may become more conscious of the impact of their current behaviour and be motivated to change.

In this system, the role of actors is critical in order to effectively support customers' activities. As described in the literature review, this approach to co-design represents a significant change for designers and; rather than a focus on production, their role can be extended through encouraging customers to practice sustainable design action for social change by facilitating user engagement and sustainable production and consumption in the design process.

- **Owner**

The owners were defined by Checkland as 'the person or persons who could modify or demolish the system'. The owner of this system is both customers and actors who use the sustainable fashion design tool and co-design system. For example, a professional designer or a design agency manager who has responsibility for the establishment of sustainable fashion design can be taken to be owners of the system. They can be part of the actors and have authority for implementing sustainable design and transformational action that would affect their customers. However, the customers (users)'s responsibility, contribution and ownership can be extended during the transformation process depending on the degree of involvement in the system. Without the customers' contribution, the system cannot exist. There is a symbiotic relationship between customers and actors while actors facilitate the consumers to provide more ownership of sustainable design activities.

## 5.8 Constructing the transformation model (Phase 4)

The conceptual model is derived from the root definition and illustrates the relationship between system and sub-system activities. The modelling language is based upon verbs which indicate assembling and structuring the minimum necessary activities to accomplish the transformation process through the clarification of the definitions of the CATWOE elements (Checkland and Scholes, 1990). Patching (1990) suggested that the model should not contain too many activities where five to ten activities is adequate for each model. Construction of the use of the verb, the initial conceptual model and transformation process presents in figure 5.18 which includes the list of essential activities.
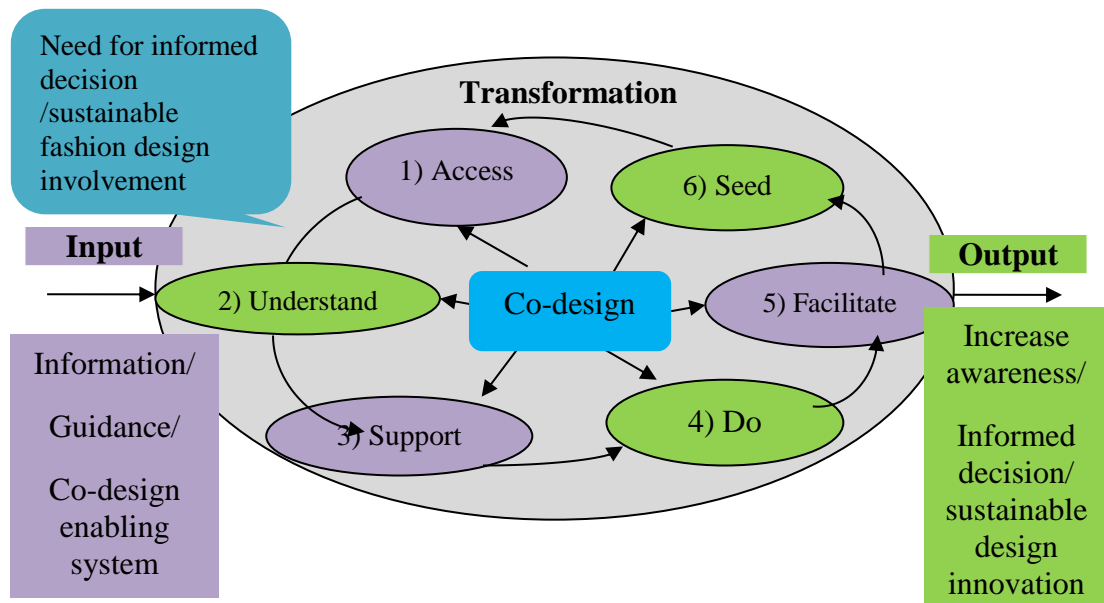
**Figure 5.18: Initial transformation model incorporating the most relevant verbs**

The purple colour represents the input of the system where users can be provided with, supportive guidance and facilitative enabling platform. The green colour describes the output of the system by which users can understand, do or practice their sustainable design practices and seed their sustainable design thinking. More specifically, users who can access the sustainable fashion design information become aware of the environmental and social impacts and think through the issues and see other options. During the co-design workshop process, users can create their own solution for sustainable fashion. Actors can provide or support guidance for users' activities then users can crystallise core solutions incorporating their personal creativity. Actors facilitate the co-design workshop for sustainable fashion and users' ideas begin to seed through social innovation.

The next step decomposes each sub-system in order to clarify the essential lower activities which illustrate how the ideal system actually works. The essential part of the input is the development of 'a sustainable fashion design toolkit' which provides information and learning resources to support more informed decision for designers and potential users. The sub-system comprises the consideration of participants' feedback and requirements from the previous primary study (Stage 1 in SSM). By this stage the researcher had decided that the conceptual system was calling for a real toolkit to be developed to facilitate the co-design process. The toolkit provides designers and users with a more informed design action of the full range of sustainable issues in clothing production and consumption and how their practices may address these. The toolkit information required the integration of theory from a

wide range of issues and examples of sustainable production and consumption in the area of fashion design. The contents of the toolkit information are specifically described in chapter six. Figure 5.19 shows a more detailed set of input in the system.

Environment (off-line)

Environment (on-line)

Identify users and their requirements

**(Assessing) Toolkit information & contents**

Provide inspiring examples

Provoke issues and problem points

Consider clothing sustainable production & consumption

Identify existing effective design led tool & methods

Design layout of the toolkit

Tool development

**(Doing) Toolkit performances & activities**

Define activities & tasks

Supplies performance & design process

Considers co-designing process

Identify existing effective implementation

Triggers benefits & design led innovation

Identify user's capabilities and their aspiration

**(Seeding) Sustainable fashion design practices**

Re-seed new design solution

Provide the toolkit information

Facilitate

Seed sustainable design thinking

Network

**Figure 5.19: Detailed inputs in new system.**

Each stage of input is illustrated below:

  **Inputs**

- **Stage 1: Develop the ideation toolkit information and contents**

Provide and develop a guidance and learning resources for sustainable fashion design considering both sustainable production and consumption in order to facilitate motivation to raise awareness of it. It aims to provide capability for users' own process of learning in both individual and group situations during the co-design workshop to enhance shared language and conversation. Users can be allowed to at not only rethink a range of sustainable issues in fashion design but also are given the opportunity to see existing examples of how other people tackled the issues and problems.

- **Stage 2 : Support the doing process and co-design workshop**

Build an effective workshop process which enhances creative design solutions by providing users' ownership of their project and facilitating a synergy of co-creative actions. This design led approach to the workshop process intends to facilitate various new solutions for sustainable innovation and trigger positive behaviour for production and consumption processes.

- **Stage 3: Seeing a social innovation through on and offline platform**

The different level of users and actors can co-create knowledge and seed sustainable design innovation through providing community level group workshops and online meta-design platform. The social design environment will provide a space for interested participants to network and share ideas, concepts and outcomes, and a network of diverse skills and understanding.  The web platform could have a range of resources which expand on sustainable design thinking and practice.

The toolkit and workshop process was developed continually through a co-design process. The details of participants' feedback from inputs are described in chapter seven. According to Checkland and Scholes (1990), the notion of transformation can be judged on three different criteria which are known as the '3Es' in SSM. A first dimension is efficacy which checks whether the transformation T is working in producing its intended outcome. A second dimension is efficiency which considers whether the transformation is being achieved with a minimum use of resources. Final consideration is effectiveness which tells whether this transformation helps to achieve some higher-level or longer-term aim. These '3Es' commonly added a

valuable richness to the later comparison between the real model and the insight of the real world (Checkland and Scholes, 1990). The 'three Es' are used to assess the final model in chapter eight in order to demonstrate whether the developed system works valuably.

## 5.9 Chapter summary

This chapter used four stages of SSM (Soft System Methodology) to improve the current situation of sustainable fashion design practices. The primary research supported the understanding of the current problem situations illustrated by the use of rich pictures. The first two stages of SSM assist to clarify underlying problem points in relation to sustainable fashion design.

At the stage three of SSM, researcher constructed a root definition for a relevant activity system and developed the conceptualisation of a scenario though use of the CATWOE test which established the customers, actors, transformation, worldview, owners and environment. The essential information of the worldview which was developed by primary research and secondary research from the literature review illustrated why the transformation process is meaningful. The transformation which is at the heart of the CATWOE elements described the inputs and outputs of the new system.

Chapter 6: **Development of the Sustainable Fashion Design Toolkit**

## 6.1  Introduction

In the previous chapter, soft systems methods were used to describe the key subsystem and a root definition of the activity system. The problem situation was expressed using rich pictures and this identified the need for appropriate guidance for designers and potential users embracing sustainable production and consumption to catalyse design led strategies in the idea generation phase of fashion design. It is necessary to present clear environmental and social problem points incorporated with the creative design process in ways that go beyond stereotypical approaches. Furthermore, the social side of sustainability and consumption strategies were found to be not actively integrated into the design process. Therefore, taking into consideration human factors, including influencing positive user behaviour in fashion design practices, a sustainable fashion design toolkit has been developed for use in the early conceptual phase of the design process. This chapter describes the development of the sustainable fashion design toolkit, including contents, structure and layout.

## 6.2 Context of Sustainable Design Bridges (SFB) toolkit

In order to address the issues identified through the use of SSM, a tool to support sustainable fashion design and user innovation called Sustainable Fashion Bridges (SFB) was developed. Sustainable Fashion Bridges (SFB) aims to develop in its users a personal understanding of sustainable fashion which increases awareness of and promotes a change towards, more sustainable fashion and textile design practices. Table 6-1 shows the required actions for the development of the toolkit and inputs and outputs of the system.

**Table 6-1: Required actions for the development of the toolkit: SSM inputs and outputs**

| Input | Input (objectives) | Action required for Inputs; sub-systems | Output (Aspiration) |
|---|---|---|---|
| Toolkit information & contents | Support understanding of the role of sustainable fashion design | **Collect information on sustainable design** : considering sustainable production and consumption for fashion design - Identify existing effective design led tool & methods **Design toolkit contents** -Identify issues and problem points -Provide examples and alternative options | -Increase awareness of sustainable fashion |
| Toolkit performance & activities | -Encourage the self-creation of new design solutions | **Design layout of the toolkit use** -Define toolkit use activities and tasks -Considering co-designing process -Triggers benefits and design led innovation: Identify existing effective implementation activities -Supplies performance & design process | -Create new sustainable design solutions for toolkit users |
| Online environment for the toolkit assessment | -Facilitate engagement in sustainable design practices | **Develop an online environment which can increase toolkit accessibility and availability** -Provide a space for various users to access the toolkit information -Seeding and re-seeding new sustainable design solutions through utilisation of social media | -Seeding sustainable fashion design practices |

The central input to SFB is the 'SFB toolkit' which supports better articulation of sustainable fashion. It is intended to encourage designers in the design process to consider sustainability from the very beginning. As discussed in Chapter 3, the most significant social and environmental benefits can be attained at the idea generation stage.

The SFB toolkit incorporates sustainable production and consumption strategies especially taking account positive behaviour change theory in fashion design practices. The contents of the SFB toolkit are loosely based on Lockton's 'Design with Intent' tool (Lockton *et al.*, 2008), 'pattern language' (Alexander *et al.*, 1977) and existing industrial design frameworks exploring changing user behaviour, particularly with regard to encouraging more sustainable practices (Lilley, 2007). These research studies have been valuable in the development of this toolkit and have highlighted the potential for design to encourage sustainable behaviour. However, their contexts makes them challenging for fashion and textile designers to engage directly with and, in studies of encouraging sustainable behaviour. The concept of the 'design pattern' has been adopted and applied in a number of ways including problem solving, human interaction and educational contexts. Alexander *et al.* (1977) defines a 'design pattern' as a framework which, "describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice" (Alexander *et al.*, 1977, p x). The benefit of using pattern language is to provide both designers and potential users to communicate with each other and bring their knowledge together to solve problems as a participatory process. The categorisation of patterns allows the user to have a common language for recognising and discussing problems. It explains why a particular situation causes problems, and proposes alternative solutions. The format generally consists of a problem, context, possible solution and descriptions of a language associated with human behaviour within an environment. According to Lombardi (2000), pattern language allows users to access a format and document design knowledge on personal, project, or organisational levels by providing a summary of the problem, context, examples and solution in a format that is more rigorous than heuristic and more accessible than a library of design books. Additionally, it facilitates an interactive process through communication with other participants by educating and assisting the design choices at the beginning of a

project. Therefore, the design patterns enable users to establish a common language and ensure that a collaborative design action could take place. The 'Design with Intent toolkit' (Lockton *et al.*, 2008) has also loosely adopted the idea of pattern language and it is considered effective and appropriate for identifying design problems and generating new solutions during the idea generation stage. Utilizing pattern language, the SFB toolkit provides a shared common context of sustainable fashion and encourages discussion of transformative sustainable design action based on reflection of environmental and social impacts associated with our behaviour.

## 6.3 Contents of SFB toolkit

A typology is proposed for triggering sustainable behaviour and optimization of the design process. The SFB toolkit has six distinct groupings of design patterns which encourage innovation in sustainable fashion. These six topics consist of choice, optimization, empowerment, persuasion, interaction, and social conversation. The conceptual framework for the SFB Ideation tool is shown in Figure 6.1. It represents an overview of the relationship between each pattern.
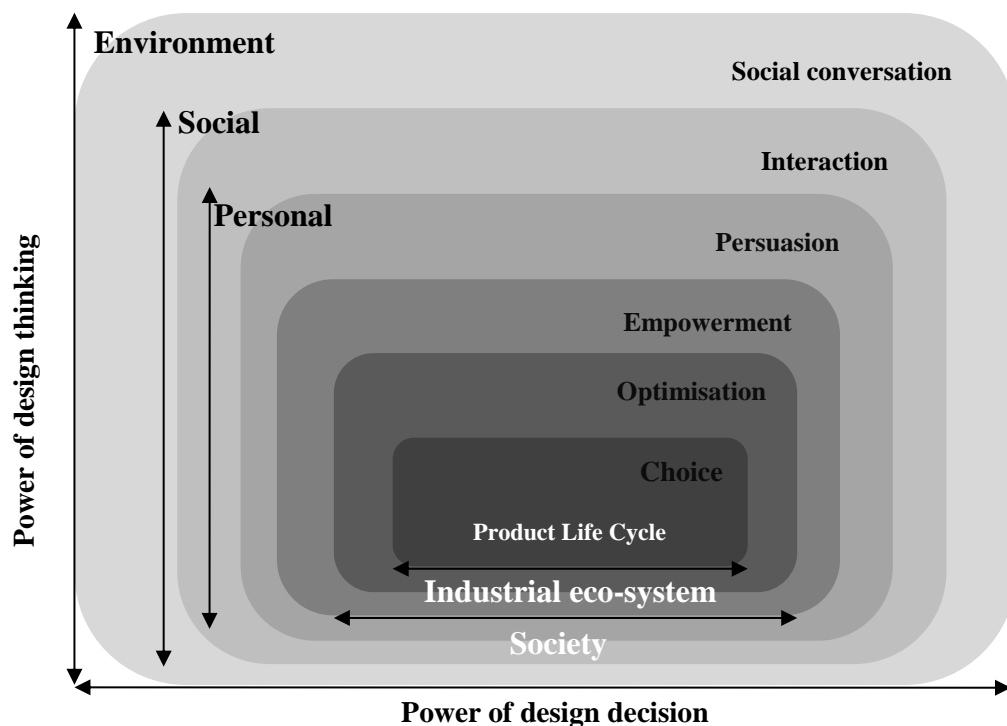


**Figure 6.1: Conceptual framework for SFB Ideation tool**

The framework represents the integration of design thinking in the design process and considers how a sustainable approach can be employed at a personal, social and

environmental level. In a similar approach as Bras (1997) model (figure 3.3), the SFB framework is not linear. At the outset, users can understand at a single product life cycle through 'Choice pattern'. Second, the scope of concerns can be extended beyond a single product life cycle through exploring an 'Optimisation pattern' which shows a different possibility of an industrial eco-system. Both Choice and Optimisation patterns are embedded in life cycle thinking, while Empowerment, Persuasion, Interaction and social conversation patterns are concerned with the different possibilities to interconnect with sustainable consumption and design for behaviour strategies.

### 6.3.1 Descriptions of each pattern

**The Choice patterns** consider life spans of products. This pattern encourages the designers to reflect and rethink the importance of their decisions that include the choice of materials, energy, and the production of the product, clothing packaging, distribution, and ways of buying, wearing, maintaining, washing and the disposal stage at the end of the product's life. Looking at the overview of product life cycle from clothing supply and demand side, the choice pattern considers our resource use throughout the clothing lifecycle. Our behaviour has significant environmental and social impact and affects choice which critically influences on the environmental change (Stern, 2000, p408). Choice patterns encourage individuals to take responsibility for their actions, by reflecting on and rethinking their use of resources; choice patterns encourage experimentation in material, process and application

**The Optimisation patterns** seek ways to maximise the positive impact of the product and system by intervening in the clothing life cycle, and hence changing the degree of flexibility of design. This pattern emphasises on the systematic approach to the production and manufacturing system involving the idea of the re-imagination of the clothing life cycle system, turning it upside down, merging, skipping, segmenting, suggesting flexible manufacturing systems and alternative service design rather than one-size-fits-all. Optimisation includes industrial ecosystems corresponding to the design process, this pattern encourages the designers to rethink clothing durability, embrace the idea of biomimicry, cradle to cradle, modularity, circular model of apparel supply chain, reducing number of design processes and increasing serviceability through multi-fashion, updatable, swap and share services. Adopting biological principles; for example, Janine Benyus (2002)'s biomimicry

innovation inspired by nature  and 'Cradle to Cradle' (McDonough and Braungart ,
2002) have proposed a whole system view of design which extends product life
beyond a first life into another product's future life. Optimization patterns explore
the solving of human problems and the design of innovative new production
processes and design systems.

**The Empowerment patterns** support the creation of products and services which
can satisfy people's psychological and social needs both through creating
meaningful relationships with the user in the design process and encouraging the
user to rethink their behaviour; it offers users design options, experience, and
empathy. Jonathan Chapman (2005) suggested that a more empathic experience be
more inclined to satisfy people's psychological needs. Thus, if involvement in the
design process can develop empathy with outcomes, resultant products are likely to
be emotionally connected to consumers. The empowerment pattern does not directly
deal with the ecological function but it would consider human wellbeing triggered
from both conscious and unconscious levels such as self-esteem, a sense of identity
and participation.  This extended approach moves beyond functional clothing but is
more emphasised on the symbolic value of the clothing through influencing the
design process and user experiences. The empowerment patterns trigger more
exciting and meaningful relationships with the product and design process, this
pattern covers storytelling, magic, poetry, playfulness, personalization, partial
completion, user as maker, smart craft, open source fashion, cultivating creativity.

**The Persuasion patterns** raise awareness of the issues for motivating people in
sustainable fashion and textiles through interactive engagements. This pattern seeks
to influence user behaviour by granting immediate rewards when they do so. Several
researchers have proposed how design can influence user behaviour by promoting
awareness of and motivating sustainable behaviour toward more sustainable
direction through using physical and cognitive interventions including the effective
use of contextual guidance, information and systems (Lilley, 2005; Lockton *et al.*,
2010; Jackson, 2005; Wever *et at.*, 2008). This approach could potentially motivate
sustainable behaviour and can be applied to the fashion design process for
sustainable consumption.  This pattern looks at how design can support informed
guidelines and choices for consumers to raise awareness of design for behaviour
through considering information, ways of guidance, and use of innovative stories,
transparency, warnings, reinforcement, rewards, simplicity, commitment and

shareholder incentives. This pattern could particularly be an effective approach to develop new service design.

**The interaction patterns** are associated with the idea of automatic responses and an interactive design process in the product/user relationship. Several authors have identified that our behaviour is embedded in habits and routines (Jelsma, 2006; Jackson, 2005) and consumer behaviour is not the always result of processes of conscious cognitive reflection, but may be instinctive, automatic responses to stimuli (Jackson, 2005). This approach can be applied to design research to reduce the cognitive effort needed to function effectively and produce an automatic response through product design, communication between products and users allowing 'intelligent control' (Rodriguez and Boks, 2005; Wever *et al.*, 2008). Lilley (2005) also explored the intelligent and clever design approach to control user habit using advanced technology or purely a smart design approach without changing their routine behaviour. The interaction pattern helps users to reduce cognitive effort for behavioural change. The design with Intent toolkit (Lockton *et al.*, 2009; 2010) has also proposed this strategy through 'cognitive' and 'Interaction' lenses. This approach could be applied to the fashion design process to influence user habits and routine behaviour through an interactive and intelligent design process and product system. An element of interaction patterns comprises the use of sensory effects, parameter changes, reactive fashion, preliminary actions, segmentation, navigation, tailoring, notification, feed forward, and behaviour feedback.

**Social Conversation patterns** combine ideas of the effectiveness of social learning, including the concept of creative communities and open-source concepts encouraging people to interact on a local level (Scott, 2008). One of the critical issues of unsustainable fashion and textile practices are linked to the scale of production and consumption and its use of resources. Fletcher (2008) proposed various possibilities for sustainable fashion design. Her project captures 'local wisdom', giving a platform to flourish and inspire. While Manzini (2004) suggests the idea of 'enabling solution' through networking local services and systems which offer sustainable alternatives for urban living from ten different countries by using material and non-material satisfiers to help us connect with and better understand ourselves. Social conversation seeks to find solutions through social networks and social innovation that enable individuals or communities to build symbiotic synergy to tackle social challenges.

## 6.4   Layout of SFB toolkit

The layout of SFB toolkit utilises as a card-based approach. Lilley (2008, p 50) identified that the card-based tool can be utilized as simulation for the generation of design briefs, providing inspiration and new perspectives, showcasing innovative design methodologies or issues for consideration during their idea generation stage Similarly, research by Clatworthy (2011) found that the card-based approach offers tangibility especially for the encouragement of team collaboration, communication, shared common understanding at the idea generation stage. Further, it is also useful to utilize multiple usage alternatives as individual ideas generation. They identified that card-based tools encourage systemic innovation, embodied communication and cognitive processes involved in the design task. It is often difficult to distinguish between the function of the cards themselves and the process of the idea generation process in workshops. The card sorting is considered as a tool or technique that Spencer (2004) defined as 'a user-centred design method for increasing a system's findability. The process involves sorting a series of cards, each labelled with a piece of content or functionality, into groups that make sense to users or participants'. This technique has commonly been used in designing information architecture and user-experience design that allows users insight into mental models and provides guidelines for tasks within their own heads.

The SFB Ideation toolkit is intended to assist with exploring new possibilities through the combination of different 'design patterns' which encourage innovation in sustainable fashion. The SFB Ideation toolkit consists of 60 ideation cards divided into six distinct groupings of 'design patterns', with each of the six design patterns containing 10 sub-categories. Each set, or 'design pattern', proposes alternative ways of lowering the social and environmental impact of clothing production and consumption.  The structure of the ideation cards consists of the summary of problems associated in design and consumption activities, and then proposes the alternative solutions through visualised examples.  Figure 6.2 shows the presentation of the SFB toolkit.

**Figure 6.2: SFB Ideation cards**

The ideation cards involve an element of learning through play; a potential outcome will be a better understanding of sustainable fashion and the discovery of new design synergies, as well as insight into future contexts for design. During the workshop process users become aware of the environmental and social impacts and explore the issues and alternatives through the toolkit before defining key ideas and solutions incorporating personal creativity. Designers and users can access the toolkit which encourages them to identify true design problems through motivational design questions.

The summary of problems is characterized by a format of open-ended questions, allowing users to rethink and reflect on the importance of the user's design decision and address sustainability concerns ranging from product life cycle, industrial eco-system to the socio-cultural level. These open-ended questions are used to define the design problem at a point where the solution is not pre-determined. The toolkit supports the user in creating their own solutions in flexible ways through providing methods and guidance. Therefore, once the user has identified the design problem, it assists in initiating further investigation to solve it. The visualized examples containing a short explanation and example scenario are one of the possible solutions employed to generate users' investigation of the design brief. Figure 6.3 shows the structure of a card.

**Pattern name**

**Design brief & open-ended question:** Utilizing provocative questions which address sustainability concerns at every stage of the fashion design lifecycle.

**Example & scenario:** Using the examples with a short explanation can be one way to inspire users to generate their own future solution to the design brief.
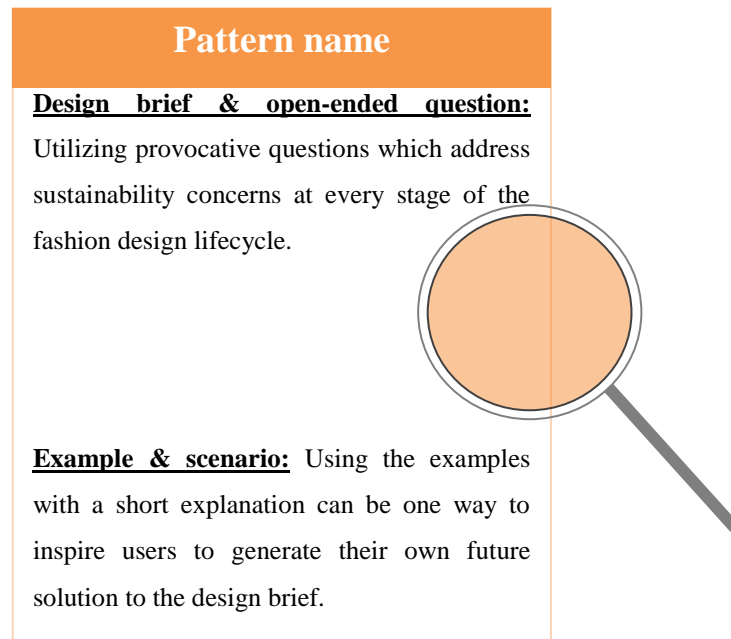
**Figure 6.3: Structure of the ideation card**

Figure 6.4 describes the overview of ideation patterns that come from the authors' current research (Hur *et al.*, 2011; Hur *et al.*, 2013). The SFB cards are presented.

| Production | Alternative Materials? | Alternative Energy? | Alternative Process? | Alternative Packaging? | Alternative Distribution? | **CHOICE** encourages designers and individuals to take responsibility for their actions by reflecting on and rethinking their use of resources throughout the clothing lifecycle. |
|---|---|---|---|---|---|---|
| Consumption | Way of buying? | Way of Wearing? | Way of Maintaining? | Way of Washing? | Way of Disposal? | |

| **OPTIMISATION** | **EMPOWERMENT** | **PERSUATION** | **INTERACTION** | **SCOCIAL CONVERSATION** |
|---|---|---|---|---|
| seeks ways to maximise the positive impact of the product and system by intervening in the clothing life cycle, and hence changing the degree of flexibility of design. | propose the creation of products and services which can satisfy psychological and social needs both through creating meaningful relationships with the user in the design process. | play a supportive role in motivating people to engage in positive behaviour, and granting immediate rewards when they do so. | explore the idea of automatic responses in the product/user relationship. They challenge bad habit and routines, and reinforce unconscious positive behaviour. | Influences the effectiveness of social learning and and helps participants to develop skills and knowledge, build networks and have confidence to tackle social challenges. |
| **Optimization cards cover:** Rethinking durability / Biomimicry / Cradle to Cradle / Modularity / Merging / Zero-waste /Dynamic upgrade / Multi-fashion / Updatable systems / Swap & Share service | **Empowerment cards cover:** Storytelling / Magic / Poetic / Playfulness / Personalization /Partial completion / User as maker service / Smart Craft /Open source fashion / cultivating creativity | **Persuasion cards cover:** Information / Ways of guidance / Story of Use / Transparency / Warning/ Reinforcement / Reward / Simplicity / Commitment / Shareholder Incentive | **Interaction cards cover:** Sensory Effects / Parameter Change / Reactive fashion / Preliminary Action/ Segmentation/ Navigation /Tailoring / Notification / Feed forward/ Behaviour feedback | **Social Conversation cards cover:** Symbiotic Relationship / Catalyzing Actors / Enabling Solutions / Localization / Community Learning/ Creative Enterprise / Power Shift / Social Feedback / Social Service / Ways of Living |

**Figure 6.4: Structure of SFB Tool cards and patterns**

## CHOICE

| Energy | Process | Packaging | Distribution
Buying | Wearing| Maintaining | Washing | Disposal

### Alternative Materials

✓ Have you tried out different possible materials and thought about implications at various stages during the life cycle of a clothing product?

Everyday waste can potentially be transformed into valuable ingredients for your design object or service system. Fashion designer Emily Crane designed cultivated couture from everyday cooking ingredients such as gelatines, kappa carrageenan, agar-agar seaweed, water, natural flavour extracts, glycerine, food colouring and lustres. Every day cooking ingredients transform into high-tech kitchen couture. Picture from www.emilycrane.co.uk

www.sustainablefashionbridges.com

## CHOICE

Materials | Energy | Process | Packaging | Distribution
Buying | Wearing| Maintaining | Washing | Disposal

### Alternative Energy

✓ Can your design minimise energy use in the design process and maximise the life of the garment using alternative energy resources?

Sunlight can be a major resource of natural energy for utilisation. The Zegna designed Eco-tech Solar Jacket, made from 100% recycled plastic sources and a detachable solar cell sleeves, can convert sunlight into renewable energy. It can also keep the body warm and charges the battery pack that can hold enough electricity to recharge a cell phone or iPod. This is done with 5 hours of sunlight. Source from www.digitalnewsagency.com

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## CHOICE

Materials | Energy | Process | Packaging | Distribution
Buying | Wearing| Maintaining | Washing | Disposal

### Alternative Process

✓ How can innovative thinking and new technologies help you to rethink materials and process?

Technological innovations and creative thinking can create new materials that can be grown, cooked or become self-sufficient. Artist Donna Franklin and scientist Gary Cass explore the idea of growing seamless biosynthetic materials from cellulose microfibrils; Suzanne Lee has coined the name 'bio-couture' for her clothes grown from microbial-cellulose. Picture from www.bioalloy.org

www.sustainablefashionbridges.com

## CHOICE

Materials | Energy | Process | Packaging | Distribution
Buying | Wearing| Maintaining | Washing | Disposal

### Alternative Clothing Packaging

✓ How can you design alternative ways of packaging clothing to minimise waste?

Rethinking clothing packages can solve three common product design problems at once. Hangerpack suggested a clothing package design that provides flexible packaging for shipping is easy to recycle at the end of life cycle stage and transforms into a reusable object (hanger) in the package. Source from www.dornob.com/shipping-eco-friendly-products-in-multifunctional-packages

www.sustainablefashionbridges.com

## CHOICE

Materials | Energy | Process | Packaging | Distribution
Buying | Wearing| Maintaining | Washing | Disposal

### Alternative Distribution

✓ Can you design alternative distribution services and systems?

One of the main criticisms of the circular economic approach is that if all the products have to be sent back to producers for reuse or remanufacturing, the tr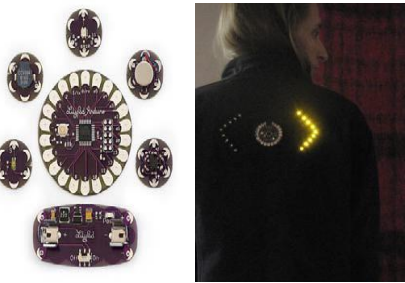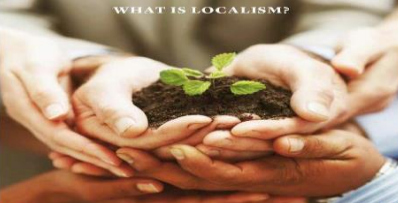ansportation will be considerably increased. Moreover, remanufacturing activities often cost more than production of products from virgin raw materials (Mont, 2008). Alternative ways of distribution using local supplier and distribution enable you to reduce transportation and create jobs for the local community. How might you distribute your product? See more information: empowerment and social conversation pattern

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## CHOICE

Materials | Energy | Process | Packaging | Distribution
Buying | Wearing| Maintaining | Washing | Disposal

### Ways of Buying

✓ How can your design suggest alternative ways of buying our clothing?

Current consumption patterns are crucial causes of environmental and social problems and consumer behaviour is central to society's impact on the environment (Jackson, 2005). Considering how and where clothing is made, who it is made by and rethinking consumption activities can play a critical role in supporting sustainability. Designers can also provide effective instructions for efficient and environmentally friendly use. See more information: empowerment, persuasion and social conversation pattern

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## CHOICE

Materials | Energy | Process | Packaging | Distribution
Buying | Wearing| Maintaining | Washing | Disposal

### Ways of Wearing

✓ Have you suggested alternative uses for your clothing to develop your unique individual look using your existing clothing rather than buying more?

People can have a limited perception about what can be worn. If a designer makes clothing with a more flexible approach, people can be encouraged to wear things differently. Uniform project is a one-year fundraiser for the education of underprivileged children in India, where they designed a dress to wear 365 days as an exercise in sustainable fashion. How creative can you be with how your piece of clothing can be worn? More information www.theuniformproject.com

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## CHOICE

Materials | Energy | Process | Packaging | Distribution
Buying | Wearing| Maintaining | Washing | Disposal

### Ways of Maintaining

✓ How can you extend the length of clothing life and make the clothing user think of their garments as more valuable?

Exploring new ways of maintaining and manipulating existing products can extend product life as well as add new value to the product during the design process. Use of organic, bio- or renewable materials which are more sustainable, means the clothing can be maintained, re-used or repaired by users infinitely. It also allows disassembly or re-assembly according to users' mood or accession. See more information: Optimisation, empowerment and social conversation pattern

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## CHOICE

Materials | Energy | Process | Packaging | Distribution
Buying | Wearing| Maintaining | Washing | Disposal

### Ways of Washing

✓ How can your design influence positive behaviour in laundering to deal with future water shortages and high energy consumption?

One of major environmental impact of clothing comes from laundering and aftercare during the consumer use stage (Cited in Fletcher, 2008). Designers can trigger pro-environmental behaviour through suggestion of alternative designs including modular or badge type and only the dirty part of the garment has to be washed. Fletcher proposed the design that is not to resist or repel dirt, but to wear it like a badge. She documented the response to this idea in a laundry diary over six months. www.5ways.info

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## CHOICE

Materials | Energy | Process | Packaging | Distribution
Buying | Wearing| Maintaining | Washing | Disposal

### Ways of Disposal

✓ How can the impact of clothing disposal be reduced?

Only around 15% of disposed clothing and textiles in the UK are collected for reuse and recycling at present. 70% is sent to landfill (60%) or incineration (10%) (Forum for the Future, 2007). When rethinking our clothing disposal behaviour, the designer can suggest different possibilities of disposing methods such as reuse, converting garment for another purpose or making clothes easy to recover for re-manufacturing, trading or selling. E.g. Wearable Collections provides a useful solution by collecting clothing for recycling in NYC. Image from www. wearablecollections.com

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## OPTIMISATION

### Rethinking durability

✓ Can the use of durable materials support the sustainability of long-lived garments? What kind of clothing might need to be designed for disposal or a low-impact short-life?

Fashion product life has become extremely short and people often discard clothing because they are tired of existing clothing or it is out of fashion. Helen Storey (2008) designed disposable short life clothing through suggesting the wider issues of sustainability and ethical living. www.helenstoreyfoundation.org

www.sustainablefashionbridges.com

## OPTIMISATION

### Biomimicry

✓ How could you apply biomimicry to make fashion and textiles as sustainable as natural systems?

Benyus (2002) suggests that looking to nature could solve human problems and contribute great 'levels of innovation'. The main idea of biomimicry is to understand nature's biological principles and apply problem solving ideas to develop innovative new materials, production processes and design systems. Designers can explore the idea of biomimicry for sustainable fashion including Lotus Effect textiles, Velcro brand fasteners, Golden Ratio fashion, **Deployable Structures & fashion and Mobius Strip fashion. Image from** http://inhabitat.com/tag/biomimicry/

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## OPTIMISATION

### Cradle to Cradle

✓ Can you design every product with the potential to never become pointless waste

Adapting metabolism concepts, 'Cradle to Cradle' (McDonough and Braungart , 2002) suggest a whole system view of design which extends product life beyond a first life into the next cycle of life where waste is reconceived as a useful and valuable component of another product's future life. A biological nutrient can be designed to return to the biological cycle and can be safely biodegradable. A technical nutrient is a product designed to go back into the technical cycle; for example it may be disassembled and the parts re-used. www.mcdonough.com/cradle_to_cradle.htm

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## OPTIMISATION

### Modularity

✓ Can you make your product moveable, adaptable and able to be disassembled by the user? How can modularity encourage positive behaviour and promote sustainability?

Modular systems embrace the concept of "minimum inventory and maximum diversity". Modular pieces can be combined or taken apart at the will of the user, allowing the product to be co-created by designer and consumer as part of a unique experience. The design practice could encourage the end-user to participate in design process through a flexible approach to creation. E.g.) Eunsuk Hur 's Transformative modular textiles www.eunsukhur.com

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## OPTIMISATION

### Merging

✓ Can your project decrease the flow of production and increase consumer interaction with your design? Can you skip similar parts of production process and share similar characteristics

Merging similar processes or parts to perform parallel operations through adaption of technologies and innovative thinking can help to decrease the production flow and garment waste. E.g.) Constructible clothes: A-POC Making ( Issey Miyake & Dai Fujiwara)

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## OPTIMISATION

### Zero-waste

✓ How can you eliminate fabric waste during pattern making and create environmental and economic benefit?

The creation of fabric waste resides within fashion design and patternmaking, which generates 10 to 20 percent of fabric scrap (Rissanen, 2008). Mark Liu (2007) suggested Zero waste fashion through designing the garment pattern and the printed textile simultaneously; hence the entire textile piece becomes the dress without creating fabric waste. There are still issues regarding clothing size and limited styles but perhaps you can suggest the next version of Zero-waste fashion? Source from www.stique.com

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## OPTIMISATION

### Dynamic upgrade

✓ How can you provide a dynamic upgradable fashion to the user, so that those consumers can upcycle over and over again?

If a designer provides a dynamic upgradable system, the consumer could buy fewer quality garments with the expectation of upgrading and refashioning them over again rather than buying new clothing. Image from Infinity Dress by Donna Karan

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## OPTIMISATION

### Multi Fashion

✓ Can you make a multifunctional apparel design or fashion system so people can use it for a different purpose, or produce an alternative product?

Transformative multi- functional clothing can be one of the tools to trigger emotional attachment over an extended period of time. This emotional response could be extended from one occasion to various others beyond conventional rules of style. Can you design an item of clothing which is more fun and can be engaged with by the owner, depending on the occasion and their personal mood? Image from www.azumianddavid.com

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## OPTIMISATION

### Up-cycling system

✓ Can you design a system which allows the user to make continuous process improvements through up-cycling?

Designers can encourage the user to rethink how they can mend, repair and up cycle with reclaimed garments. Earley has been exploring the idea of up cycling textile and clothing since 1999 as a digital sketchbook records the making and development of the Top 100 projects. Her project is practice-based textile and fashion design research which divides the 100 shirts into a series of refashioning methods. www.upcyclingtextiles.net

www.sustainablefashionbridges.com

## OPTIMISATION

### Swap & Share

✓ What are the potential opportunities to support sustainability in the fashion and textile design through swap & share service design?

Service design can has considerable sustainability potential through providing opportunities to meet needs with fewer resources and less energy. (for example, clothing libraries and clothing swapping services, product to service shifts for classic items – hiring desired fashion items for a short period of time) E.g.) keep & share offers quality pieces and versatile products that can be worn in different ways and by different people over their lifetimes. www.keepandshare.co.uk

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## EMPOWERMENT

Storytelling |Magic| Poetic| Playfulness| Personality| Partial completion | User as maker | Smart Craft | Open source fashion| Cultivating creativities

### Storytelling

✓ How can you make multiple layers of storytelling through series of discoveries which enhance emotional connections?

Storytelling allows new discoveries of personal value with a more empathic experience that leads to emotional attachment to the user. Marie Ilse Bourlanges explored the idea of anticipation of the decay through investigation of the human movement and the relationships between notions of time, body, skin and clothes and intended to express the broad semantic of decay. Bourlanges captured the gestures of body bending and trace of time in the garment which potentially anticipated eventual decay of the textile and human body movement of daily life www.marieilsebourlanges.com

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## EMPOWERMENT

Storytelling |Magic| Poetic| Playfulness| Personality| Partial completion | User as maker | Smart Craft | Open source fashion| Cultivating creativities

### Magic

✓ Can your design evoke a magical experience and curiosity, marrying traditional design skills with advanced technologies?

The Magic element in the design process allows numerous user engagements and experiences; the resultant product is likely to be emotionally connected to the consumer (Chapman, 2005). Ezgihan Talay explored the idea of 'Movement and Interactivity' through using Nintendo Wii to update the experiential marbling art, the outcome of the movements is translated to the fabrics. This incorporated new technique allows anyone to easily alter the artwork by moving white-gloved hands. www.ezgihantalay.com

www.sustainablefashionbridges.com

## EMPOWERMENT

Storytelling |Magic| Poetic| Playfulness| Personality| Partial completion | User as maker | Smart Craft | Open source fashion| Cultivating creativities

### Poetic

✓ Can your design trigger memory as a poetic experience and evoke personal intimacy?

The poetic pattern can promote emotional bonds with the object which encourages on-going use, enduring values within products. This poetic element sustains the slow passing of time and an overall sensitivity to how fabrics and garments are actually used. Veasyble is a conceptual set of accessories that transform to create an intimate world for the wearer at a moment's notice as symbolic representations, but contribute to the user's experience of the world around them. www.veasyble.com

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## EMPOWERMENT

Storytelling |Magic| Poetic| Playfulness| Personality| Partial completion | User as maker | Smart Craft | Open source fashion| Cultivating creativities

### Playfulness

✓ How can you maximise playful experiences through visual appearance, usability, service, process, materials etc.?

Playful experiences provoke curiosity and emotional attachment with the user. Elisabeth Buecher designed a series of costumes, 'Siamese Accessories' which only functions if worn by two people at the same time. This playful experience provides two users to become Siamese twins and formed new creatures. Source form www.elisabethbuecher.com

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## EMPOWERMENT

Storytelling |Magic| Poetic| Playfulness| Personality| Partial completion | User as maker | Smart Craft | Open source fashion| Cultivating creativities

### Personality

✓ Can you suggest different options which depend on the user's personality or characters that provoke emotional attachment and social enjoyment through other people?

Fashion service provides a personalised clothing avatar and allows any accessory and clothing to be tried on through a virtual experience. GirlSense Design Studio allows creation of personalised clothing depending on the mood. This platform allows the user to show facial expressions through the use of their own personal avatar. www.girlsense.com

www.sustainablefashionbridges.com

## EMPOWERMENT

Storytelling |Magic| Poetic| Playfulness| Personality| Partial completion | User as maker | Smart Craft | Open source fashion| Cultivating creativities

### Partial Completion

✓ Can your design be rearranged in various configurations or semi-finished platforms according to individual needs, so that people could contribute to the design process?

People are used to having 'perfect' looking fashion through ready-made products. Walker (2006) suggested that partial completion could encourage people's care and maintenance of our material environment and contributes to product longevity. Hanna Nyman creates 3D wall papers which give unique experience and personal user touch in product. More information http://www.hannanyman.se

www.sustainablefashionbridges.com

## EMPOWERMENT

Storytelling |Magic| Poetic| Playfulness| Personality| Partial completion | User as maker | Smart Craft | Open source fashion| Cultivating creativities

### User as maker

✓ Can consumers become co-partners in your design process? Might this encourage more sustainable consumption?

A widespread DIY (Do it yourself) culture and micro-production gives the opportunity to everyone to become a creator and social actor in design. This movement develops competent individuals who have the potential to produce their clothes or supply skills and resources to others, enabling them to create as well as consume. E.g.) Craft DIY community ; www.craftzine.com

www.sustainablefashionbridges.com

## EMPOWERMENT

Storytelling |Magic| Poetic| Playfulness| Personality| Partial completion | User as maker | Smart Craft | Open source fashion| Cultivating creativities

### Smart Craft

✓ Can you use your design process as an educational and experimental tool in which the user can easily learn to use new technologies and science for their own project?

Smart craft gives people the opportunity to work with science and technology in an easy and enjoyable way to create new ideas. Technologies such as, LilyPad Arduino encourages active participation with DIY Community. People can learn and share their knowledge about smart materials and new technologies for their own fashion design. More info www.arduino.cc www.fashioningtech.com/

www.sustainablefashionbridges.com

## EMPOWERMENT

Storytelling |Magic| Poetic| Playfulness| Personality| Partial completion | User as maker | Smart Craft | Open source fashion| Cultivating creativities

### Open source fashion

✓ How can open source support reshaping the meaning of innovation through socially engaged process with a wide range of actors?

Open source fashion has been transformed in craft and design as social dimensions of activities, derived from digital technology which opened up a range of new media deliver to consumers and the creative industries. This shift change design practices in production and development that promote access to the end product's source materials. Growing open source design provides an open digital designing service for micro-manufacturing. More info: http://openwear.org

www.sustainablefashionbridges.com

## EMPOWERMENT

Storytelling |Magic| Poetic| Playfulness| Personality| Partial completion | User as maker | Smart Craft | Open source fashion| Cultivating creativities

### Cultivating creativities

✓ Can your design system provide everyday people with a way to become more creative and get inspired to create?

Studio Ludens help anyone explore their own creativity through providing the digital design tool. Their aim is to serve people the creative freedom and promoting the use and re-use of customised design. The online tool enables people to get involved with some 2D geometry to CAD programming which is then applied to laser-cutting, fabric printing, and weaving. More info www.studioludens.com

www.sustainablefashionbridges.com

## PERSUASION

Informative | Guidance| Story of Use | Transparency | Warning | Reinforcement | Reward | Simplicity |Commitment | Shareholder Incentive

### Informative

✓ How can you make more informed choices for producers and consumers?

Education is one of critical elements for facilitating sustainable fashion design. It is capable to persuade people to address sustainability issues associated in fashion design. Fashioning an Ethical Industry (FEI) provides useful education resources, student workshops in order to promote sustainability in the industry. FEI works with educators and students on fashion related courses in order to raise awareness of a global overview of the fashion industry and fashion design practices. See more information http://www.fashioninganethicalindustry.org/home/

www.sustainablefashionbridges.com

## PERSUASION

Informative | Guidance| Story of Use | Transparency | Warning | Reinforcement | Reward | Simplicity |Commitment | Shareholder Incentive

### Guidance

✓ Can your design offer the appropriate guidance to the user?

Eco-labels and certification can help inform guidelines and choices for consumers who want to buy eco-friendly products. Furthermore, the designer can provide more product information in the integrated labels with a garment's history such as designer's intention, life time with garment, material properties, laundry method, and updatable methods. For example, the Fair trade Labeling Organisation (FLO) provides useful information regarding cotton production processes.

www.fairtrade.net www.ethicalfashionforum.com

www.sustainablefashionbridges.com

## PERSUASION

Informative | Guidance| Story of Use | Transparency | Warning |Reinforcement | Reward | Simplicity |Commitment | Shareholder Incentive

### Story of Use

✓ Can your design scenario promote a more sustainable way of living in the context of their everyday behaviour as a story?

The use of innovative story and awareness-raising campaigns enable and encourage people to lead more sustainable life style e.g. Green thing provide unique videos and inspiring stories from creative people and community members around the world, aiming to inspire people to lead a greener life. www.dothegreenthing.com

www.sustainablefashionbridges.com

## PERSUASION

Informative | Guidance| Story of Use | Transparency | Warning | Reinforcement | Reward | Simplicity |Commitment | Shareholder Incentive

### Transparency

✓ Can you make your design more transparent by revealing under the surface of the design process? Can this be used to influence user's perceptions and behaviour?

Transparency is one of the vital aspects to create brand loyalty and encouraging sustainable design practices. Made-By label is a non-profit organisation involved with a fashion brand to show the entire production process behind a product including from raw materials through to the finished product which aims to improve environmental and social conditions in the fashion industry. Made-by label encourages transparency of supply chain and openness leading to more sustainable design practices. www.made-by.org

www.sustainablefashionbridges.com

## PERSUASION

Informative | Guidance| Story of Use | Transparency | Warning | Reinforcement | Reward | Simplicity |Commitment | Shareholder Incentive

### Warning

✓ Can your design reflect the user's energy consumption depending on their behaviour?

Critical reflection on the design process and interactive design process enables people to understand the issue of user's energy use and take control in their actions. For example, a pollution sensing and visualising garment (CO2-dress) has been designed by collaboration between diffus.dk, Alexandra Institute, The Danish Design School and embroidery company Forster Rohner. www.diffus.dk

www.sustainablefashionbridges.com

## PERSUASION

Informative | Guidance| Story of Use | Transparency | Warning | Reinforcement | Reward | Simplicity |Commitment | Shareholder Incentive

### Reinforcement

✓ Can you emphasise the new possibility of resources and increase awareness of value of resource use through your design?

Hyun-Jin Jeong explored the potential of earth as a material for textile design and colouration through various dyeing and printing experimentations. She emphasised the alternative possibility for dyeing colouration and new aesthetic values of natural material using 45 different soils collected from varied geographical locations. www.earthdyeing.com

www.sustainablefashionbridges.com

## PERSUASION

Informative | Guidance| Story of Use | Transparency | Warning | Reinforcement | Reward | Simplicity |Commitment | Shareholder Incentive

### Reward

✓ Can you encourage the user to participate in continuous positive action through a series of rewards or incentives when they achieve positive action in your system?

Reward and incentive can instantly motivate people to adopt pro-environmental behaviours. 'Fashioning the Future Awards' encourage designers to create innovative sustainable fashion design through engaging the participation of students and graduates from across the world. More information.
http://www.sustainable-fashion.com/fashioning-the-future/

FASHIONING THE FUTURE AWARDS

www.sustainablefashionbridges.com

## PERSUASION

Informative | Guidance| Story of Use | Transparency | Warning | Reinforcement | Reward | Simplicity |Commitment | Shareholder Incentive

### Simplicity

✓ Can you simplify your design system or service to be easier, so that people's behaviour can adapt to habitual routine?

If the design process is simple and easy to adopt, people tend to change behaviour more effectively and act over and over again in a habitual routine. In pursuing simplicity, people have a tendency to stick to their routine (Fogg, 2009). More information regarding behaviour change http://www.behaviormodel.org/

Simplicity

www.sustainablefashionbridges.com

## PERSUASION

Informative | Guidance| Story of Use | Transparency | Warning | Reinforcement | Reward | Simplicity |Commitment | Shareholder Incentive

### Commitment

✓ How can your design create a dialogue with the user that encourages responsible use of products? How could we actively promote reliable garments?

The Clean Clothes Campaign support and promote the fundamental rights of workers in the global garment and sportswear industries. They educate consumers, lobby companies and governments, and offer direct solidarity support to workers as they fight for their rights and demand better working conditions. www.cleanclothes.org

www.sustainablefashionbridges.com

## PERSUASION

Informative | Guidance| Story of Use | Transparency | Warning | Reinforcement | Reward | Simplicity |Commitment | Shareholder Incentive

### Shareholder Incentive

✓ Can your design promote continuous improvement of shareholder value?

Sony and the Solar-bear Foundation made a partnership which aims to encourage consumers to participate in an environmental conservation activity when they buy batteries. A picture book featuring the cubs is available to help parents educate their children about climate change and its effects (cited in WBCSD, 2008). How can your project increase each actor's values? Image from http://www.japanfs.org/en/pages/029704.html

www.sustainablefashionbridges.com

## INTERACTION

Sensory Effect| Parameter Change| Preliminary Action |Reactive Fashion |Fairytale Fashion| Tailoring | Notification| Feed forward | Behaviour feedback| Environmental response

### Sensory Effect

✓ How can the use of sensory effects (sound, light, smell, etc.) encourage users to interact or behave more positively?

Sensory experiences trigger emotions, sentimentality and memories for the user and help to reduce cognitive effort for behavioural change. Jenny Tillotson explored the multi-sensory enhancement through suggesting the smart second skin dress which allows the wearer to enter a sixth dimension by creating a rainbow symphony of aromas. www.smartsecondskin.com



www.sustainablefashionbridges.com

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## INTERACTION

Sensory Effect| Parameter Change| Preliminary Action |Reactive Fashion | Fairytale Fashion| Tailoring | Notification| Feed forward | Behaviour feedback| Environmental response

### Parameter Change

✓ How can smart materials be used to create better mobility and interaction? How can you control user behaviour automatically through design combined with advanced technology?

Changing an object's physical state (e.g. to a gas, liquid, or solid), changing the degree of flexibility or changing the temperature. The life-span of ordinary things and everyday life may be transformed in relation to existent energy conditions. Kerri Wallace explored idea of the human motion response incorporating it with thermo-chromic and liquid crystal heat responsive technology. www.kerriwallace.com



www.sustainablefashionbridges.com

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## INTERACTION

Sensory Effect| Parameter Change| Preliminary Action |Reactive Fashion| Fairytale Fashion| Tailoring | Notification| Feed forward |Behaviour feedback | Environmental response

### Preliminary Action

✓ Can your design protect from danger?

Preliminary action allows reflective material to respond to direct light; the patterns redirect the light back, making wearer more visible at night. Lost Value designed a reflective scarf that is produced for the urban cyclists or runners. www.lostvalues.com



www.sustainablefashionbridges.com

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## INTERACTION

Sensory Effect| Parameter Change| Preliminary Action |Reactive Fashion | Fairytale Fashion| Tailoring | Notification| Feed forward | Behaviour feedback |Environmental response

### Reactive Fashion

✓ Can your design automatically respond to user behaviour and outside environmental conditions such as light, movement, touch etc.?

Reactive fashion gives the impression that the clothing is alive, opening itself to breathe and take in the rays of light. Fashion designer and Professor Ying Gao is exploring the concept of transformative & interactive fashion collections with the environment such as light, movement, wind or touch using interactive microelectronic technology. You can find more information at www.yinggao.ca



www.sustainablefashionbridges.com

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## INTERACTION

Sensory Effect| Parameter Change| Preliminary Action |Reactive Fashion | Fairytale Fashion| Tailoring | Notification| Feed forward | Behaviour feedback| Environmental response

### Fairytale Fashion

✓ Can your design provoke curiosity and mutual discovery through various interactions with clothing or your design system?

The magical element in design can help to potentially deliver a series of future discoveries and the life of an object is dramatically increased as users remain captivated in anticipation of the next event (Chapman, 2005). Fairytale Fashion is created by Diana Eng. They are producing a collection of magical clothing incorporating science and technology like inflatable, deployable structures, muscle wire and microcontrollers. www.fairytalefashion.org



www.sustainablefashionbridges.com

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## INTERACTION

Sensory Effect| Parameter Change| Preliminary Action |Reactive Fashion | Fairytale Fashion| Tailoring | Notification| Feed forward | Behaviour feedback| Environmental response

### Tailoring

✓ How can your design meet individual user needs as well as supporting production efficiency?

Jasmin Schaitl is an artist and a fashion designer who designed Body-Index-Cloth through exploring the idea of the relationship between body and cloth. She suggested a new pattern making technique which is a visually and logically understandable system. She created a garment using the calculated parabolic formula which gave a standard index from which all body types could be tailored for. www.jasminschaitl.com



www.sustainablefashionbridges.com

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## INTERACTION

Sensory Effect| Parameter Change| Preliminary Action |Reactive Fashion | Fairytale Fashion| Tailoring | Notification| Feed forward | Behaviour feedback| Environmental response

### Notification

✓ Can you notify the consumer of just-in –time information within your design?

Just-in-time notifications and simulation of actionable information could support in motivating people to adapt their action point. For example, Web 3.0 RFID is possible to track products in real-time and enable actions like logistics companies being able to sell off spare space on long-haul shipping through auctions (Forum for the Future and Levi Strauss & Co, 2010) More information http://www.forumforthefuture.org/sites/default/files/project/downloads/fashionfutures2025finalsml.pdf

Customer service:

Real time notification?

www.sustainablefashionbridges.com

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## INTERACTION

Sensory Effect| Parameter Change| Preliminary Action |Reactive Fashion| Fairytale Fashion| Tailoring | Notification| Feed forward |Behaviour feedback | Environmental response

### Feed forward

✓ Can you give the user a preview of future scenarios or demonstrate the results of their different actions or choices?

Reviewing the energy feed forward of 'unsustainable' products provides an opportunity to influence the users to make the right decision. STATIC! Suggested various designs which increase user awareness of how energy is used and for stimulating changes in energy behaviour. Heat is a form of energy that is often taken for granted. They designed disappearing pattern tiles using a thermo-chromic ink that reacts to heat, fading away to reflect splashes and intensities of hot-water use. www.tii.se/static



www.sustainablefashionbridges.com

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## INTERACTION

Sensory Effect| Parameter Change| Preliminary Action |Reactive Fashion | Fairytale Fashion| Tailoring | Notification| Feed forward | Behaviour feedback |Environmental response

### Behaviour feedback

✓ How can you design to motivate behavioural change through playful experiences?

The use of positive feedback can enhance the social connectedness. Takkiainen is a jacket for lonely or bored people who want to interact with other people. The Jacket helps the wearer to get in contact with others. The materials used are Velcro strips of different widths. When these materials touch each other, they grab onto each other. The lonely user can be happily connected with others www.saumadesign.net/takkiainen.htm



www.sustainablefashionbridges.com

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## INTERACTION

Sensory Effect| Parameter Change| Preliminary Action |Reactive Fashion | Fairytale Fashion| Tailoring | Notification| Feed forward | Behaviour feedback| Environmental response

### Environmental response

✓ Can your design communicate with people to encourage them to practice pro-environmental behaviour through the use of environmental response?

Suzanne Goodwin designed clothing collections that respond to rapidly changing weather patterns. She emphasised the growing concerns of climate change through fashion design. The garments are responsive to the elements of sun, wind and rain. Patterns appear and disappear depending on weather conditions. The collection of fashion products offers to increase awareness of environmental issues and also possesses a pleasure element. www.suzannegoodwin.com



www.sustainablefashionbridges.com

## SOCIAL CONVERSATION

Symbiotic Relationship | Catalysing Actors | Enabling Solution | Localisation| Community Learning | Creative Enterprise | Power Shift | Social Feedback |Social Service| Way of Living

### Symbiotic Relationship

✓ Can your design promote positive symbiotic relationships?

Fashion 4 Development (F4D) is a global platform that implements creative fashion design strategies for sustainable economic growth through engagement with multi-stakeholder partnerships. It aims to improve society and the planet, especially in developing nations supported by UNESCO.

www.fashion-4-development.co



www.sustainablefashionbridges.com

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## SOCIAL CONVERSATION

Symbiotic Relationship | Catalysing Actors | Enabling Solution | Localisation| Community Learning | Creative Enterprise | Power Shift | Social Feedback |Social Service| Way of Living

### Catalysing Actors

✓ Can your design be catalysed by an actor's knowledge in design development process? How can local actors, possible users and other stakeholders contribute to sustainability in fashion design development?

Collaborative design processes could potentially foster a more connected and active engagement with fashion and textiles. One of the most extensive craft micro-production networks is Ponoko which brings together creators, material suppliers, digital fabricators, DIYers & buyers in a collaborative design environment. www.ponoko.com



www.sustainablefashionbridges.com

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## SOCIAL CONVERSATION

Symbiotic Relationship | Catalysing Actors | Enabling Solution | Localisation| Community Learning | Creative Enterprise | Power Shift | Social Feedback |Social Service| Way of Living

### Enabling Solution

✓ How can your project support local creative communities to continuously lead innovative practices with the aim of supporting sustainable fashion?

Enabling Solutions are 'systems of products, services and organisational tools that enable individuals or communities to achieve a result using at best their skills and abilities' (Manzini, 2004). 'Instructables' is an active DIY community where any individual can share their design projects and network with others regarding everyday life objects, abilities and skills. See more information

http://www.instructables.com/group/sustainability



www.sustainablefashionbridges.com

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## SOCIAL CONVERSATION

Symbiotic Relationship | Catalysing Actors | Enabling Solution | Localisation| Community Learning | Creative Enterprise | Power Shift | Social Feedback |Social Service| Way of Living

### Localisation

✓ How can local products and production be worth giving up global sourcing and production?

One of the main issues of the unsustainable fashion and textile practices are linked to the scale of production and consumption and its use of resources. High volume production and consumption mean that we buy and discard more than ever (Fletcher, 2008). Dr Kate Fletcher deeply investigated various possibilities of the local design and wisdom. Her project captures the 'local wisdom', giving a platform to flourish and inspire. www.localwisdom.info/



www.sustainablefashionbridges.com

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## SOCIAL CONVERSATION

Symbiotic Relationship | Catalysing Actors | Enabling Solution | Localisation| Community Learning | Creative Enterprise | Power Shift | Social Feedback |Social Service| Way of Living

### Community Learning

✓ Can your project support to frame environmental issues in the context of everyday life clothing use as community learning service?

When we are actively engaged in, learning about or teaching something, we tend to feel more fulfilled. Amy Smallwood promotes a creative business for young children aged 5-9 years through encouraging to learn about fashion and design with a creative mind. Working with young people in a meaningful and educational way Amy captured the vibrancy and enjoyment of children's creativity throughout the workshop using recycled materials. www.fashionasplay.wordpress.com



www.sustainablefashionbridges.com

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## SOCIAL CONVERSATION

Symbiotic Relationship | Catalysing Actors | Enabling Solution | Localisation| Community Learning | Creative Enterprise | Power Shift | Social Feedback |Social Service| Way of Living

### Creative Enterprise

✓ How will your service or product be of benefit to society or new creative enterprise in 2050 or beyond?

Local action can help to develop human creativeness as we inventively respond to problems with the resources and expertise that are to hand. Local products inspire and challenge the community while at the same time, creating jobs and making use of local resources. Funding platforms for creative projects to artists or designers: www.kickstarter.com



www.sustainablefashionbridges.com

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## SOCIAL CONVERSATION

Symbiotic Relationship | Catalysing Actors | Enabling Solution | Localisation| Community Learning | Creative Enterprise | Power Shift | Social Feedback |Social Service| Way of Living

### Power Shift

✓ How can your project lead to new forms of cultural exchange and enhance positive human values?

In order to achieve the social and environmental standards, promoting positive social and cultural improvement and consumer participation is significantly important to enhance quality of life. Von Busch has explored a method for questioning the forces at play between the global fashion system and small-scale local production using collaborative design practices. Equally, local scale projects such as the 'community repair' workshop provide spaces for skills development. www.selfpassage.org



www.sustainablefashionbridges.com

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## SOCIAL CONVERSATION

Symbiotic Relationship | Catalysing Actors | Enabling Solution | Localisation| Community Learning | Creative Enterprise | Power Shift | Social Feedback |Social Service| Way of Living

### Social Feedback

✓ How can your design system or service be catalysed by social learning process?

People could be influenced consciously and subconsciously through social learning and in turn spread positive ideas to others in their social domain (Pettersen and Boks, 2008). Social feedback could encourage people that they are part of a collective movement that's making a real difference e.g. Web 2.0, web-based communities and hosted services such as social-networking sites, wikis, video sharing site and blogs) Image from http://blog.fanchimp.com



www.sustainablefashionbridges.com

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## SOCIAL CONVERSATION

Symbiotic Relationship | Catalysing Actors | Enabling Solution | Localisation| Community Learning | Creative Enterprise | Power Shift | Social Feedback |Social Service| Way of Living

### Social Service

✓ Can you design a service that is of a benefit to businesses or is an aid to small local design communities?

In order to maximize positive environmental and socio-cultural conditions, social conversation is a crucial part to help achieve this level. Aid to Artisans provides a designer platform to a small community engaging with third world culture. The background of their design strategies is to create value and innovation that can support beyond current capabilities engaging with diverse design communities and craftspeople. www.aidtoartisans.org



www.sustainablefashionbridges.com

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## SOCIAL CONVERSATION

Symbiotic Relationship | Catalysing Actors | Enabling Solution | Localisation| Community Learning | Creative Enterprise | Power Shift | Social Feedback |Social Service| Way of Living

### Way of Living

✓ How can you inspire people to lead greener, healthier and happy life through your design?

Re-structuring of sustainable life styles is central to sustainable development. Manzini, E. and Jégou, F. (2003) suggested the 'Sustainable everyday' which is a network of local and connected services and systems, drawing together a whole series of living strategies. Their website offers sustainable alternatives for urban living from ten different countries www.sustainable-everyday.net



www.sustainablefashionbridges.com

## 6.5 Process of SFB toolkit use

The SFB Ideation toolkit is a design thinking tool which is intended to encourage users in the design process to consider sustainability from the outset. Regan (2007, p150) suggested that the designer's design thinking is crucial for success in the fashion business because innovative ideas and creative products are the impetus to be successful, critical to manufacturers and the entire design process. Furthermore, design thinking is a powerful medium for designers to imagine, draw, re-interpret and visualise a multitude of ideas and solve real-world problems through the development of innovative products (Regan, 2007, p151). As discussed in Chapter 3, there is a lack of design-led or practitioner-based approaches in existing sustainable design tools. Therefore, it is necessary to take into account a designer friendly process and design thinking in order to facilitate creative new design solutions. Figure 6.5 provides the overview of the workshop process which involved four distinct phases.

| Assessment of the toolkit | Problem identification | Future Scenario building | Idea visualisation |
|---|---|---|---|
| • Users have an opportunity to look and discover at a holistic view of sustainability issues and assess the ideation toolkit. | • Personalise their own thinking and ideas to develop concepts; combination of two or three different ideation cards. Defining the problem and decide the scope of what issues can be tackled, which issues require to be tackled | • Create future scenarios and tell the story to tackle their design problem and design briefs. | • Redefine their Idea and demonstrate results by visualized format which can be planning for a fashion product design, service design or business strategy. |

**Figure 6.5: Ideation toolkit in use at a workshop process**

For the first phase, users can discover problem situations and action points through use of the SFB toolcards. The tool enables to discovery of the problem points and share of insights within a group situation to focus on the specific problem and action points.

Second, users can combine two or three different cards incorporating their own personal creativity. In this synthesis process, the form of an initial design idea can be

defined to build a concrete concept.  Third, users can create future design scenarios for user actions by defining how developed a new product is. A service or system concept can support sustainbility and differentiate between exsisting design solutions. The future scenario building task was applied in order to discover new ideas and efficient solutions for a sustainable fashion future. The final stage was involved with a design led approach incorporated with an idea visualsation process such as drawing or describing a 'rich picture' that represents the users' final design concept which can be designing for a product, service and system or business strategy. Figure 6.6 presents the relationship between the toolkit assessment and co-design workshop.
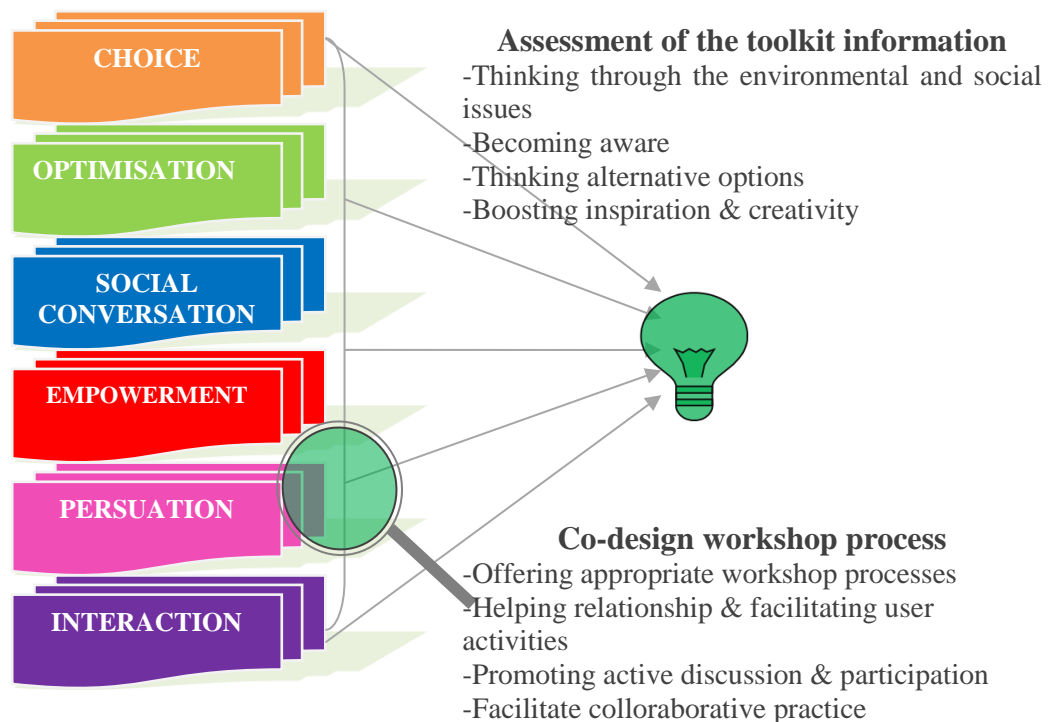


**Figure 6.6: Relationship with toolkit assessment and co-design workshop**

The toolkit assessment can be part of the design process in which uses can re-think the existing design process through open-ended questions and discover alternative solutions through seeing examples. While, the co-design workshop facilitates user activities and design innovation through facilitating relationships and collaborative practice.

## 6.6  Chapter summary

This chapter has discussed the potential for fashion designers and users to facilitate sustainable fashion solutions through co-design, with emphasis on involving the user at the earliest stages of the design process and embedding education.  The Sustainable Fashion Bridges ideation toolkit can be used in a number of ways to facilitate this, depending on the engagement of both fashion design practitioner and user (stakeholders or consumers). The key input of the system for transformation is the toolkit cards that can be used in a systematic way in which users can identify problems themselves and find better solutions for design. The co-design workshop can support user activities through amplifying design innovation and facilitating a more sustainability embedded design practice. It is aimed to support the way of thinking in the design process and rethink ways of current apparel design practices through allowing users to become aware of sustainable fashion and trigger design synergy for new design innovation. Designers can have an opportunity to handle the complexity of sustainable fashion and develop critical thinking. The next phase of this work was the evaluation of the SFB tool kit for usability and exploration of best practice in workshops. It is incorporated with real world activities involving design students and identifying whether the developed toolkit can be feasible or desirable for users as a preferred transformation.

Chapter 7: **Evaluation of Toolkit and Workshop (SSM Action Six)**

## 7.1 Introduction

Chapter 6 describes the contents, structure, layout and target audience for the Sustainable Fashion Bridges toolkit. In Chapter 7, the various approaches to applying the SFB toolkit, identified through a series of workshops, is discussed. The workshop process involved facilitating and observing participants' activities by providing an opportunity to assess the toolkit, encourage creating new design solutions and discussing the different possibilities for a sustainable fashion design future. To evaluate the developed toolkit and workshop process, it was necessary to test this tool amongst key 'actors' and to examine the usability, effectiveness and enjoyment values amongst this target group. The toolkit was tested by three different types of users including a public group, fashion design students, and a mixed group of design students and revised according to the feedback from the workshops. After several revisions, the toolkit was evaluated by professional designers and educators using semi-structured interviews. The chapter also outlines the potential for use of the toolkit in design education and it may promote action in the idea generation stage for sustainability.
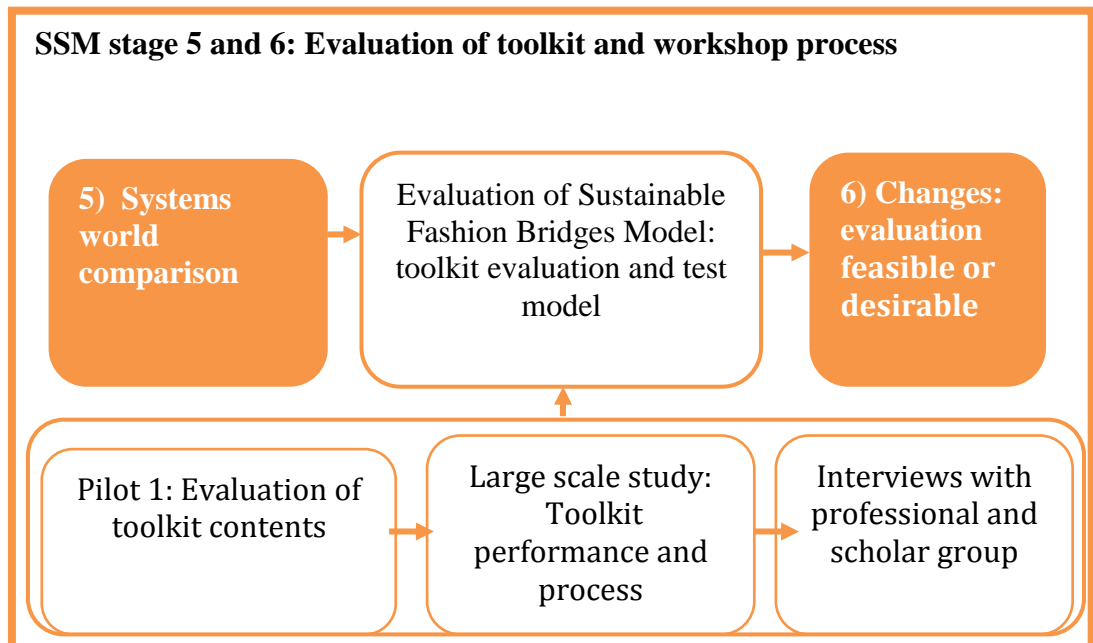


**Figure 7.1: Overview of chapter 7**

## 7.2  **Pilot study**

### 7.2.1  **Process**

The purpose of this pilot study was to examine the effectiveness of the initial iteration of the toolkit and associated workshop process with a mixed group of people with and without design experience. The workshop took place at the University of Leeds in August 2011 and involved four female and one male student covering the age range 20 – 35.  Three students had some experience in the design industry but were still considered to be novice designers.  The other participants were classed as non-designers. The workshop lasted 2 hours. Table 7-1 shows the participants attributes from pilot study.

**Table 7-1: Participant attributes**

| Participants | Person A | Person B | Person C | Person D | Person E |
|---|---|---|---|---|---|
| **Profession** | Fashion design student | MA Design student | BA Design student | BA East Asian studies student | BA East Asian studies student |
| **Design experiences** | Some experience | Novice | Novice | Never | Never |
| **Gender** | F | F | F | F | M |
| **Place** | Leeds, UK | | | | |
| **Sampling method** | Workshop, participant observation, semi-structured interviews: Convenience sampling | | | | |
| **Duration** | 2hours | | | | |
| **Period** | 2011, August | | | | |

The workshop sessions began with a brief introduction to the purpose of the study and described the toolkit and workshop process. Second, a discussion was held to obtain information on previous understanding and familiarity with sustainable fashion as well as participants' previous experience and attitudes towards sustainable fashion. Participants then applied the SFB toolkit to identify the specific problem point they were interested in.  They were then encouraged to visualise their thoughts and possible solutions visually, using drawing, diagrams and/or collage. In order to express their perspectives and thinking in a more creative and tangible way, participants were provided with various old magazines, several papers and thick and

thin coloured marker pens and sticky notes.  The outcomes were shared and open-forum feedback from the workshop process was obtained.

## 7.2.2  **Results of pilot study**

The discussion started from the participants' understanding of sustainable fashion and their previous experiences and interest levels. Participants were encouraged to talk about what sustainable fashion design meant to them and whether they considered sustainable production and consumption in their daily activities.

The issues were categorised as being production and consumption-related. Participants were relatively more concerned about general environmental problems including climate change, air and water pollution, waste of materials, child labour issues and unethical production. Notably, non- design participants mentioned that they had some interest and concerns regarding environmental problems such as climate change or health and safety issues. However, they had thought about the role of fashion in relation to these.

After brief discussion of participants' perceptions toward sustainable fashion, they assessed the toolkit and visualised their thinking through a combination of collage and hand drawing. Figure 7.2 shows the process of the idea visualisation during co-design workshop.



**Figure 7.2: Pilot study for co-design workshop**

Initially, non-design students were not familiar with the sustainability issues associated with fashion and textiles. They tried to understand the problems and issues through assessment of the toolkit and then they visualised their understanding

and design solution through mapping their idea (see Figure 7.3). Meanwhile, design students appeared more familiar with sustainable design and they tended to focus more on the design solutions for the environmental and social problems related to clothing production and consumption. Figure 7.3 shows the visualised idea of sustainable fashion from person E from the non-design student group. Figure 7.4 is the outcome of visualisation from person C in the design student group.
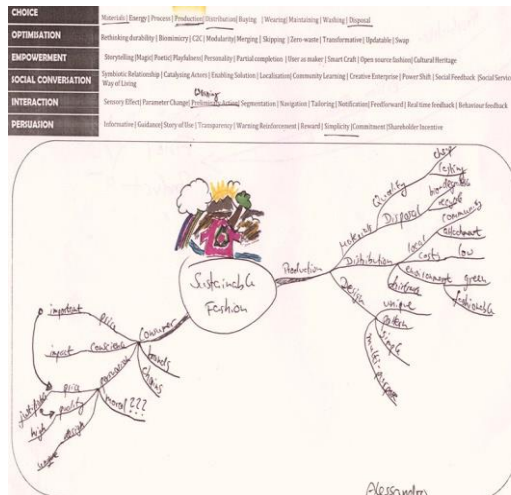


**Figure 7.3: Example of idea visualisation from non-design student (Person E)**
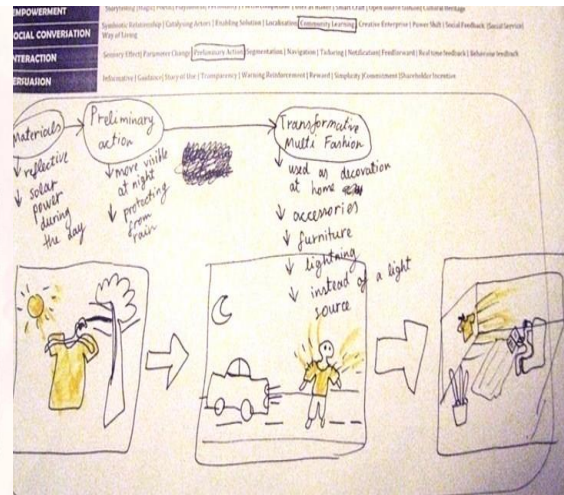
**Figure 7.4: Example of idea visualisation from design student (Person C)**

Person E visualised his idea regarding the role of the production process from the fashion industry and the role of consumer responsibility in our daily activity in order to improve sustainability in fashion design. He suggested that every individual requires more environmentally conscious consumption such as encouraging purchasing more quality products rather than quantity. Meanwhile, person C generated an idea using alternative energy and multi-fashion cards. The created T-shirt can absorb solar energy during the daytime and then reflect it at night. This T-shirt gives the user protection from danger during the night. Furthermore, this T-shirt can be used for lighting at home.

After individual idea generation, participants shared and presented their idea to other participants and all their understanding and design concepts started to be represented on one big piece of paper. Figure 7.5 shows the outcome of a drawing from a group sketch which was created by participants:

**Figure 7.5: Group sketch (Drawing with collage)**

Through application of the toolkit, participants suggested various ideas such as production of good quality products using green energy (e.g. solar energy), modular sleeves, and sticker pattern created by consumers, adoptable, transformative fashion, eco-friendly distribution, experts and consumers' engagements for sustainable fashion and so on. They considered that any individual could contribute to sustainable consumption in everyday activities which could be encouraged by a range of organisations including at the local level of communities, universities and government support.

### 7.2.3 Opportunities and challenges of the pilot study

The initial stage of the co-design workshop helped to identify both opportunities and challenges of co-design practices in the concept generation stage. Positive opinions were expressed in that both design students and the public group considered the co-design process as an interesting experience. The co-design process provided valuable contributions to strengthen understanding of sustainable fashion and it provided an opportunity to rethink sustainable fashion across various spectrums and allowed sharing of different peoples' perceptions. During the process, participants had an opportunity to understand more about sustainable fashion and share their knowledge and experience with other participants in an active way.

Observation indicated that design students tended to more actively engage in the idea visualisation process. This might be because design students were more familiar with expressing their thinking via a visual format. Conversely, initially the non-design students (general public) were not very familiar with the idea of visualisation. However, it appeared that every individual was capable of creating a valuable contribution in the concept development process. It is observed that non-design students faced an initial challenge to express ideas using drawings; however they became familiar with the design practice and began to enjoy their activity. Particularly, the group sketch was more helpful in order to engage with all participants through the use of a combination of collage, drawing and free discussion activity.

The idea visualisation process and toolkit made the participants actively engage in discussions and more dynamically enjoy the process of the workshop. The process of visualisation was generally considered positive, although one participant remarked that she had been challenged to formulate her perspectives and then express her thinking on paper. Regarding content of the toolkit information, participants responded that the toolkit information was useful and participants wished to use it again. It was observed that participants were capable of identifying the problem points through use of the toolkit. Participants mentioned that it was a good opportunity to think of the clothing life cycle as well as the importance of the consideration of sustainable consumption of clothing in their daily life. However, they also identified several weaknesses of the toolkit. Participants replied that although the toolkit provides useful information regarding sustainable design issues and increases awareness of sustainability, it does not make clear where to start and how to effectively use the toolkit. The initial toolkit was the information centric and had not much considered users' tasks. Taking into account participants' feedback and observation of participants' actions in the pilot study, the workshop process was developed and improved further.

## 7.3 Large-scale workshops for toolkit evaluation and workshop

### 7.3.1 Participants information

A main study focused on exploring the toolkit performance and idea generation process as a co-design process, in order to evaluate effectiveness of the toolkit and obtain various opinions about the SFB toolkit. Although the toolkit was intended to be used by fashion and textile designers and highly engaged users (co-designers), the main study was conducted with a target audience who were selected from fashion design students (N=35) and mixed design students (N=17) in the UK during 2011. As defined in the target audiences from chapter 5, these are the future of the fashion and textile industries and it is crucial to educate fashion design students in how to integrate sustainability for their future design practices.

The majority of participants were female students (N=46) and male students (N=6). Two students were under 20; forty-six students ranged in the age group of 20 to 29 years old, two students in the range 30 to 39 and two students in the range 40 to 49. A total of 52 participants' feedbacks were collected for evaluation of the toolkit and workshop process. Among 52 participations, 42 students had experience in fashion design and 10 had no experience in fashion design. However, all students had experience in overall design practices. At the beginning of the workshop, participants were asked to indicate their levels of understanding of sustainable design and the co-design process. As shown in Figure 7.6, the majority of participants (N=27) were considered as intermediate level for their understanding of sustainable fashion. 14 reported as elementary, 8 indicted as beginners and 3 people responded as advanced level.
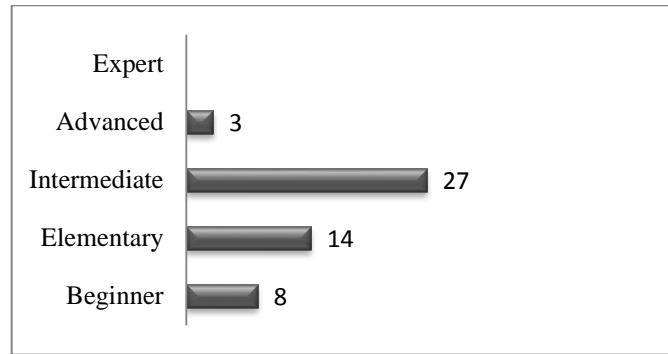
**Figure 7.6: Participants' level of understanding of sustainable fashion**

Whereas, it appeared that the co-design process was less familiar to participants. 28 indicated as beginner level, 12 for elementary, 10 for intermediate and 2 people were considered as advanced level of understanding in co-design.
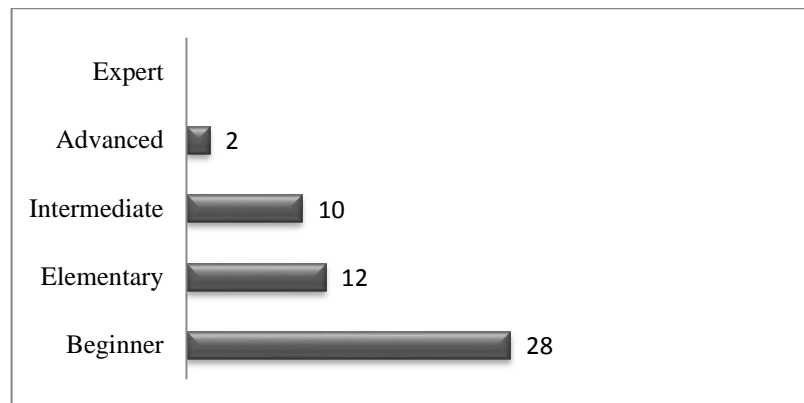


**Figure 7.7: Participants' level of understanding of co-design**

Table 7-2 shows the summary of the large scale workshops and participants' information.

**Table 7-2: Large scale workshop participants**

| Participants' Profession | Level 3 fashion design students | Level 3 fashion design students | MA design students |
|---|---|---|---|
| **Number of participants** | N=17 | N=18 | N=17 |
| **Gender** | Female=17 | Female=18 | Female=11, Male=6 |
| **Period** | October,2011 | October, 2011 | November, 2011 |
| **Place** | The University of Leeds | | |
| **Sampling method** | Convenience sampling | | |
| **Duration** | 2-2:30 hours | | |

## 7.3.2  **Procedure of large-scale workshops**

Usability and feasibility were evaluated through task analysis assessing how participants accomplished the generation of new design concepts using the SFB toolkit and whether participants consider this toolkit useful or beneficial for integrating sustainability in the design process.

The participants were provided with a design brief and descriptions of the workshop process and participant tasks as shown in Table 7-3. Utilising the SFB Ideation toolkit, with instructions and tasks provided as aids, participants were involved in both learning and doing activities during the idea generation phase, sharing their knowledge of the problem and transforming the group concept into workable solutions.

**Table 7-3: Workshop process and participant's tasks**

| | Task Description | Objective |
|---|---|---|
| Step 1 | Welcoming and presentation of the project aim | Explanation of the purpose of the workshop and timescale. Distribution of design brief, tool cards, workshop process sheet |
| Step 2 | Assessment of the toolkit information | Participants have an opportunity to look at a holistic view of sustainability issues and assess the ideation toolkit. The ideation toolkit serves to help the user understand the context for sustainable fashion and encourages them to create new solutions. |
| Step 3 | Problem identification (Mind mapping) | Personalize their own thinking and ideas to develop concepts; combination of two or three different ideation cards. Defining the problem and decide the scope of what issues can be tackled, which issues require to be tackled. |
| Step4 | Future scenario building | Synthesis of their ideas and create future scenarios to tackle specific design problem and design briefs. |
| Step 5 | Idea visualization | Refine their ideas and demonstrate your results by visualized format which can be planning for a fashion product design, service design or business strategy. |

| | Group discussion and presentation | Discuss their concept with other people whether your idea can be feasible and useful for environmental and social sustainability. |
|---|---|---|
| **Step 6** | | |

During the initial stages of the workshop, participants were invited to take part in the workshop process and a brief background of the research was presented. Following this, in phases two and three, each participant accessed the ideation toolkit and was given a 20 minute timeframe to explore and identify specific problems.



**Figure 7.8: Assessment of the SFB toolkit (Step 1)**

Participants were encouraged to construct a holistic view of sustainability issues through assessment of the ideation toolkit and conceptual brain mapping of design ideas. During these stages, the toolkit served to help understand the context for sustainable fashion and encouraged the creation of new solutions. Participants then selected two or three ideation cards and defined the scope (age group, life style, target markets) in order to articulate the specific problem.

**Figure 7.9: Mind mapping and future scenario building and (Step 3-4)**

Participants were encouraged to imagine and consider sustainability issues related with either contemporary or possible future situations including near future (2020-2030), mid-term future (2040-2050) and long-term future (2060- beyond). During visualisation, participants were encouraged to trigger their inner creativity through facilitating the prospective approach using design thinking and future scenario building into design solutions. They then reviewed their concepts more critically through consideration of technological, and design capability to achieve their design scenario as a reality. The mind mapping, future scenario building and visualisation could be overlapped using thinking about the issues.

**Figure 7.10: Idea visualisation (Step 5)**

Steps four and five involved the integration of design thinking with other design criteria to establish a core solution. In this phase, the participant's personal creativity was incorporated into the design process including their insight in presenting the idea in a visualised format, as in Figure 7.10. As we noted in earlier discussion, design thinking is an important tool for business success enabling the visualisation of a multitude of ideas and transforming the idea into a novel creation (product or service design). Throughout the visualising process, participants communicated their ideas with others, synthesising these in a visual format through successful combination of the group's design skills, encouraging the maximisation of potential creative skills through the workshop process.

During the final step presentation stage in Figure 7.11, each team presented their design concepts and discussed their ideas with the other groups to explore whether their ideas were considered feasible and beneficial for environmental and social

sustainability. The group discussions encouraged the identification of alternative perspectives and shared understanding among the groups.



**Figure 7.11: Group discussion and presentation**

### 7.3.2.1 Types of user generated ideas

Evaluations of the user-generated ideas are presented below; the project aimed at designing sustainable clothing consumption specifically focusing on the product consumption and use stage. The overall user-generated concepts can be divided into four different categories of sustainable design.

First, user generated design strategies that focused on the use phase of products through optimisation of different functions and effective use of new technology and energy resources. Although most designers are already aware of this issue through user behaviour research, designers are able to develop innovative solutions rather than just adopting new technologies.

Second, user generated design intervention, focusing on the creation of a more tangible and intangible product value through observing different age groups, gender and their behaviour.

A third type of user generated ideas focused on more radical design innovation in order to create new market and service systems with both local and global levels of community.

**Group (a) Growing fabrics with baby:** Participants selected a problem area of 'Way of Maintaining' card at choice pattern. Their target audience was babies. They grow very quickly and their parents need to buy a new garment too often. To solve this problem, after participants selected the alternative material and modularity cards, they suggested design for babies clothing through observing user behaviour. The garments can be detached or separated for different purposes and because they used stretch fabric, when a baby grows, that garment grows with them.

**Group (b)**: **Tailored bespoke jacket:** This group considered that the way to reach sustainable fashion is good quality of design. Participants selected 'Tailoring', 'User as a maker' and 'Share holder incentive' cards. Participants suggested a community project that collaborates between a tailor designer and a local or supermarket retailer through bringing expertise to an assessable level. A tailor designer run workshop for local community to foster more personalised style and look using high quality and sustainable materials.
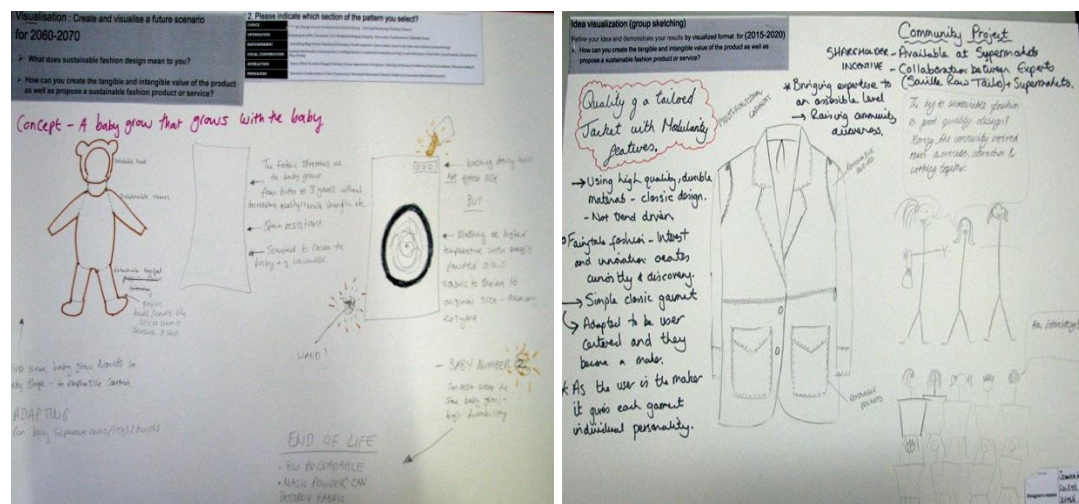


Group (a):  Growing fabrics with baby          Group (b): School Uniforms

**Figure 7.12: User generated concepts: focusing on age and behaviour**

**Group (b):** Focusing on the 'Way of Maintaining' card, users suggested an online platform for a swap and global share service with local communities. The clothing library can be activated from community to community and sell intangible value of

the services. Furthermore, one size versatile cloth can be worn by various users without size limitation.

**Group (d):** The consumer can personalise their fashion through advanced technologies such as a body scanner which allows the user to personalise fit form and styles. The designer provides not only a tangible product but also various services for long term use stages for redesigning of clothing. They suggest the best suitable style and design and an option of a life time membership card for redesigning, shaping and embellishment of the design.
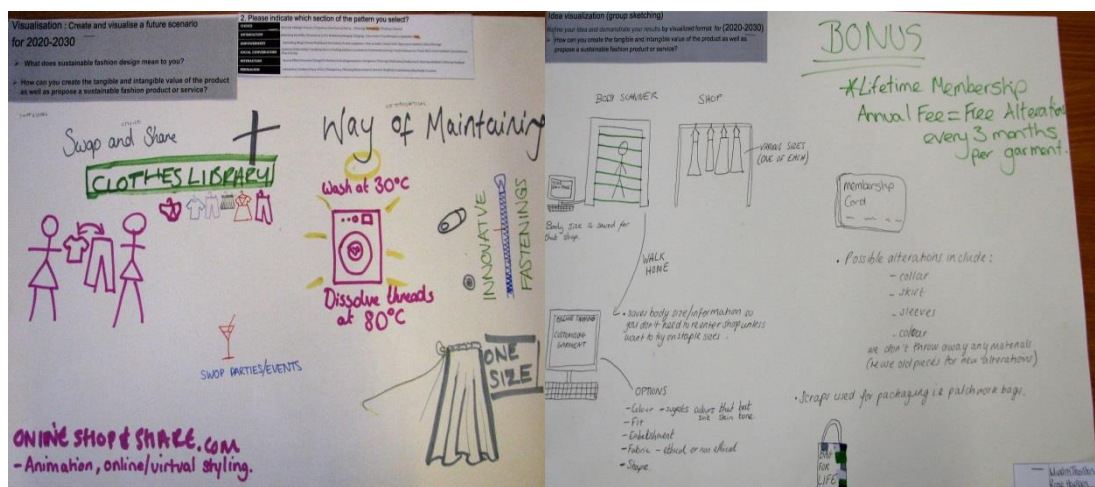


Group (c): Clothes library          Group (d): Lifetime clothing

**Figure 7.13: User generated concepts: new way of end of life services and system**

Considering possible user behaviours and situations, some other concepts were suggested by participants to tackle the design brief. The following design concepts were suggested by participants during the workshop. They considered consumer journeys including the design stage and consumption as well as the end of the life process to address more sustainability through apparel product design and services. Depending on the situations and user activities, clothing can be designed differently.

**Group (e) Jogging wear:** Top can change colour according to light using illumination when jogging at night. It provides safety especially outside for the jogger or biker.  When the heart rate goes up, fibres open up cooling the consumer down. Fabric can pick up levels of oxygen and carbon dioxide in the atmosphere and adapt to the person's shape becoming tighter or looser.

**Group (f) Climate MAC clothing:** Emphasising on the function of clothing (safety, comfort, utilities) as well as consumer emotional and behavioural interactions with

products; garments also can offer protection from pollution and react to the climate such as wind, sun and rain. Adaptable, UV resistant, waterproof, breathable fabric has reacting fibres that can expand and contract responding to the temperature and weather. The clothing also reacts depending on the couple's movement and temperature and how they breathe. Garments can react to different senses (smell, sound, touch). When they are hugging each other, the garment can interact with wear and enhance couple's relationship.



| Group (e) Jogging wear | Group (f) Unisex product used by couple |

**Figure 7.14: User generated concept: focusing on human behavior and situations**

**Group (g) The Lifejacket:** Compartments can be blown up to help the wearer float. Puffer jacket transforms into a sleeping bag. Elongates or reduces size by inflating itself. It can give aid to workers in disaster zones (floods). The outer shell is made from waterproof recycled tent fabric lined with a smart thermo fabric to regulate temperature. The sleeping bag section rolls into a pouch at the back to provide padding and ease of movement. A filter system allows the wearer to drink flood water. Clothing contains emergency rations.

**Group (h) The future bicyclers**: In order to encourage safe motorcycle or bicycle riding, the back of the LED Jacket allows indication of the wearer's level of cycling skills, handle movement and speed. Incorporating the idea of design modularity and use of Zips or Velcro, clothing can be changed- the look, the length of the garment and sections can be removed depending on the user's activities and temperature. The design component can be interchanged to other functions and adjusted to different

sizes. The fashion company sell a section of the modular components and provide sponsorships for safe riders.
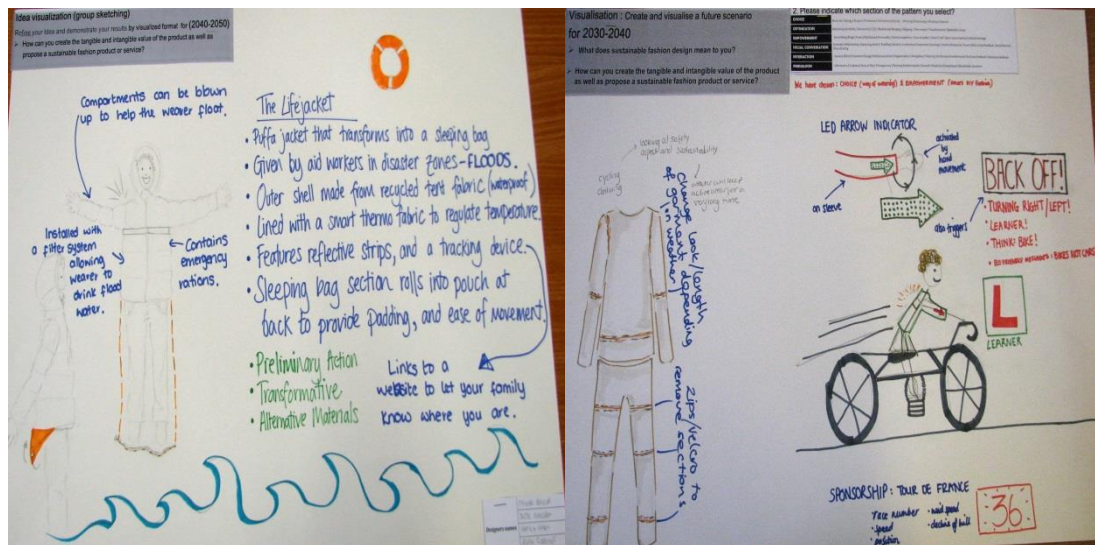


Group (g): The Lifejacket          Group (h): The future bicyclers

**Figure 7.15: User generated concepts: Focusing on life styles and situations**

**Group (I) Future retail shop:** Retail shops can provide individual users with their needs through changing the way users shop, providing alternative, higher quality and smart fabric selection. Incorporating the idea of smart DIY fashion, consumer could buy fabrics, colour swatches with video instructions. The consumer could design and produce the garment at home emphasising self-efficiency and effective communication with consumers. The manufacturing process would need to be more transparent, fashion companies sell various services including knowledge, ideas, and production qualities. Computer aided design could contribute to virtual design. Production and consumption process would be continually improved based on an effective consumer feedback loop.

**Group (J) Future retail shop:** Using a smart clothing selection system, customers can easily select their favourite styles and clothes by use of virtual system, a real time mix and match recommendation system depending on personal preferences. The machine can detect the tastes of the customer such as colour, pattern and style preference. A real time system might automatically suggest the most attractive look and styles depending on their skin colour, body shapes, hair styles and so on. Both customers and retailers can gain advantages through selling and buying appropriate clothing and the optimisation of customer's experiences in retail shops.
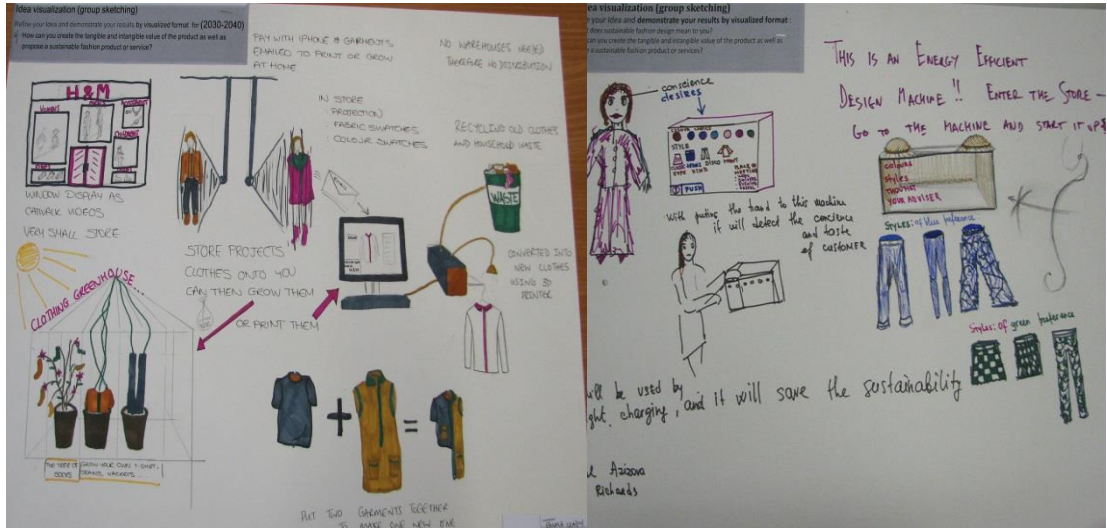
Group (I): Future retail shop                    Group (J): Future retail shop

**Figure 7.16: User generated concept: Focused on future retail shops**

**Group (K) Wearing maintained**: Minimising waste and optimisation of up cycling process through considering the end of life cycle of clothing, for example, a good quality of yarn wool jumper with holes. Fibres are wet and packed on holes in the jumper. Add fibre as user wants, different ideas of pattern and colour could be fabricated and changed to different shapes using old jumpers.

**Group (L) Loyalty scheme**: As the user is the maker, it gives each garment individual personality. In order to facilitate a continuous up-cycling design process, retailers can provide different options of yarns and colour and offer incentives or competition for best up-cycling designs for customers. Fashion companies can provide a Loyalty scheme for sustainable consumption regarding up-cycling design and treatment of clothing for consumers.
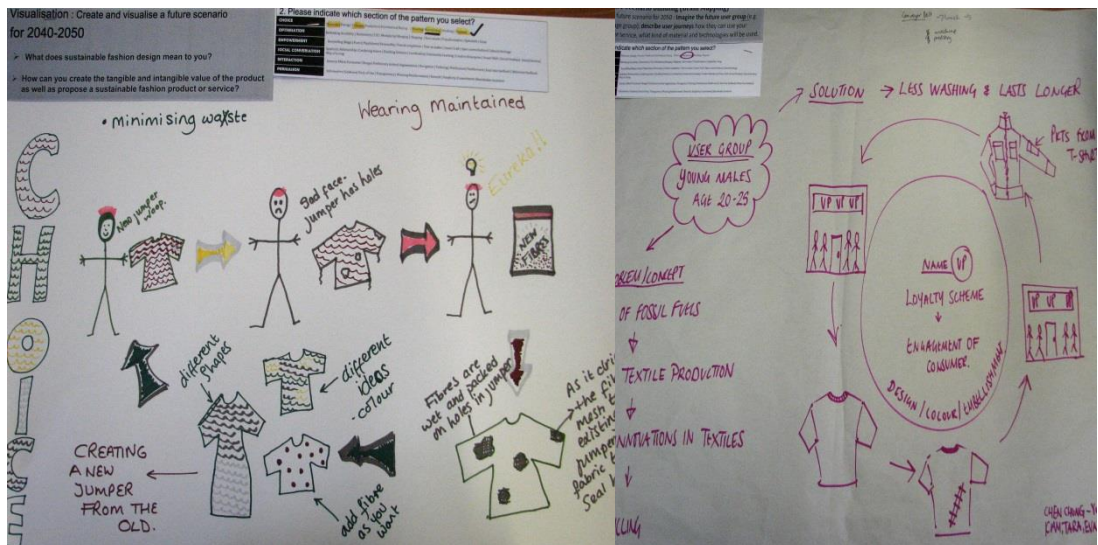


Group (k): Wearing maintained                 Group (L): Loyalty scheme for environment    of
                                                                                            consumers

**Figure 7.17: User generated concepts: new way of end of life services and system**

The various concepts proposed by participants through using ideation cards and their design concepts were shared with participants during the group discussion. Most participants agreed that individual small action combining with personal creative ideas can be very powerful for the design process as well as for society rather that big and uncontrollable agendas, which due to volume, can be hard to reach the target. Participants suggested various design strategies which can be applied to sustainable products, services and system design for further development of design.

### 7.3.3 Evaluation of SFB toolkit

To identify whether participants had boosted their awareness of sustainable fashion, the first question asked for the SFB toolkit evaluation was; 'After participating in this workshop "using ideation tool kit", would you consider that your knowledge and awareness has increased?
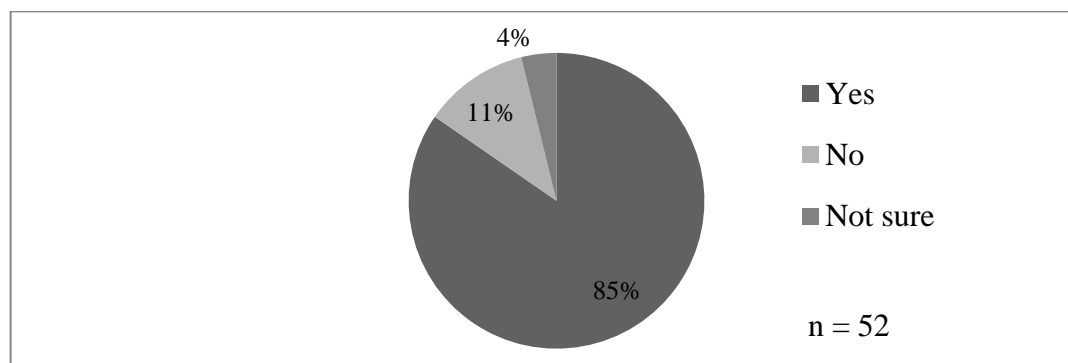


**Figure 7.18: Participants' responding of increased awareness after toolkit**

As shown in figure 7.18, the overall response to this question was positive. 85% of participants responded that their knowledge and awareness had increased, 11% replied 'No' and 4% stated 'Not sure of this question.

The next question was 'Please indicate how clear you found the information and knowledge provided in the tool kit'. This question was scored on a five-point scale, 1 being negative feedback and 5 as positive feedback. The question was designed to gauge participant perception of content provided in the toolkit and whether the content of the toolkit was clear, effective, and informative and if use of the toolkit was an enjoyable process. Figure 7.19 and Table 7-4 presents the overall participants' perspectives for SFB toolkit.
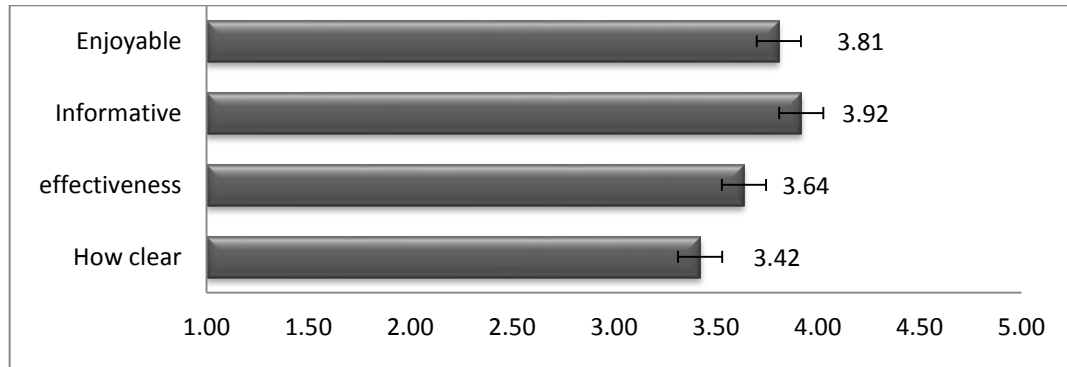
**Figure 7.19: Evaluation of the ideation toolkit**

**Table 7-4: Evaluation of SFB toolkit's Mean and Standard deviation**

| Evaluation | Mean | Standard deviation |
|---|---|---|
| Clearness | 3.42 | 0.65 |
| Effectiveness | 3.64 | 0.65 |
| Informative | 3.92 | 0.85 |
| Enjoyable | 3.81 | 0.95 |

The feedback received on the SFB Ideation toolkit was largely positive. Evaluation of participant feedback indicated that the informative level of the toolkit (M=3.92) was highest ranked followed by its perception as enjoyable (M=3.81). The mean for clearness (M=3.42) and effectiveness (M=3.64) were not quite so high compared with 'informative' and 'enjoyable' but it is still considered as acceptable. The standard deviation (SD) indicates that there was a high level of agreement between the participants' assessment of the toolkit's clearness (SD=0.65) and effectiveness (SD=0.65). Whereas, there are less agreement for 'informative' and 'Enjoyable' but it is considered that from 0.6 to 1 would be reasonable agreement for a five rank scale. Overall, responses for these questions indicated that informative and enjoyable were one of the main benefits of the SFB toolkit. Next, participants were asked 'please indicate which pattern of the toolkit you found the most useful?
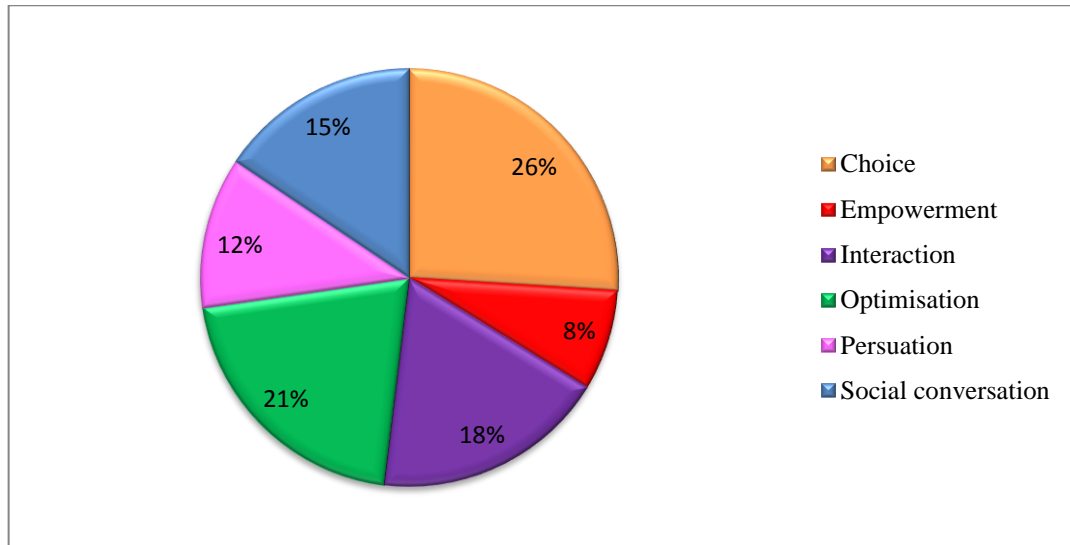
**Figure 7.20: Useful pattern of the toolkit**

As can be seen from the data in figure 7.20, Choice pattern (26%) was considered as the most useful section followed by 'Optimisation pattern (21%) and 'Interaction pattern (18%). While, 'Empowerment' (8%) and 'Persuasion' (12%) had less high ranking compared with others. However, open-ended responses showed that the majority of the participants considered that most sections of the SFB Ideation toolkit were useful and all contents were considered as equally important. Table 7-5 shows a sample of the feedback for each pattern of cards obtained from the participants.

**Table 7-5: Participants' opinions regarding useful patterns**

| Patterns of cards | Respondents opinions to each pattern of cards |
|---|---|
| Choice | 'It seemed more relevant to look particular task' <br> ' Looking at different ways of sustainability' <br> 'To learn how it affects society' ' Interesting got the thinking' |
| Empowerment | 'It shows how you can personalise products to suit consumer needs' <br> 'It is alternative  possible sustainable approach' <br> 'It was most interesting' |
| Interaction | 'It had scope for future development' <br> 'I like the idea of incorporating interacting into sustainable product and services' 'The tool provides a lot of interaction solution which expand the designers horizon' |
| Optimisation | 'It is more active approach' 'Interesting to see how you can maintain products' 'It talks about essential topic of sustainability and practices which need to implement' |
| Persuasion | 'It is good to know others ideas and rewarding to reach conclusion and |

| | |
|---|---|
| | solution as a group' |
| | 'To persuade other partner to accept your idea is quite important' |
| | 'Awareness is important' |
| Social conversation | 'Something more involved with modern future' 'It's useful due to the social responsibilities and importance' |
| | 'It is interesting to see how solution can be generated in social way' 'It is most fun' |
| Other opinions | 'All equally same value' 'all very well understood' |
| | 'Because of the cards, we were already set down paths of ideas' |
| | 'The different sections of the toolkit helped generate ideas' |
| | 'Good to see questions the cards that make you think more about your design' |
| | 'Different ideas are merged to get a unique idea' |
| | 'Working on a new concept logically really helps to bring out lot of things innovation at its best' |

The participants' responses indicated that the cards made it easier to identify problems and think more about their design process in order to capture problems quickly and set down paths of ideas through combining different cards. Most participants replied that they used the toolkit for problem identification through the open-ended questions and produced alternative solutions through viewing other examples in the different cards. This enabled the generation of new solutions through synthesizing and discussing their ideas with the group.

Additionally, one participant replied that *'I think that the process of idea generation can be applied to almost any subject matter, and will definitely benefit me in the future. Assessing and reflecting on the toolkit helps to understand the problems that I encountered better, which means that I shouldn't make the same mistakes in the future'* (Workshop participant, 2011).

They consider that the toolkit helped them to understand the subject of sustainable fashion better, see the bigger picture, and understand the way new ideas are pitched. Participants replied that ideas that were merged through combining the different sections of the toolkit assisted the generation of innovative concepts. Responses indicated that participants viewed the toolkit as thought provoking.

One participant commented that *It helped me to consider the points that haven't occurred to me before (for example, I used to concentrate on the materials choice only, but now see it just like a small part of the whole sustainability concept). 'I think that it also helped me to link ideas that at first might have seemed totally unrelated'* (Workshop participant, 2011). It is recognized that when participants looked at the toolkit information first, they considered that some cards were not related to sustainability especially 'persuasion' and 'empowerment' pattern cards, but later they found these the pattern cards were very useful in contributing to the new idea generation for sustainable product and service design.

Participants were asked 'Have you found any confusing part of the ideation tool kit or less useful section?'
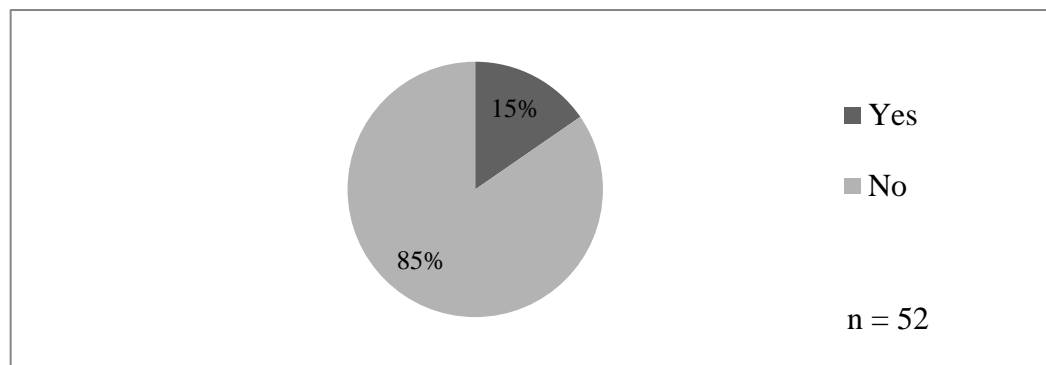


**Figure 7.21: Confusing part or less useful section of the SFB toolkit**

In response to this question, the general response was very positive, 85% of participants replied that there was no confusing part in the toolkit and 15% indicated 'Yes'. Most of the participants considered that all the sections were equally helpful, but they found it was a very challenging process with time pressure and with comprehending such an amount of information. Furthermore, the introduction part was not clearly presented regarding task and aim of tool use. Other participants also indicated their opinion of difficulty regarding the understanding of sustainability. It confirms that sustainable design is difficult to fully understand in a single time event. It is recognized that for the first time the information provided on the cards might not be enough to understand all the aspects of sustainability, which makes the toolkit use confusing and overwhelming. They found that it was very challenging to understand and generate new ideas within a limited time. Additionally, one

participant responded that they found connecting pattern sets with each other in order to generate new solutions both difficult and confusing. This participant also indicated that there was a lot of information to read and take in when deciding on a specific problem to solve. Consequently, these issues need to be improved for future study.

Next, participants were asked 'Would you consider using this ideation tool kit again?'
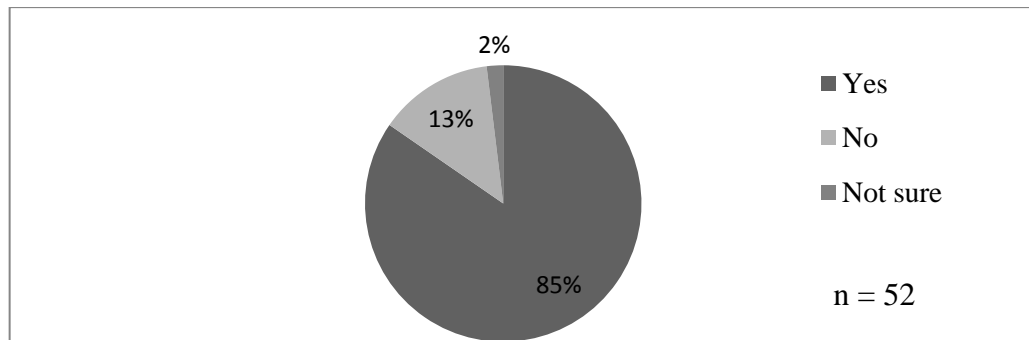


**Figure 7.22: Participants' respondent regarding future intention of toolkit use**

The pie chart above shows that 85% of participants indicated they would like to use the toolkit again, 13% stated 'No' and 2% replied 'Not sure'. It appears that some participants who had deeply engaged in the workshop process, they tended to use the toolkit again (85%). While, among 13% of negative feedback, one participant stated that *'I am not using sustainability in my design project this year'*. It appears that depending on participants' pervious interests and motivation toward sustainable design practice, the future intention of toolkit use can be different.

The final question for the toolkit evaluation was 'What Improvement would you suggest to the toolkit?' The summary of participants' suggestions is shown in Table 7-6.

**Table 7-6: Summary of suggested toolkit improvement**

| (1) Contents of information | 'Very lengthy' <->'A little bit more explanation' |
| | 'Shorter summaries and more inspiring photos' |
| | 'A little bit complicated, more simple way' |
| (2) Toolkit instruction | 'provide how to use section and clear output of user task' |
| | 'Slightly more explanation, perhaps an introduction to even |

| | instruction page to explain to guide through, perhaps making the initial steps clearer', 'Another example in each section of we use' |
|---|---|
| (3) Easy accessibilities for future use | 'Own copies of PowerPoint presentation or tool cards' 'Digital format' |
| (4) Layout of design | 'More visuals', 'More Graphics, better images', |
| (5) Additional learning information | 'More background on problems surrounding sustainability' 'Additional learning information for advanced tool user' |

There are five main suggestions which were classified for further development of the toolkit improvement.

 (1) **Contents of information:** there are pros and cons regarding various options of the cards. Some participants considered that the tool cards had too many options and they found it difficult to choose specific cards. Whilst, others considered that the tool cards assisted in saving time as most of the aspects of sustainability were covered and summarized. They considered that the various options, of the tool cards provided, enhanced the perception of sustainability by incorporating sustainable production and consumption through distinguishing from existing ideas to create a unique concept. However, participants found that some parts seemed to be too similar or found it difficult to understand their differences, especially, if the time given to read through was quite short. For example, the social conversation part (social service, social feedback).

(2) **Toolkit instruction:** suggested improvements for the ideation toolkit included more instructions within the 'how to use this toolkit' section and further explanation was required on the design tasks. It became apparent that participants found the initial steps, describing how to use the ideation cards, confusing.

(3) **Easy accessibilities for future use:** Another suggestion indicated that an easily accessible version (e.g. a digital version of toolkit or interactive web-platform) could be more effectively used in the design process for individuals to generate ideas. It is acknowledged that online media as a design platform could support continuous sustainable design practice in the long term.

(4) **Layout of tool cards design**: another recommendation was for a more visual format containing less text and more graphics and cards could be designed as sticky

notes so that the user could organize their thinking as a visualizing process in the mind mapping stage.

**(5) Additional learning links or index:** Some participants suggested that the toolkit could also have a relevant reading list (books, articles, web) on the reverse side, as well as some more complex terminology explained (which is probably required by the beginners in the sustainable fashion field). Every potential user would have an ability to research each card that interests them more in depth, rather than relying on the card information only. Therefore, it could be used as a design index to provide additional information including the definition of sustainable fashion, relevant reading lists, idea generation process.

### 7.3.3.1.1 Workshop process evaluation

The process for the workshop evaluation was conducted in a similar procedure to that for the ideation toolkit in which the questions were scored on five-point scales (1 indicating negative feedback and 5 indicating positive feedback). The feedback received on the workshop process was similar to that for the toolkit. The workshop process evaluation form consists of eight questions: (1) what did you think about this workshop process and how did you feel about the workshop?
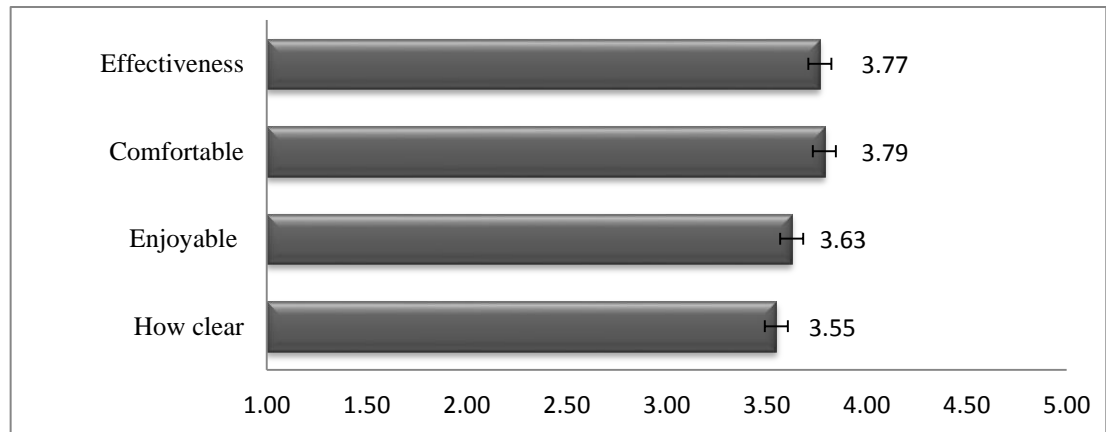


**Figure 7.23: Overall feeling of workshop process**

**Table 7-7: Evaluation of the overall feeling of workshop process**

| Element of evaluation | Mean | Standard deviation |
|---|---|---|
| Effectiveness | 3.77 | 0.78 |
| Comfortable | 3.79 | 0.81 |
| Enjoyable | 3.63 | 0.86 |

| | | |
|---|---|---|
| Clearness | 3.55 | 0.79 |

As can be seen from Figure 7.23 and Table 7-7 above, 'Comfortable' (M=3.79) ranked top category followed by 'Effectiveness' (M=3.77). While, 'Enjoyable' (M=3.63) and 'Clearness' (3.55) obtained less high mean values. Most of standard deviations were similar degree from 0.78 to 0.86 which means reasonable agreement between numbers of participants. In general, therefore, 'comfortable' and 'effectiveness' were considered as one of main benefits of the workshop process. The next question was 'Did you feel the workshop process was creative & learn new ways of generating ideas?' The overall response to this question was positive, 88% of participants indicated 'Yes', 10% of participants replied the 'No' and 2% reported 'Not sure'. The evaluation of participant responses found that majority of participants considered the workshop process creative, facilitated the learning of new methods of idea generation and indicated that enthusiasm had increased for the area of sustainable fashion. The specified participants' positive perspectives for the workshop process are presented in Table 7-8.

**Table 7-8: Positive feedback on the workshop process**

| Specific section | Positive feedback on workshop process |
|---|---|
| Problem identification (Brain mapping) | 'The brain mapping process helps narrow down the specific problems through writing down the keyword. It allows the identification of the key solution to work on a new concept logically. It really helps to bring out lot of ideas from the ideation cards and write down a core solution through mapping system. It identifies key elements and looks at the co-relation of each idea which triggers innovation and bounce ideas off each other'. |
| Future Scenario building | 'I had never really thought about future fashion problems in much detail before. Thinking of future scenario leads to the generation of a new solution. I can use this elsewhere on the course for my future projects. It is really thought provoking'. |
| Idea visualization | 'Idea visualization is great fun and helps make my idea readable for other participants. It helps the details to process better and practical to further the design processes.' |

| | |
|---|---|
| | 'Visualizing the idea can be difficult in group situations, but it was easy to work with others as everyone integrated their idea to create solutions'. |
| Group presentation/ Discussion | 'Discussion of ideas and presentation was enjoyable and we showed ideas to each about sustainability. Group presentation helped to develop ideas through learning from other people's concepts and discussion of further development of the ideas with each other'.<br><br>'During the group discussion, It helps you to critically analyse the design concepts through further discussion and feedback from other participants'. |
| Other | 'I deeply loved it and become more enthusiastic about it'<br>'Give me a new way of learning'<br>'Very creative & hands on'<br>'Thinking outside the box and into future'<br>'Enjoyable and we showed ideas off each other the sustainability'<br>'Working & designing as group was new to me'<br>'Working as group helped develop an idea into something better' 'Good to brainstorm roughly, then other generate idea readable & clear ideas for presentation'<br>'Brainstorming in a group is a great idea' |

On the other hand, participants also were asked about negative aspects or less useful section of the workshop process. A specific question was 'Have you found any confusing part of the workshop process or less useful section?' 79% of participants considered 'no confusing part of the workshop processes and 21% indicated some confusion during workshop process. It appeared that although there were positive feedbacks regarding the workshop process in the previous session, there were also negative view points which need to be improved and resolved for the future study. The details of negative feedback on workshop process are shown in Table 7-9.

**Table 7-9: Negative feedback on workshop process**

| Negative feedback (improvement required) |
|---|
| 'Future scenario building: I didn't understand at first that I was creating a product for a specific year in the future. <br> ' Introduction-how to guide' <br> 'A bit hard to understand, the process of beginning the initial stage wasn't entirely clear' 'Difficult to establish what task was' <br> 'A lot of info to take in and read when deciding a problem to solve thinking of ideas 'Give more details regarding instruction' |

The findings of the negative responses showed that there was a similar problem identified in the workshop process regarding clear instructions for the user task. Some participants had confusion about the task at the beginning of the initial stage of the workshop. Improvement of the effective instructions and clear guides on how to use the toolkit is essential for potential users.

Next question was 'Did you obtain any benefit from co-design (design together with other people)'? It is noted that this question was not aimed to evaluate whether group based idea generation gave more benefits than individual idea generation. Both approaches can be combined according to the situation. However, as stated in the literature review, there is a lack of appropriate process and tools for the co-design process. 84% of participants considered that the participatory design process was of benefit to obtain an effective design concept, 10% stated 'No benefit' and 6% replied 'Not sure'. Table 7-10 shows both positive and negative perspectives obtained from participants.

**Table 7-10: Specified user perspectives for co-design**

| Positive viewpoints (specified answers) | |
|---|---|
| Supporting strong idea generation | 'More ideas & solutions' <br> 'A variety of answers and more imaginative concept' <br> 'Supporting ideas generated new scenario' <br> 'It helps to critically analyse ideas' <br> 'Stronger ideas generation' 'Gain different idea' <br> 'Brainstormed off each other and more ideas' <br> 'Collect different ideas' |

| Learning | 'Informative & educational for personal knowledge' |
| | 'learn from others' |
| | 'A mixture of ideas meant a more broad- mined view on the subject' |
| | 'I could understand deeply the idea of fashion sustainability' |
| Communication skills | 'Got to convince with others and feel more confident telling ideas and thought' |
| | 'The amalgamation of ideas helps the designer process' |
| | 'You have other people to balance ideas off' |
| | 'Learning how to discuss ideas is always useful' |
| | 'Interactive' |
| Sharing knowledge | 'With group discussion, came to know lot of things when analysing it' |
| | 'People can inspire you more' |
| | 'Exchange information and create a new idea' |
| | 'Good to hear other people' ideas' |
| | 'Bounced ideas off each other - others think of things which you may not think of' |
| Others | 'Helpful for final year ideas' , 'more sustainable ideas', 'I liked the ideas' |
| **Negative viewpoints(Specified answers)** | |
| | 'Not realistic' |
| | 'Prefer independent solution' |
| | 'Hard to get people involved' |
| | Sometime inside a group, there are different opinions' |

There were four distinctive positive co-design benefits which were stated by participants. First, co-design supports more strong idea generation through providing several concepts and widened perspectives of sustainable design from a peer group. Second, participants can learn from other people and consider a more holistic view for the specific problem situation. Third, each participant can develop communication skill in order to convince other people during the idea generation stage and then they can present core solutions to other members of the group. Finally, participants can share different viewpoints and they can inspire each other. On the other hand, negative viewpoints were also recognised that, especially when participates had different opinion inside a group, it was hard to resolve the problem and select the final solution. Some participants considered co-design as 'not a realistic solution'; others simply preferred individual idea generation.

Next question was 'Did you feel the workshop process was creative & learn new ways of generating ideas?'
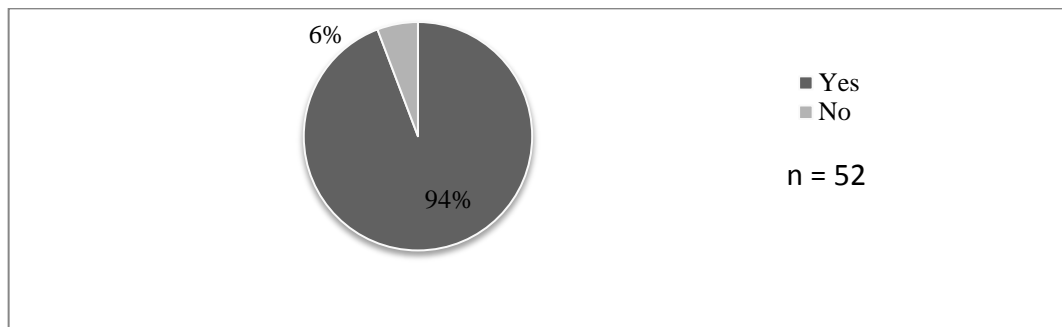


**Figure 7.24: Overall workshop process impression**

It can be seen from the pie chart in Figure 7.24 that 94% of participants indicated that the workshop process was creative and a new way of creating ideas, 6% respondents stated negative. Overall, the majority of participants considered that the workshop process was very positive.

The final question was 'What improvements would you suggest to the workshop process?' There were also some suggested improvements regarding the workshop process. Participants' suggestions were classified into four issues including; toolkit use instructions, time issues, and additional feedback after presentations, and integrating with making process. Table 7-11 shows the detailed participants' suggestions for the workshop process.

**Table 7-11: Detailed participants' suggestions for workshop process**

| What improvements would you suggest to the workshop process? | |
|---|---|
| Toolkit use instruction | 'Clear objectives for users' outcomes and tasks' |
| | 'A little more explanation of workshop process- Bullet points' |
| | 'Some manual objective on elements through which can make something 'More explanation of tasks' |
| Time issues | 'More time need all the information provided' |
| | 'More time & classes' |
| | 'Allow a little more time to get to group with each pattern |
| | 'Maybe a bit longer time allowed, so we can read all the sections each sheet and more details' |
| Additional feedback | 'After group presentation, please give more feedback' |
| Integrating with making process | 'More hands on garments to play with' |

**Toolkit use instructions:** This was recognised as main limitation of the workshop process. The clear instructions for user' tasks and explanation of the workshop process would be required. Participants suggested providing the background and design procedures materials in advance of the workshop to enable greater familiarity with the workshop process. Although most of the participants were familiar with brain mapping and the visualisation of their ideas, a number of individuals felt that future scenario building was initially challenging as they considered it a less familiar procedure. They suggested that the description of 'what is future scenario building' would be useful to understand and could effectively use this technique.

**Time issue:** As discussed in the previous section, the time issue was raised by some participants. Especially beginner users who were not familiar with sustainability, more time is required to understand issues related within fashion design. Furthermore, those who had knowledge of fashion design tended to use the toolkit more effectively and created unique concepts by combining different cards.

**Additional feedback:** Some participants requested additional feedback for the final outcome of their own design concept. Although during the presentation and group discussion, participants shared ideas with other groups and provided feedback to other participants, some participants asked for a systematic feedback loop to obtain additional feedback effectively. This can be resolved by an online platform that the toolkit users could upload their own design and allow other participants provide feedback or vote for the best sustainable design concept.

**Integrating with making process:** One participant indicated that she would have preferred to move directly onto the next step in the fashion design process with hands on experience of garments to assist the generation of solutions. This issue will be discussed in next chapter; how the SFB toolkit can be integrated with the making design process.

## 7.4  Interviews by professional and scholar group

### 7.4.1 **Participants and procedure**

After evaluation of the SFB toolkit and workshop process among the design students group, the researcher had the opportunity to present the overall research project and toolkit to three international conferences The European Academy of Design in 2013, Sustainable Innovation in 2011, and Making Futures in 2011. The audiences provided valuable feedback for the overall research. Meanwhile, six participants were recruited to evaluate the toolkit with professional fashion designers and educators based on a semi- structured interview for flexible conversation. The period of interviews took place from September to October, 2012 and each interview lasted around 1-1.30 hours. The Table 7-12 shows the summary of interview method and participants' information.

**Table 7-12: Methods for interview and participants information**

| Interviewees | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| Profession | Fashion Design lecturer | Fashion Marketing lecturer | Sustainable design lecturer | Fashion designer | Design management lecturer | Design management lecturer |
| Sampling method | Semi-structured interview, face-to-face interview Convenience sampling | | | | | |
| Period | September to October, 2012 | | | | | |

The purpose of this phase was to identify professional designers and educators' perspectives on quality and usefulness of toolkit information and obtain their suggestions for the further improvement of the research. The six interviews were carried out using the same procedure. The interview described the purpose of the project and the toolkit and how workshops were conducted. The Participants were provided with the SFB tool cards and description. The participant were then asked about the following the elements including the information quality on the toolkit contents, usability, design layout and values of the toolkit. Table7-13 presents the element of evaluation and specific questions.

**Table 7-13: Questionnaire for interviews**

| Element of evaluation | Specific question |
|---|---|
| Information quality on the toolkit contents | Would you consider that the toolkit is appropriate and provides useful information to integrate sustainability in the design process?<br>Is the information presented clearly? |
| Usability of toolkit | Would you consider that this ideation toolkit is effective?<br>Is it feasible and useable? |
| Values of the toolkit use | Educationally valuable?  Might it facilitate Innovation?<br>Commercially valuable? |
| Design & layout of the toolkit | Would you consider that this ideation toolkit is aesthetically pleasing and has a clear layout? |
| Other suggestions or comments | What improvements would you suggest to the tool kit?<br>What improvements would you suggest to the toolkit use process?<br>Any challenges to using the toolkit and implementing the sustainable design decisions? |

## 7.4.2  **Information quality on the toolkit contents**

The interviews' result indicated that the quality of information on the toolkit considered as largely positive but interviewees also suggested valuable opinions regarding improvement to the content of the toolkit information.

- **Positive feedback (Strengthen of the toolkit contents)**

*'I think the toolkit is very useful for fashion designers and students particularly to make them aware and explore the possibility and marriage of different aspects of sustainability that they can be achieve. In term of industry, again they can identify how they can enhance sustainability within the company and also identify limitations. I think it is really clear and concise; you look at various different levels and possibilities that can make a difference. Each time you look at the sustainability it will be likely more incorporated sustainability'* (Interviewee A, 2012).

*'It does look like you've got to build to get a quite comprehensive set of information to use as an inspiration point to develop ideas. The information on the cards sets is very easy to understand ....I can see how this inspires discussion among the people to develop ideas. I think the layout of information is good'* (Interviewee B, 2012).

*'I think the content is sufficient and comprehensive. The patterns that some of them are focusing on are consumption and some of them are production focused; it will be very useful for the idea generation stage to incorporate sustainable design concepts'* (Interviewee C, 2012).

### 7.4.3  Suggested improvements to the toolkit contents

Similar suggestions were given from workshop participants, the interviewees also suggested adding further descriptions such as terminology, the workshop process and the idea generation techniques for users who want to see and learn more about sustainable fashion. Interviewees suggested that this additional information would help to assist in generating new ideas.  Interviewee C stated: 'though *the tool card briefly summarise each section, it will be difficult to understand the whole concept of sustainable fashion through a one-day workshop. It would be much better if the tool cards have some more illustration regarding terminology and overall meaning of sustainable fashion'*.

Another suggestion for the contents was more description in the toolkit instruction what each pattern represents and how patterns are distinguished from each other. Especially, when users have more time, they would consider learning and reading about all the contents thoroughly (Interviewee C). Further suggestion was for expected user outcomes so that users can see the overview of potential outcomes for their practices (Interviewee B).

### 7.4.4  Usability of toolkit and value of toolkit

#### 7.4.4.1  Educational values in school and University

Overall, interviewees considered that the toolkit could be more suitable for fashion and textile design students to understand sustainable fashion as well as for teachers as a teaching material.  Interviewee E stated that *'I can see the potential value of the toolkit. Inside formal education, I can see the context of an educational tool for*

*designers in making them aware of systems thinking approach.'* Interviewee C also gave a similar opinion that *'It can be useful for educational purposes and teaching sustainable fashion and textiles for design students'.* Most of the interviewees considered that the toolkit would be particularly beneficial for educational purposes in integrating sustainability in the early design process.

### 7.4.4.2 Commercial values in fashion companies and creative enterprise

Some participants observed potential values and usability for design consultants and small or medium size enterprises in which they can address this process (Interviewee E and F, 2012). Another interviewee also commented that *'It would be useful for the Corporative Social responsibility (CSR) department as big fashion companies start to incorporate sustainability into the design process* (Interviewee F, 2012). The respondents showed positive perspectives for potential practical value for fashion companies or design consultancies such as training purposes or development of a new strategy underpinned by sustainability.

Interviewee A noted that *'from school to university level let them think and start sustainable design practices. Sometimes, simplistic ideas can be very commercially valuable. For example, I could see much potential possibility to develop student' generated ideas that can be commercially desirable as well as innovative. The ethos of company has to adopt sustainability at every level including managing director'.*

Interviewee E stated that *'I can see the potential value for consultancy in this area in fashion design companies. A lot of companies and organisations need to take knowledge from the design sphere. For the design consultancy, a more multi-disciplinary team including designers, pattern makers, technologists, buyers, merchandisers, marketers and managers sitting down and developing strong design strategies would be very valuable. They often need to develop better understanding of where they are going and what the real future concerns are. I think there are some benefits in terms of thinking as a tool outside formal education'.*

Similarly, interviewee B stated her perspective utilisation of the toolkit in fashion industry that *'I think there is a lot of organisations and designers that can actually build in time for incorporating sustainability into the design process in the same*

*way you tested. Although it seems more useful to a group of people rather than an individual, the toolkit could be assessed during the individual concept generation stage.'*

While Interviewee D shared her experiences working at a fashion company. She normally obtains information at the idea generation stage through subscribing with online trend forecasting companies' publications or reports (e.g. WGSN Trend forecasting and analysis) but she stated that there are only small sections that cover sustainable fashion design. She mentioned that a design agency or consultant could adopt this process and provide more unique and various ideas for other fashion design companies.

### 7.4.4.3 Creative values

Interviewees stated that one of the strengths of using the toolkit was that users can explore sustainable fashion in more creative ways through combining two or three cards which can make new and strong concepts. Interviewee B pointed out that many environmental tools often restrict innovative thinking. However she suggested the toolkit could allow creative design concepts and more design led approaches.

Whereas, interviewee E stated that *'I think the combination of the toolkit with future scenario building is a very strong point of this workshop process. I think it is not only for use at the idea generation stage, once used in the professional situation, it can be a good strategy for companies. If you got people, sitting around the table, who are normally arguing precise quality parameters, it would have potential to take out that point to let them think that we are in the 2020s or 2030s, and to start sharing pictures where their business might go, I think that is very useful point.'*

## 7.4.5 Suggested improvement for toolkit usability

Similar responses were observed from design students' feedback, some interviewees suggested some improvement of usability for the toolkit. Although the toolkit provides the broad guidelines how users can use the toolkit, there is a need for a more clear flow of the idea generation process and recommendation for cards selection.

**Clear flow of the workshop process inside the instructions:** interviewee C suggested that it would be better to make a clear description of the idea generation

process with the toolkit so that users can follow the task and look at this inside the instructions. Therefore, potential users could use the toolkit without a facilitator and they can also use the toolkit during the individual idea generation process.

**Some guidance on how users can select cards:** Interviewee B also suggested a possible card sorting process whereby the user can use two set of cards or three set of cards, or just let them select some specific part to allow them to explore it. If they are given some guidance on how they would select those cards in the first place, they would easily utilise the cards.

**Accessibility for during individual idea generation**

Interviewee F questioned whether professional designers can have time to use the toolkit. Interviewee F stated that *'the current situation of the fashion design business model is driven by increasing economic value. It will be very challenging if the process is too complicated and if a lot of effort is needed to incorporate this.'*

While, interviewee B stated a different opinion that if a designer can see the benefit or value of the toolkit use, such as why they should use it and why this kind of process would be more beneficial to them, the professional designers will make time to use the toolkit as it supports the development of designers' ideas integrated in sustainable fashion.

Interviewee D stated that within a design department, design team members including fashion design manager, senior designer, designer, textile designer, accessory designer, can get together and they could use the toolkit during the concept development stage. But sometimes it is difficult to organise a meeting due to different time schedules. She considered that an online web environment could enable them to easily access the toolkit information during individual idea generation stage.

## 7.4.6  Design & layout of toolkit (Aesthetic, creativity)

**Would you consider that this SFB toolkit has an aesthetically pleasing and clear layout?**

Most of interviewees considered that the A5 size poster is quite clear and users can look at an overview of the each pattern and what each pattern can represent.

Interviewee A noted that *'A lot of books suggest fashion design products rather than think how they can be made different as a holistic aspect. A company may not even think about any other possibility, for example they might have thought the environmental friendly materials use but not many other options are considered. I think it can create awareness of all the different aspects and support to create new capability for overall design'.*

**More visualised and different format of card types**

On the other hand, some interviewees provided suggestions for toolkit layout of design. Interviewee C stated that *'I think the toolkit needs to be more visual especially if the toolkit is targeted for designers and consumers.'*

Interviewee B also suggested some strategy for format of card types. *'Double-sided card type in which front side provides the open-ended questions while, reverse side shows short description of the image and description....Perhaps, when users start to build ideas through the visualisation process, other pieces of cards can be provided that are white and clean. Users can put their own image on the reverse side and they can use these various images for future use to help as a creative process for themselves'.*

## 7.4.7  Other suggestions and comments

**Suggestion 1: Different types of assessments**

Interviewees also suggested some opinions for future work. Interviewee B, D and E suggested a different type of assessment of the toolkit such as integrating the sophisticated game or IPod interface, a website that enables the users to easily access the toolkit in a more interactive way. One interviewee B suggested that *'as you stated, an online platform can be very useful but it will be more beneficial if the process and platform can be like a sophisticated game or enjoyable environment where they can enjoy practices rather than work. Sometimes sustainability is considered as very hard work or an enormous task'.*

**Suggestion 2: Integration with a reflective tool**

Interviewee E suggested some further development of a reflective tool that links with the SFB toolkit. He stated that

*'Design education is constant a process: well informed, creative and then reflective… Use of cards can be an initiator for sustainable fashion design concepts, way of capturing to make sure they might be encouraged to go through the process to the increase awareness of sustainability issues; conversation into the creative outcome.....What is missing is an evaluation part… Creativity can get complex losing focus of the initial objective. Outcome of design concept can be something completely different… Especially, design students are outcome oriented; people often jump to solutions before really understanding the problems. Maybe a reflective tool that users can evaluate their end outcome that captures where the sustainable impacts are and what the change is and where the change is..'*

### 7.4.8  Discussion of the interviews result

The findings showed that information quality on the toolkit contents was considered easy to understand and comprehensive to support triggering discussion and supporting creation of hybrid alternative solutions by combining different cards. The interviewees considered the toolkit can be the most suitable for the undergraduate level of fashion and textile design students and multidisciplinary design students as shown in pervious series of workshops. The interviewees also showed that professional fashion designers and other team members in design team or CSR department can also utilise the toolkit. The third potential users recognised in the design consultancies or educational organisations. Overall, there are many possibilities to use the developed new system and toolkit in real world situations. However, it was also found some limitations which required some improvements in order to successfully achieve the transformation.

## 7.5  Chapter summary

This chapter has described how the SFB Ideation toolkit can be applied during the concept generation stage of the fashion design process. It illustrated how the workshop was conducted and evaluated whether the developed toolkit and process was useful for potential audiences incorporating design led approaches for sustainable fashion design.  The workshop participants' and interviewees' suggestions were very useful for reflecting on the whole PhD project as well as further improvement of the toolkit and workshop process. However, it is recognised

that there is no magical solution to cover all different people's aspirations. Therefore, it is essential to look back to initial objectives of the transformation of the system. The initial objectives of the toolkit was to develop in its users a personal understanding of sustainable fashion which increases awareness of and promotes a change towards, more sustainable fashion and textile design practices. The main objectives for input in the system were:

- To support informed decisions for sustainable fashion at a concept generation stage
- To encourage users to create new design solutions for sustainable fashion with users' themselves.

The evaluation of the outputs was:

- **Degree of awareness of sustainable fashion was increased after the toolkit use (85%).**
- Future intention for toolkit use was relatively high (85%).
- Overall feeling and impression about the toolkit were:
  Informative (3.92): High
  Enjoyable (3.81): High
  Effectiveness (3.64): Moderate
  Clearness (3.42): Moderate
- **Users smoothly generated various new design solutions using the toolkit.**
- 94% of participants indicated that the workshop process was creative and a new way of creating idea.
- 84% of participants considered that the co-design provides benefits during the workshop, 10% reported 'No benefit' and 6% stated 'Not sure'
- Overall feeling and impression about the workshop
  Comfortable (3.79): High
  Effectiveness (3.77): High
  Enjoyable (3.63): Moderate
  Clearness (3.55): Moderate

The summary of the toolkit evaluation is shown in Table 7-14 which describes the inputs and outputs of the transformation process in the system.

**Table 7-14: Summary of the toolkit evaluation: the Inputs and Outputs of the transformation**

| Input | Input of the initial objectives | Output Implementation | Suggested improvements & other aspirations |
|---|---|---|---|
| Toolkit information & contents | * To support informed decision for sustainable fashion at a concept generation<br><br>(Support understanding of the role of sustainable fashion design) | *Overall, degree of awareness of sustainable fashion was increased after the toolkit use (85%).<br>*Future intention for toolkit use was relatively high (85%).<br>*Overall feeling and impression about the toolkit were:<br>Informative (3.92): High<br>Enjoyable (3.81): High<br>Effectiveness (3.64): Moderate<br>Clearness (3.42): Moderate | *Provide additional learning information such as terminology, general meaning of sustainable design, how to distinguish each pattern<br>*More visualised format<br>*Easy accessibilities and availabilities for future use |
| Toolkit performance & activities | * To encourage to create new design solution for sustainable fashion with users' themselves | *Users smoothly generated various new design solutions using the toolkit.<br>*Overall feeling and impression about the workshop<br>Comfortable (3.79): High<br>Effectiveness (3.77): High<br>Enjoyable (3.63): Moderate<br>Clearness (3.55): Moderate<br>* 94% of participants indicated that the workshop process was creative and a new way of creating idea.<br>*84% of participants considered that the co-design provides benefits during the workshop, 10% reported 'No benefit' and 6% stated 'Not sure' | *Toolkit use instruction: provide clear user tasks and expected outcomes, some guideline for how to select cards<br>*Integrating with reflection tool whether user generated concepts are environmentally, socially and economically sustainable<br>*Accessibilities for the toolkit during the individual idea generation |

Overall, the development of the toolkit meets the initial objectives to support and understand sustainable fashion. Most of participants considered that their degree of awareness of sustainable fashion was increased after the toolkit use. Second main objective was to promote the creation of new design solutions for sustainable fashion with users' themselves. The study indicated that the SFB Ideation toolkit would support designers to guide responsible decision making at the concept generation stage. Overall feedback from the participants revealed that the SFB toolkit helped to generate concepts for sustainable fashion. Participants noted that the toolkit and design process facilitated design thinking and triggered creativity. Furthermore, the toolkit helps to set a common objective of sustainable fashion and it was especially useful to communicate common 'language' in a group idea generation situation. In fact, the toolkit was intended to support the users to create their own solutions as a flexible way rather than suggesting pre-determined design or evaluating environmental impact of production. The participants found that the process aided the development of ideas and suggested a new way of working and thinking 'outside the box' and for the future. Feedback indicated the process was found to be informative, educational and inspirational with group learning and sharing of knowledge through the group tasks and group presentations. Responses noted that the workshop process had encouraged the development of a variety of ideas resulting in what participants considered more imaginative concepts. They considered that the process motivated them to create their own solutions.

**Suggested improvement and other aspirations**

As recognized by the findings of this study, effective instructions and clear guides on how to use the toolkit are essential for potential users. The workshop process would be designed as a card-based tool in order to help users give guidance for the use of the toolkit. The workshop process and ideation process will be included in the SFB card based toolkit in order to maximise effectiveness of toolkit use. To summarise, further improvement of toolkit and workshop process were recognised:

**The toolkit information and contents**

- Provide additional information such as terminology, general meaning of sustainable design, how to distinguish each pattern
- Easy accessibility and availability for future use

**The toolkit performance and activities**

- Toolkit use instruction: provide clear user tasks and expected outcomes, some guidelines for how to select cards
- Integrate with reflection tool to determine whether user generated concepts are environmentally, socially and economically sustainable

From the initial transformation model and its input system, the author initially planned for the development of the online platform to motivate larger audiences and allow people to access the toolkit and contribute their own sustainable solutions. The toolkit can be accessible to audiences where users can download either a card-based tool or a web-interface and users can access the overall background of the research and information such as terminology, general meaning of sustainability, specific theory behind each pattern and the examples of  participants' generated design concepts.  The toolkit performance and activities have been improved during the research time period. The next chapter describes the improvement of the toolkit which used the overall research results, co-design system and how offline and online platform can be interacted with each other.

Chapter 8: **Action Taken to Improve: Discussion of SFB Toolkit and Platform**

## 8.1   Introduction

This chapter presents the further improvement of the SFB toolkit and workshop process. The toolkit and workshop process was revised according to the participants' feedback from evaluation processes. The Sustainable Fashion Bridges (SFB) online platform has been developed in order to increase accessibility and connectivity in the real world. It is also demonstrates how the new system and toolkit can be applied into real world situations through redefining the target and sub target audiences. Finally, this chapter will cover both the opportunities and challenges for a co-design fashion system at the concept generation stage and its implementation for sustainable fashion design.

## 8.2   Taking action to improve

The in-depth description of the toolkit was been covered in chapter 6. The main objectives of the toolkit and target audiences have been defined in chapter 5 using soft systems methodology including root definition, CATWOE components and the transformation of the input and output system.   However, the initial toolkit instructions did not include descriptions of the purpose of the toolkit or guidelines for the expected outcomes. In order to make sure the initial steps are clearer, the toolkit instructions were improved based on previous participants' feedback. Summaries of the SFB idea generation process with the use of the toolkit and guidelines for expected outcomes are illustrated in Table 8-1 and 8-2. The suggested model can be conducted within a group or on an individual basis, enabling toolkit users to integrate sustainability in to the concept generation process for apparel products, services and systems.

**Table 8-1: Guidelines for community level of workshop**

| Instruction for the SFB workshop | |
|---|---|
| **Purpose of the toolkit** | The Sustainable Fashion Bridges (SFB) toolkit aims to catalyse social conversation and promote engagement for sustainable fashion design practices. The main purposes of the toolkit are:<br>• To support informed decisions for sustainable fashion at the concept generation stage<br>• To encourage users to create new design solutions for sustainable fashion with users' themselves |
| **Guidelines for expected outcomes** | The SFB toolkit encourages you to explore many different possibilities with freewheeling design scenarios and creative design solutions to tackle the design brief using the SFB ideation cards.<br><br>Firstly consider the clothing's lifecycle and its end of life and then expand your ideas to go beyond the initial product life of the clothing. Imagine various design scenarios that combine different SFB ideation cards. You are encouraged to explore the challenges of sustainable fashion and generate highly conceptual design scenarios without restraint. **However, your design scenarios are expected to effectively communicate and meet the design brief through your visualised sketches. The outcome of your design concept can be designing for a sustainable fashion product, planning of a sustainable service design or business strategy and event etc.** |
| **Group size** | 5 to 30 participants (divide the group into 5) |
| **Time required** | 2:30-3 hours |
| **Materials** | colour markers, pencils, large paper |

**Table 8-2: Guidelines for the toolkit use**

| How to use the toolkit? |
|---|



| **Step 1:** Toolkit assessment | Using the SFB ideation toolkit, you are encouraged to create new design solutions to address sustainability in fashion design. The toolkit serves to help you understand the context for sustainable fashion and assists the identification of environmental and social impacts of clothing. Further, you can see the alternative design solutions through examples in the toolkit. |
|---|---|
| **Step 2:** Problem identification & future scenario building | Please define the problem and decide the scope of what issues can be tackled, as well as which issues need to be tackled. Then create new solutions through the exploration and combination of different SFB ideation cards. A guideline for the future scenario building is illustrated in Table 8-3. |
| **Step 3:** Visualisation & refine design concept | Demonstrate your design concept in a visualised format, which can be used for planning a fashion product design, service design or business strategy. Examples of other tool user generated concepts can be found at www.sustainablefashionbriges.com |
| **Step 4:** Final review for execution (Presentation & group discussion) | This phase is the most critical review required for execution of new design development. In a group, discuss whether your final concept is feasible and useful for environmental, social and economic sustainability. The final stage is group reflection where groups of people can vote for the winning final design concept. |

**Table 8-3: Guideline for future scenario building**

| Guideline for Future scenario building | |
|---|---|
| What is your design? | Product? / Process? / Service? (E.g. event/promotion..)/System?<br><br>What: |
| Specify target problem (Why?) | |
| Specify by who/when/where your design will be used | |
| How will your design tackle the specific problem? (Describe your unique, distinctive features and technical solutions) | |
| Environmental benefits? | Choice of environmentally friendly materials, energy, overall design process and production, distribution, overall consumption, use, reuse and disposal. |
| Economic benefits? | Optimisation and effectiveness of resource use or reuse, design process, production, infrastructure, enhancement of flexibilities of design. |
| Social benefits? | Social conversations of justice, labour, welfare, ethics, security and empowerments of personal identity, social, cultural interaction, persuasion, strengthening of creativity, learning, health and wellbeing. |
| www.sustainablefashionbridges.com | |

## 8.3 Extending the impact of the SFB Toolkit: online platform

The final main study followed the development of an online co-design platform (environment) which provides a more global level of interaction. Throughout the research, the context of community level co-design workshops has been explored. However, this has some limitations for accessibility, connectivity and scale of collaboration. To overcome these issues, an online platform is being developed. The social design environment provides a space for interested participants to access the toolkit information, share their design concepts and a network of diverse skills and understanding. The website developed a meta-perspective platform through utilising web 3.0 Word Press (WP). The developed web interface www.sustainablefashionbriges.com is shown in Figure 8.1
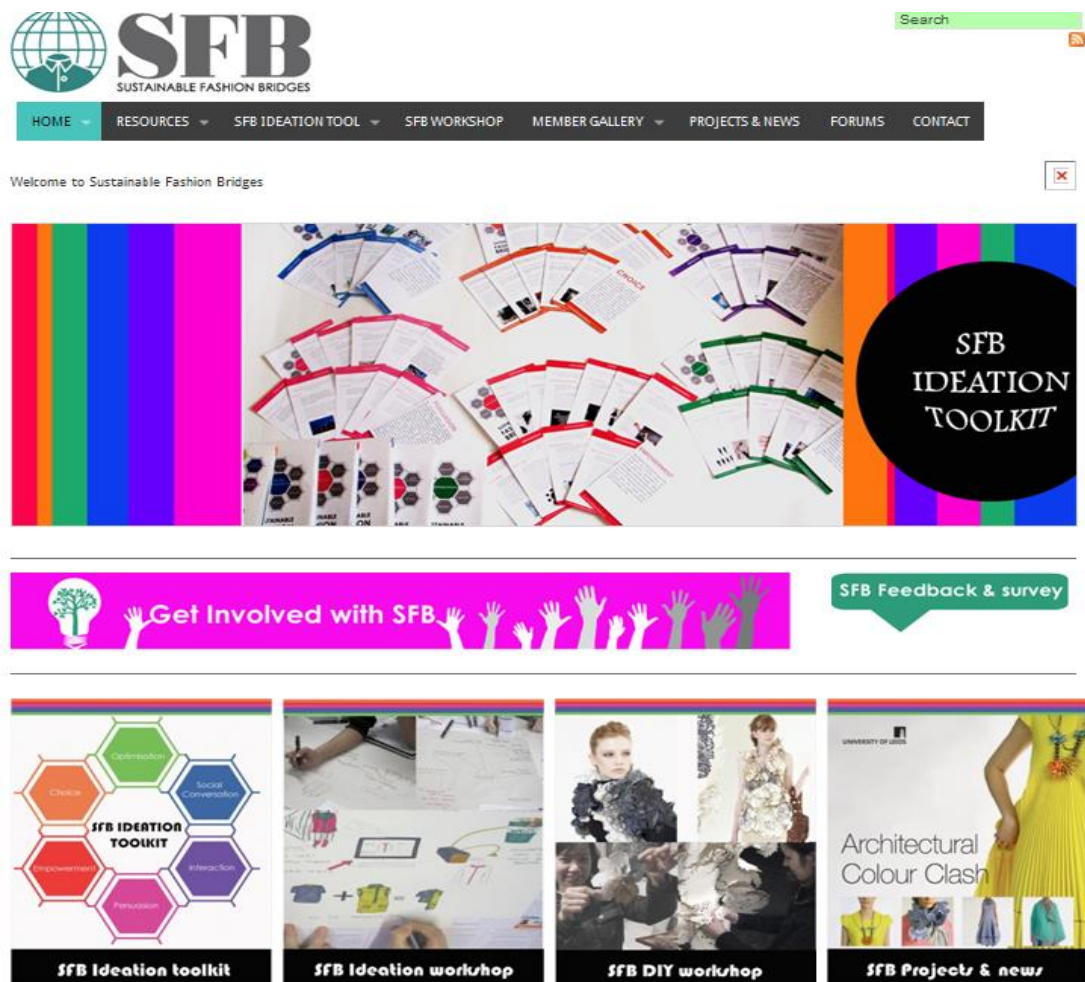


**Figure 8.1: Sustainable fashion bridges homepage**

## 8.3.1 **Structure of the online website**

The structure of the SFB website consists of nine distinctive sections. The first five of sections are linked into level two sub section. Table 8-4 shows the specific description of each section of the website contents.

**Table 8-4: Contents of SFB webpage**

| Navigation (Level 1) | Descriptions of contents |
|---|---|
| Home | This page presents setting research strategies and a brief introduction of the Sustainable Fashion Bridges including outline of research direction and scope and the fundamental aim and objectives of this website. |
| | Level 2 provides corresponding navigation of more specific overall strategies of the SFB project. This level utilises how users can use this website in effective ways providing the sub-navigations including what is SFB, how to use this site and SFB vision. |
| SFB resources | This section provides the rationale behind the SFB research discusses the meaning of sustainable design and its drivers and challenges in the fashion industry. The SFB research offers resources and recommends relevant reading which will be regularly updated. |
| | Level 2 covers: what is sustainable fashion, drivers and challenges of sustainable fashion, clothing lifecycle system, the designer's role in the sustainable fashion, sustainable design tools and recommended reading lists |
| SFB Ideation tool | Brief description of the ideation toolkit is given in this section. The main structure of this section describes the toolkit's purpose, layout, target audiences and performance of toolkit. |
| | Level 2 webpage presents more specific information and further resources corresponding with Level 1. |
| SFB Workshop | This section focuses on the process of workshop performances and identifies the method for effective toolkit use. SFB workshop provides specific information on workshop methods and description of how to use ideation cards. Through case study of toolkit use, users can understand how they can utilise the toolkit as well as their sustainable design activities. |
| | The level 2 provides ideation techniques for supporting workshops and enhancing creative thinking. |
| Members gallery | A platform for users to upload their work through step by step images, videos or visualised story boards and DIY kits with instructions. People can learn about how other users can solve their own problem using the SFB toolkit. |
| | Level 2 gives specific information regarding empowering the user to interrelate design activities including making fashion |

| | products, visualised ideas of service and system design through using the SFB toolkit. |
|---|---|
| Project & News | Provides specific information of SFB projects with students, people and industries. News and events (regularly updated): cross-linked to the homepage. |
| Forums | Forums: Discussion section with users regarding sustainable fashion and textile design |
| Contact | Contact page for questions or further information. |
| Feedback | Feedback and comments on content – Online feedback form |

The fundamental part of this web environment associated with the meta-design process concept was proposed by Fischer *et al.* (2002), who developed the Seeding, Evolutionary Growth, Re-seeding Model (SER) in order to bring co-creation to life. This SER model builds seeds that evolve over time through the small contribution of a large number of people. According to Fischer *et al.* (2002), the seeding phase, the knowledge-based design environment is evolved over time allowing users to access information. During the evolutionary growth phase, this is extended to create more work or explore a problem with various users. In this phase, the researcher or developer is not directly involved with the problem; as an alternative, the users have a direct involvement in the problem and personalise their own solution. During this time, an online platform plays a pivotal role in the design process providing resources (e.g., SFB Ideation toolkit) for work by information accumulated from prior use (e.g. offline user generated concepts) and each project contributes new information to the seed. Throughout the Reseeding phase, the researcher or system developer does not need to provide solutions but rather reseeded information gradually extended by a number of users and providing inspiration or solutions. Through adoption of the SER Model, the SFB (Sustainable Fashion Bridges) co-design system model has been developed and shown in Figure 8.2.
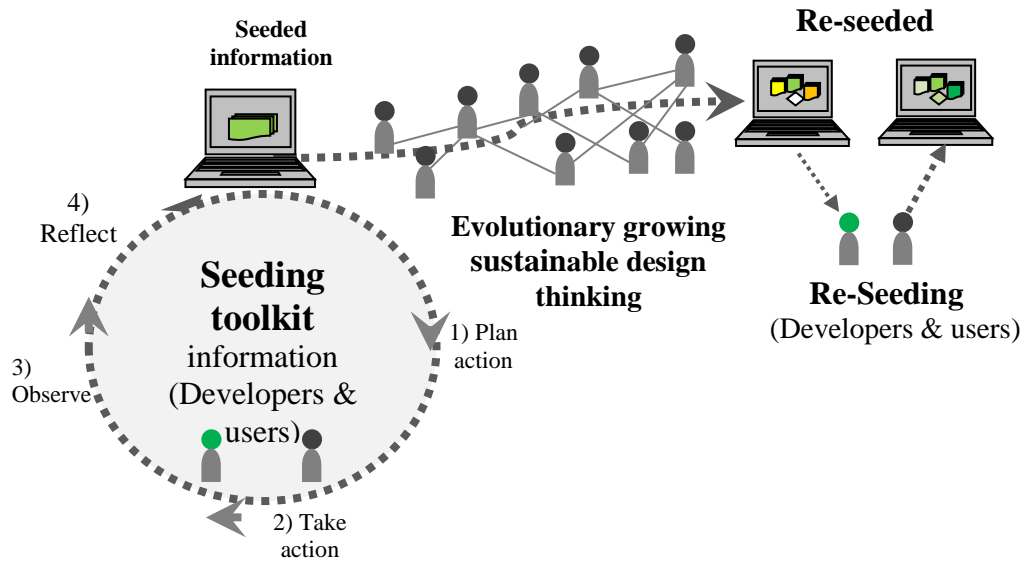
**Figure 8.2: Relationship with users & professional designers in co-design (Adopted from Fischer *et al*., 2002)**

feedback using participatory action research. The sustainability driven design concepts including initial SFB toolkit and user generated outcomes can be stored to the Sustainable Fashion Bridges (SFB) website. The platform enables co-design to take place online. This may be in real time, with designers and users working together virtually and simultaneously, defining a particular problem and generating a range of potential outcomes; alternatively, a problem or outline concept may be proposed and worked on overtime as the knowledge base of interested parties expands. The online gallery provides a collaborative space for sharing ideas and outcomes; as such, expertise becomes shared, overcoming the issue of the fragmented understanding of sustainable fashion. The gallery reflects the various 'design patterns' of the ideation toolkit and features visualised design concepts and realised prototypes or fashion product design. Figure 8.3 shows the evolutionally growing stage which can present various design concepts at the member gallery.
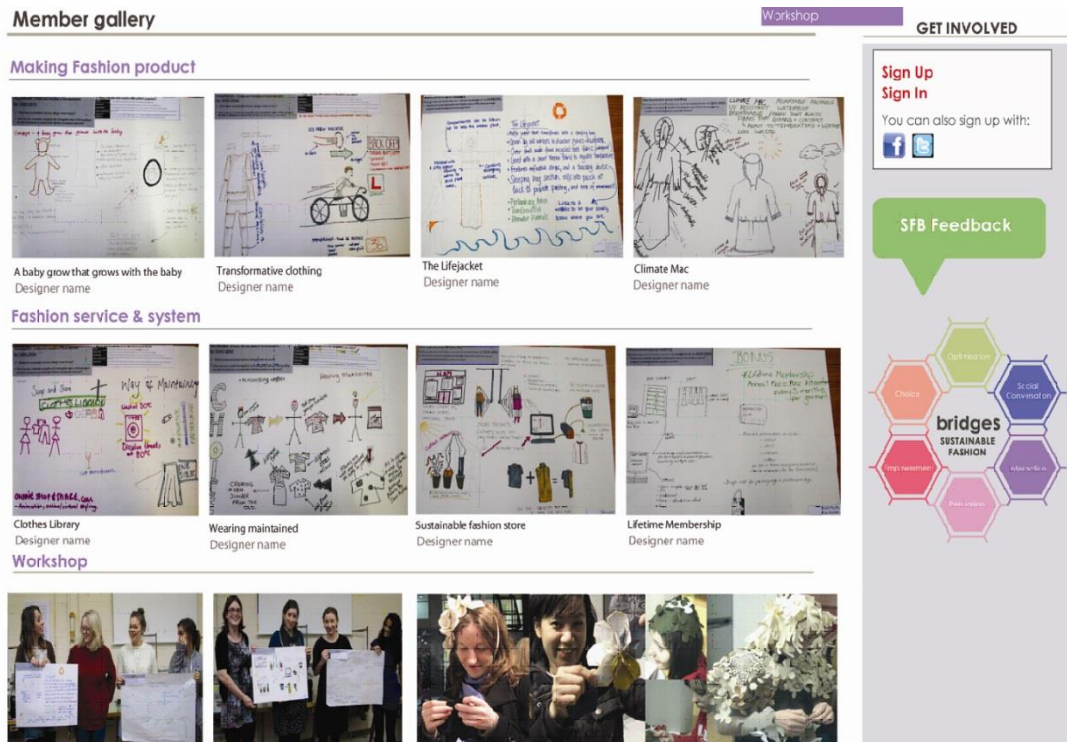
**Figure 8.3: Evolutionally growing stage: Stored various design concepts at the member gallery**

Although the SFB online platform, the evolutionary growth and the reseeding phases have not yet been fully explored, there are a number of technical infrastructures that could support these through user-innovation by utilising the distributed network. Through the creation of social innovation, the traditional idea generation process can be extended beyond the initial toolkit information and evolutionally grow sustainable design thinking and address environmental and social issues. Users will have the opportunity to provide feedback and this will also form part of the 'feedback loop' which will influence the toolkit, the website, and ultimately the community engagement projects. Indeed, offline and online activities can interact with each other, with proposed online problems forming the basis for workshops, and offline visualizations being uploaded to the gallery and share and promote sustainable thinking for a more global level of interaction. The web platform has a range of resources which expand on sustainable design thinking and practice, including examples of facilitating the ideation toolkit for encouraging sustainability at the advanced level and standard tools for encouraging creativity which may be used online and offline. Utilising a dynamic meta-process of web-platform, the sustainable Fashion Bridge can offer the potential to bridge the gap between theory and practice in the area of sustainable fashion and textile design.

## 8.4  Public participation and engagement

Target audiences for the toolkit were mainly design students and fashion and textile designers, addressing their aspirations discovered in the survey results from chapter 5. The improvement has focused on the designers to enable them to develop more sustainable solutions in the ideation phase. However, the members of the general public who are interested in sustainable fashion design also have the opportunity to use the toolkit supported by professional designers. Sanders and Stappers (2008) pointed out that any person can become a co-designer, but that the two terms are not interchangeable; whether a person can make the transition to a co-designer is dependent on one's levels of expertise, desire and motivation. The following scenarios provide ways in which the ideation toolkit can be used on various levels by users.

- **Users at the beginner level**

Users utilise the ideation toolkit to explore the design context and to make informed decisions in the idea generation stage. At the beginner level, the user has the opportunity to become aware of the sustainable design issues and increase their knowledge regarding sustainable fashion design. They can follow the practices suggested on the ideation cards. In this case, people require the minimum level of sustainable design knowledge and fashion design skills but have the potential to develop both.

- **Users at the intermediate level**

Users can combine at least two or three different ideation cards and personalise their own thinking and ideas to develop concepts which better fit with their personal beliefs, interests and motivations. At the intermediate level, the user requires more interest and understanding of sustainable design and the limitations of fashion design. It is suggested that this is the entry level for fashion and textile design students; from here they can move towards the 'advanced' and 'expert' levels.

- **Users at the advanced level**

At the advanced level, the user can address sustainable design concepts at a deeper engagement level and investigate more closely the synthesis of social, environmental and economic issues, using the questions on the ideation cards as a stimulus. Through co-design workshops, the user can share and expand their

knowledge with their peer group (in the case of community level workshops) but the guidance of professional designers is essential, if the user wants to realise the product in a sustainable manner.

- **Users at the expert level**

Users at the 'creating' level can practice sustainable fashion and textile design in more innovative ways. Using the ideation cards, the user can continuously reflect on their actions and consider short, medium and long-term impacts, based on their broader knowledge of sustainable design issues. At the 'creating' level the user can express their creativity supported by professional designers; it is this level where the user has the deepest engagement, greatest understanding and highest skill level, which may rival that of the 'expert' fashion design practitioner. At the expert level, the user can support others in the 'beginner', 'intermediate' and 'advanced' levels. Users at the 'expert' level can act as facilitators in the same way as professional designers. It is at this level that users can truly become actors for change in the sustainable design movement.

## 8.4.1 The role of users and professional designers in co-design

Professional designers can also use the ideation toolkit in the same ways as the co-designers (general public), depending on their level of understanding of sustainable design. They can rethink and reflect on their current design practices and create new solutions, developing both their understanding and their skills as sustainable designers. However, Sanders and Stappers (2008) have proposed a new role for the designer in co-design, that of facilitator. In this case, their creativity is used to amplify that of users. With the requisite knowledge and understanding, expert design practitioners can engage users in the development of more sustainable solutions by providing encouragement and guidance to people at all the different levels of creativity. However, many designers are still not aware of the wide range of sustainable design issues and methods. The ideation toolkit provides the means for fashion to experiment with sustainable design ideas and concepts and then play the role of a 'creative teaser' (van Busch, 2008, cited in Fletcher, 2008) acting as a catalyst for the user's own creativity. This approach to co-design represents a significant change for designers; rather than a focus on production; it encourages them to apply their creativity to facilitating user engagement in the design process and becoming social change agent.

Furthermore, when the user establishes a design context and alternative solutions using the ideation toolkit, they may already be, or be motivated to become, sufficiently passionate that they wish to go beyond the concept stage into the development of a real product or service and be involved in the making process.

At this 'making' and 'creating' level, users may experience fear of creation as it challenges the norms of their experiences; an easy way of visualized instructions, further development of the making tool would be an essential in the co-design system. Therefore, the provision of a 'making' toolkit and appropriate guidance (what Sanders has referred to as 'scaffolding' (2002)) will avoid user confusion during the learning and making process, thereby facilitating engagement. In this stage, the design practitioner can assist the sharing of knowledge and experience in a more active way. Through this co-design activity by informed participation, users are able to move away from limited concepts and learn new ideas in a social environment; in overcoming the 'fear of creation' they may be motivated to move to the 'creating' level. Figure 8.4 provides a visual illustration of how such making tool kits may be developed, allowing each user to easily understand how to make the product themselves.



**Figure 8.4: Example of making tool: modular fashion: Co-design workshop (Hur, 2009; Hur *et al.*, 2013)**

The professional designer can encourage the user to explore a range of different materials such (as paper and discarded clothing) in making their prototype. In this way, they can explore the craft experience of different materials evoking different responses to their initial concept. In order to construct an initial user's own design solutions, the professional designer (workshop facilitator) can guide and give feedback to users rather than imposing own solutions. Therefore, the professional designer needs to provide an appropriate design tool which reflects the user's level of skills. The toolkit is likely to be different for each case. In some cases, the professional designer will not be able to support some technical skills and may be working at the edge of their knowledge; at this point, they can suggest other contributors or stakeholders to aid the user to realise their own design concept in their role of facilitator. The different roles of user and designer are summarised in Figure 8.5.
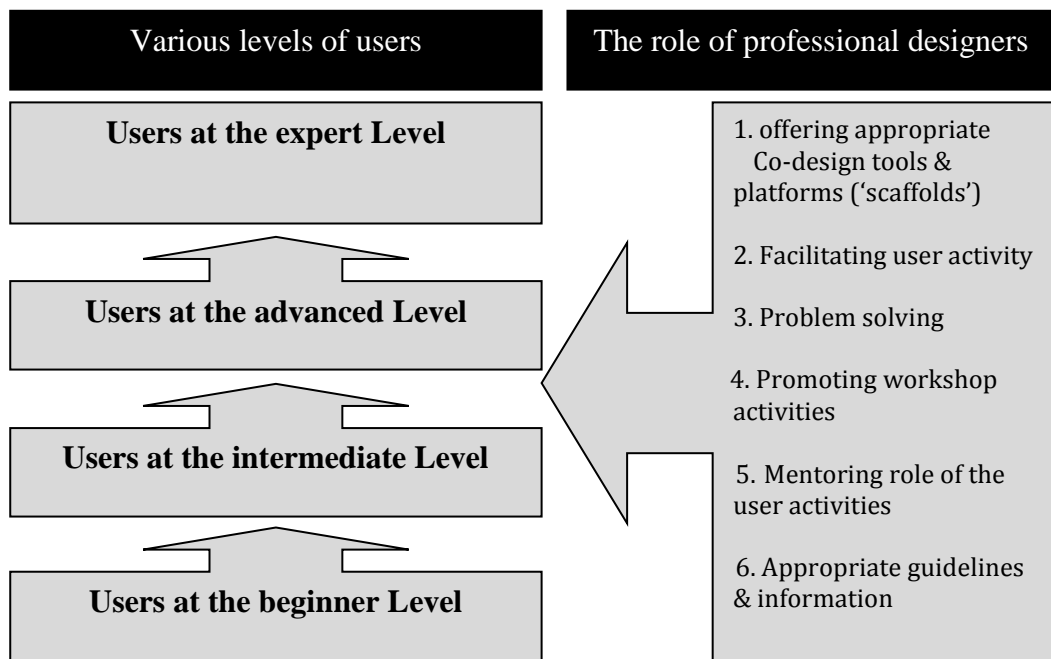


**Figure 8.5: Relationship with users & professional designers in co-design**

## 8.5 Designers and various other actors' participation

Key actors are already defined in chapter 5, using CATWOE components, and interviewees provided valuable opinions for the potential usefulness of the toolkit. They suggested the toolkit can be useful for both education and the fashion industry. Fashion and textile design students can use the toolkit for learning and idea generation purposes for sustainable fashion design. Professional designers can use

the toolkit at the idea generation stage, involving various other actors including merchandisers, fashion buyers, garment and fabric technologists, trend forecasting agencies, production managers and so on.

However, the following scenario presents the possible various actors' engagement methods for sustainable fashion design using the online environment. Initially, the online environment can be utilised by fashion design students or any collective users. They can upload their new sustainable design concepts and promote their projects through the web environment. Public users and the fashion industry can vote for the best design idea which can also be sponsored by the industry or public users. The sponsor can reserve the design concept and the designer can continue to develop the final design outcome through working together with the sponsoring Fashion Company or through working independently.  The working independent project can be backed by a funder, giving each designer 100% ownership of their work. While, a fashion design consultancy can provide or sell their services in sustainable fashion design information they can also deal with technical problems related to mobility. They can examine dynamic real time fashion business and consumer trends. A visualised possible design scenario is shown in Figure 8.6.
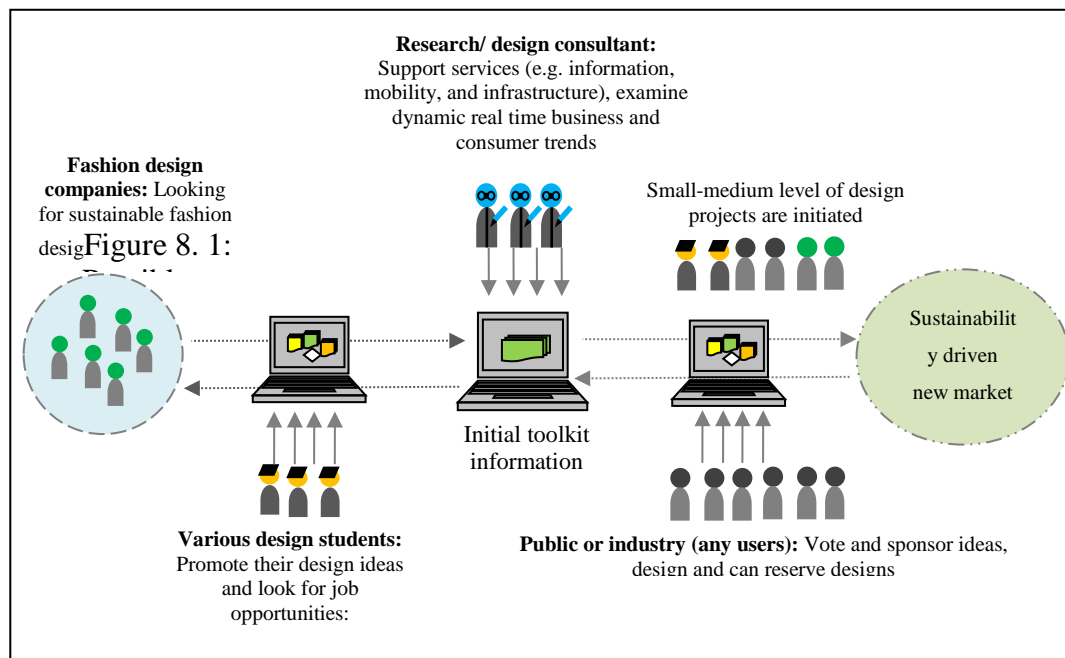


**Figure 8.6: Possible scenario for various actors' engagement for sustainable fashion design**

## 8.6 Final descriptions of input and output of the system

The toolkit and workshop process was developed and improved continually through participants' feedback. The details of participants' feedback from inputs were illustrated in chapter 7. Bringing it back to the previous Root Definition and transformation model, the final description of the system of inputs and outputs are as follows. The initial 'Root Definition' was *'a system which offers enabling support and decision making, allowing individuals and organisations to engage to different extents with the system that considers sustainable production and consumption at the concept development stage'*. The overall soft systems methodology provides a useful guide to formulate successful outcomes.
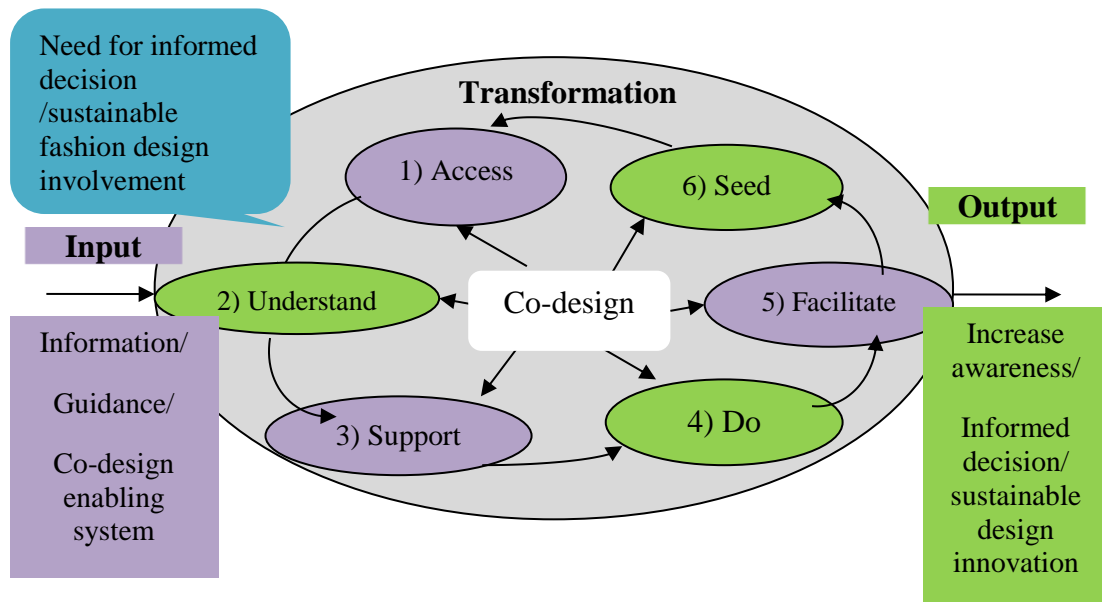


**Figure 8.7: Initial transformation model incorporating the most relevant verbs**

**Table 8-5: Final description of the input and output of the SFB transformation system**

| Inputs | Outputs |
|---|---|
| **Accessing**<br>-Developed the ideation toolkit information, contents and structure for sustainable fashion design, considering both sustainable production and consumption, in order to facilitate motivation to raise awareness of it. | **Understanding**<br>-Helped to understand overall sustainable issues in fashion design and supported a group of people to create common objectives in sustainable fashion design.<br><br>- Provided capability for users' own process of learning in both individual and group situations and also given the opportunity to see existing examples of how other people tackled the issues and problems. |

| Supporting | Doing /Acting |
|---|---|
| -Developed and improved more effective workshop processes and instructions in order to catalyse toolkit performance. | -Rather than absorbing the information, the toolkit also assisted in creating users' own design solutions for sustainable fashion design.<br>-The toolkit made users communicate in a more effective way, through enhancing shared language and conversation. |
| **Facilitating**<br>-Developed an online environment which can increase toolkit accessibility and provide additional information for offline and online users | **Seeding**<br>-Provided a space for various users to access the toolkit information<br>**(Future work)**<br><br>-Various users can share their concepts and outcomes and to access a network of diverse skills and understanding.<br>-Seeding a social innovation through on and offline platforms |

- **Ideation tool-cards** provided facilitation of the discussion of sustainable design issues, support to understand a holistic perception of sustainable fashion and assisted in offering alternative options for idea generation for new design strategies.

- **Workshop process** allowed engagement in sustainable fashion design practices. It triggered the growth of sustainable innovation in an evolutionary way.

- **Co-design online platform** allowed designers and potential users to create a new way of sustainable design through social innovation which supports the process of design and co-design.

Workshop participants and interviewees considered the toolkit as easy to understand and use but an improvement was also made in order to optimise toolkit performance. Overall, the outcome of the conceptual model and system was compelling for transformation of more sustainable fashion design practices.

By comparing the problem situations and initial objectives of the new model, outlined in chapter 5, it can be seen that the research successfully met the needs of the fashion involved group of people. On the other hand, the public perspective was not directly addressed in this research (see Table 8-6 below).

**Table 8-6: Comparison of problem situations and initial objective of the new model**

| | Problem situations Challenging perspectives for sustainable fashion (Chapter 5) | Initial objectives of the new model | Implementation |
|---|---|---|---|
| Fashion design involved people perspectives | -Considered as often too complex area to tackle the challenges<br>-Not sufficient implementation strategies for both sustainable production and consumption<br>-Not much aware of existing tools for sustainable design | ->**Enable exploration of sustainability issues in fashion design** and need to provide environmental and social issues or problem points and present examples of design led strategies beyond 'outside of box' approaches. | Yes |
| | -Sustainability is not a priority in process of design and fashion<br>-Not much involved in their real design practices | ->**Require a sustainable fashion engagement tool** which needs to be very clear and simple and easy ways of assessment tool for designers. | Yes |
| | - Challenge to incorporate sustainability in fashion design due to balancing other design criteria and fast movement of fashion trends. | ->**Valuing of experiences of sustainable design activities** by providing practical solutions.<br>->Integrate with creative design process and trigger design innovation beyond measurement of clothing environmental impacts. | Yes |
| | -Lack of awareness for the sustainable consumption in fashion and not much focusing on the sustainable consumption design strategies | ->**Offering sustainable consumption strategies for fashion design** by providing benefits of awareness of consumption issues and need directions connected to design innovation and new strategies. | Yes |
| | -Considered as insufficient consumer awareness of sustainable fashion design | ->**Provide some possibility to engage public in design process** and increase consumer awareness of sustainable fashion | Yes |

| Public perspectives | -Not much aware of specific environmental impacts of clothing<br>-Considered as long way to reach<br>-Not much involved in sustainable behaviour in real life<br>-Considered big fashion companies are not much involved | ->General people have not enough skills and need appropriate effective guidance and required communicational tools. | Partly: Indirectly |
|---|---|---|---|
| | -Considered not as great an impact as other environmental issues<br>-Actual consumption activities are led by economic benefits | ->Benefits of awareness of issues needs more varied sustainable design options and products for influencing their real decisions. | Partly: Indirectly |
| | -Considered as mostly business side role<br>-Choice limitation for green products | ->Need to create shared understanding themes during co-design workshop.<br>->Make available to the consumer more informed apparel product choices. | Partly: Indirectly |

The toolkit was developed to support designers to engage in sustainable fashion design practices with stakeholders (both fashion design involved people and the public). The research indicated that a co-design process is desirable for facilitating the engagement of sustainability in fashion design however, different actors required different values. This chapter discussed different possibilities to conduct co-design for sustainable fashion through providing different values to each actor to engage in sustainable fashion design practices. Consequently, co-design activities could cultivate sustainable design practices in which all stakeholders may ultimately benefit from the co-design experience. Co-design practices can thus potentially bridge the gap between research, design and industrial practices.

## 8.7   Chapter summary

This chapter has discussed the illustration of the improvement of the toolkit and online environment. The online co-design environment can act as potential for fashion designers and various levels of co-designers, to facilitate sustainable fashion solutions through social innovation.  It is proposed that the co-design process, ideation toolkit and a model of online platform potentially have a critical role in facilitating social innovation and design for sustainable fashion and textiles. This chapter has also discussed the role of designers in such a system in order to seed new design solutions and improve the production and consumption process by providing bridges between consumers and producers. The overall conclusions of the research, including the findings from the results and limitations will be described in more detail in chapter 9.

Chapter 9: **Conclusions and Future Work**

## 9.1  Introduction

This chapter presents the overall findings of the PhD project. It demonstrates how the aim and objectives have been addressed. Reflecting upon the research findings, this chapter summarises the conclusions and the overall contribution of the knowledge gained and limitations uncovered. Suggestions for future work are also provided.

## 9.2  Addressing aim and objectives

The initial aim of the research was to investigate an appropriate and effective enabling system and tool to assist fashion and textile designers to action sustainable design practices themselves. It was also aimed at enabling designers to encourage other stakeholders to explore sustainability as a way of thinking at the early stages of the fashion design development process. In order to achieve this, the sustainable fashion design toolkit was developed especially for fashion and textile designers who want to initiate sustainable fashion design projects. It was also targeted at designers and diverse users within multi-disciplinary development teams (i.e. a co-design process) to create product or service designs for sustainable fashion. As shown in Table 9-1, the aim was addressed through conducting various research activities to address the objectives outlined in chapter 1.

**Table 9-1: Addressing the research objectives**

| Research objectives | Addressed |
|---|---|
| To critically review essential literature through the examination of secondary sources:<br><br>-To define the definition of sustainable fashion design through reviewing the literature on sustainable development, sustainable design and the interpretation of sustainability within fashion design<br><br>-To identify the fundamental problems of current design practice by reviewing the post-industrial revolution historical context and the contemporary shift towards sustainable fashion design | The Literature Review chapter 2,3 |

| | |
|---|---|
| - To examine and review existing sustainable design principles and tools and investigate their strengths and weaknesses. | |
| To provide an overview of research methodology to develop an effective enabling sustainable design system to assist fashion designers and potentially other users to address sustainable design practices. | Chapter 4 |
| To clarify and understand underlying problem points in relation to sustainable fashion design in the real world and investigate barriers and challenges to the consideration of sustainable fashion design practices. | Chapter 5 |
| To establish key criteria and a conceptual model for the development of an enabling sustainable design system at idea generation stage, through the utilisation of Soft Systems Methodology. | Chapter 5 |
| To develop key inputs and outputs of the system and design a sustainable fashion design tool for the concept development stage. | Chapter 5, 6 |
| To demonstrate how to apply a new tool in a real world situation and evaluate the new tool through a series of participatory workshops and interviews. | Chapter 7 |
| To discuss both the strengths and weaknesses of the research outcome and its opportunities for sustainable fashion design. | Chapter 8, 9 |

The Literature Review addressed objective 1 through discussion of the concept of sustainable fashion design, its evolution through its historical context, examination of the current situation of unsustainable fashion and the barriers of incorporating sustainability into fashion design practices. Chapter 3 also examined the existing design methods and tools, through exploration of the useful insight and knowledge from many different fields. These included social sciences, education and engineering as well as other industries in the area of sustainable design such as architecture, industrial design, and computer sciences. Looking at the different

sustainable design approaches from various fields was helpful to identify the fragmented sustainable design approaches in fashion and textiles. By an in-depth analysis of existing methods, including eco-design and sustainable design for behaviour change tools, each method was evaluated and their strengths and weaknesses compared. As a result, the identified knowledge gap in design practices was examined in order to propose the future direction of the primary research.

Objective 2 was achieved by introducing a landscape of research methodology, especially utilisation of the Soft Systems Methodology (SSM) with Participatory Action Research (PAR). SSM assisted in clarifying the action points for the primary research, as well as the development of the sustainable fashion design tool at a systematic level.

In order to fulfil objective 3, two online surveys were carried out in order to understand attitudes towards sustainable fashion and identify challenges of incorporating sustainable design practices into subjects' daily activities. Since the study focuses on sustainable fashion design through a co-design process, both public groups and fashion design involved groups were targeted for the initial preliminary studies. The outcome of results was helpful to understand how different actors considered sustainable fashion. Both the public and the fashion designer group uncovered their lack of action and involvement in sustainability, although both groups revealed a high degree of importance for sustainable fashion. The public group were concerned about general environmental and social issues, but they were not specifically aware of the impacts of clothing. The level of awareness of sustainability issues in fashion was largely found to be low. While public expectation of sustainability in fashion was relatively high, actual purchasing decisions of sustainable design products was not directly influenced due to limited options for sustainable fashion design products. On the other hand, the designer group tended to be concerned about sustainability in fashion design. Their implementation of sustainability is mainly selecting eco-friendly materials and up-cycling design. There is recognition of a lack of implementation strategies for both sustainable production and consumption. It appeared that sustainable design strategies need to extend toward more innovative solutions beyond the current approaches to suggest various options for sustainable products, services and systems. The designer group held the view that sustainability is often too complex to

tackle with various challenges due to issues associated with the environmental and social impact of the fashion industry.

Objective 4 was accomplished by utilisation of Soft Systems Methodology. Overall findings of the results facilitated Rich pictures which allowed elucidation of how different actors considered sustainable fashion and reflected the current problem situations. The results also identified the need for appropriate guidance for designers and potential users embracing sustainable production and consumption, in order to catalyse design led strategies in the idea generation phase of fashion design. Chapter 5 specifically described the construction of a root definition and a relevant activity system. The criteria and necessary components of the system were established through evaluation using the CATWOE test.

Objective 5 was presented through development of the key input system. The central input to enabling the system model was the Sustainable Fashion Bridges (SFB) toolkit. This supports sustainable production and consumption strategies, especially consideration of positive behaviour change theory into fashion design practices. The layout of the SFB toolkit utilises a card-based pattern language which aimed to support systemic innovation, interaction and cognitive processing in learning by a doing and playing approach.

In fulfilment of objectives 6 and 7, the developed toolkit was evaluated in order to identify whether the toolkit can be feasible or beneficial for integrating sustainability in the design process. Participants accomplished the generation of new design concepts for sustainable fashion by use of the developed toolkit. Evaluation methods were conducted by task analysis with a combination of mix-methods strategies including questionnaires, analysis of workshop processes and observations. Most of the participants considered the toolkit as beneficial to understand and rethink the overall sustainable issues in fashion design and also to support creation of new sustainable fashion design concepts. The overall results are described below in the summarised conclusions.

## 9.3  Summarised conclusions

The research has addressed the need for an enabling system and tool to support designers and other stakeholders (both design involved people and the public) in

order to facilitate sustainable fashion solutions through a co-design process at the idea generation stages of the design process. Soft Systems Methodology (chapter 5) was useful to clarify underlying complex problems in relation to sustainable fashion design and guide the construction of the relevant activity system, the transformation process and its input and output of the new system. The central input for the toolkit was developed to facilitate sustainable fashion at an early design phase. Through in-depth analysis of existing tools and methods (chapter 3 and 6) , including the production domain of eco-design tools and the sustainable design for behaviour change tools, strategies were compared for their strengths and weaknesses and the knowledge gap was evaluated in order to suggest a direction for sustainable fashion design. A new conceptual framework for sustainable fashion design was proposed chapter 6, where the key input of the system was illustrated in order to address the aim of the research project. The central input system of the toolkit was evaluated chapter 7.

Overall feedback from the participants indicated that the inclusion of the toolkit early in the design process allows users to create more sustainable solutions and identified that integrating design thinking in the design process plays an important role in generating new solutions. The toolkit has helped a group of people establish sustainability in fashion design as a core objective and provided tangibility for co-understanding, encouragement of group collaboration, communication and capability for systemic innovation at the idea generation stage. The SFB Ideation toolkit covers components of the multi-disciplinary approaches to influence production process as well as consumption in the design process; these strategies encourage designers to look at a more holistic view. This could potentially support sustainability to create new solutions by designers themselves, whilst the toolkit can play an important role in guiding the generation of new concepts. Presenting the overall values of using the toolkit can be essential to encourage user engagement for sustainable fashion design practices. A summary of the values of the toolkit is indicated below.

1. Allowing an opportunity to handle the complexity of sustainable fashion and develop critical thinking
2. Enabling the establishment of  a common objective of  sustainability in the area of fashion design and allowing a holistic view of design

3. Facilitating discussion of sustainability issues in fashion design and triggering thought of  what potential or alternative practices could exist for the future

4. Capability to generate new design concepts in fashion design with embedded sustainability issues

5. Facilitating design-led approach, incorporating visualisation and future scenario building triggering personal creativity and design innovation

6. Supporting the creation of dialogue and communication of shared understanding within a group of people during the co-design workshop.

However, there are some considerations for the development of the tool and systematic level of change. The key findings of this research indicated that development needs included:

- **Effective instructions and clear guidance**
- **Triggering actions for sustainable design practices**
- **Segmentation and tailored approach**
- **Systemic and sustainable engagement methods**

**Effective instruction and clear guidance:** As recognized by the findings of this study in chapter 7, involvement in the early design process with ideation toolkit allowed participants to create their own solutions. However, effective instructions and clear guides on how to use the toolkit were essential for potential users. This reinforced the view that the toolkit information and process of use are critically related to the effective use of tool. Also, when engaging in the design process, users need to understand, firstly what sustainable fashion means and then they can start to create new design strategies.

**Triggering actions for sustainable design practices**: Initial development of the toolkit was more focused on the information and contents. The lesson from the pilot study recognised that absorbing information or understanding the knowledge alone makes it difficult to realise sustainable design practices. There is a critical need for learning through action and active participation. The toolkit supported more than the acquisition of knowledge; rather it helped to encourage designers have insightful engagement in the concept generation process and further explore a more sustainable realisation of their vision, as well as provoking creative thinking.

**S**egmentation **and tailored approach:** The participatory workshop processes helped to understand sustainable fashion effectively, through the process of learning by action and sharing knowledge and understanding with other participants. Potential users can understand sustainability from the ideation toolkit and combine it with their existing knowledge, refining or modifying their designs depending on their situation and desired aims. Overall, co-design can be a very powerful process, however the participating actors and sub-actors should be more specifically targeted in order to maximise the benefit of the collaboration process as different groups of people may hold conflicting values. This research was more targeted to designer group adoption of the designers' worldview as established in chapter 5. However, suggestions (chapter 8) were made of how designers can engage with different stakeholders, including a fashion design involved group and public group.

**Systemic and sustainable engagement methods:** Soft Systems Methodology (SSM) was an effective tool, especially for constructing problem situations through 'rich pictures' and systematically defining the target objective (Transformation), key users (Actors, Customers, and Owners), unsustainable fashion design practices (Worldview) and economic sustainability for the continuing existence of fashion companies (Environment). However, the sustainable design processes need to be continuously encouraged rather than a one-time event. An enabling platform and symbiotic value creations are required for long term sustainable design practices. In reflection upon this research project, it appeared a co-operative; co-design process could encourage more sustainable fashion design socially. It is proposed that the co-design process, ideation toolkit and a model of an online platform potentially have a critical role in facilitating social innovation and design for sustainable fashion and textiles. It can be a new form of fashion design development system or process beyond traditional design process models.

The toolkit could be used in a number of ways to facilitate this depending on the engagement of both designers and other actors. The research focused on group-based workshop learning and processes that involved designers at idea generation stage. For an internal fashion design company, both fashion designers and potential actors (e.g. marketer, merchandiser, textile designer and product developer) could communicate better using the developed toolkit and share their knowledge to create new strategies for sustainable fashion design. Chapter 8 also discussed the

possibilities of a co-design process where any individual can be a co-designer of sustainable fashion. Various design scenarios described in chapter 8, showed how other actors can be engaged in the design process. It is suggested that it can be used as a new educational and commercial tool for promoting action for sustainable fashion. Furthermore, a new role of designers in co-design system was illustrated in chapter 8 in order to seed new design solutions and improve the production and consumption process by providing bridges between consumers and producers. The toolkit allowed for design innovation in which participants can look at different possibilities to extend sustainable design capability, promoting long term sustainability. For a long term view, values of incorporating sustainability were indicated as:

- Supporting design innovation through looking at different possibilities and alternative solutions
- Optimising various actors engagement in sustainable fashion and textile design practices
- Enabling change to existing systems for the long term view therefore allowing social and cultural transformation
- Create new design markets and services

## 9.4 Contribution to knowledge

Sustainable fashion design is still not a well-established area and the notion of sustainability and fashion design is cautiously shifting and evolving throughout the time and context. Although sustainability should be embodied within philosophical or ethical consideration through cultural movement, there is a requirement of an enabling system that supports more informed decisions and creates a new alternative solution for future design, in order to facilitate sustainability as a cultural movement. As Madge (1997) defined green and eco-design, the dominant design research in fashion and textiles has been focused on a single environmental problem of the clothing life cycle. Although each stage of a single focused environmental problem is an essential contribution and equally important to sustainability, there is the need for significant recognition of the system and interconnection as a whole. Especially at the idea generation stage, designers need to take a holistic view of each stage of the relationship and then specify other design criteria such as function, technology, and aesthetic and so on. Furthermore, it is recognised that sustainable production

and consumption are not isolated from one other but highly interacted in the design process. Designers can connect production and consumption activities. However, sustainable consumption in the design process receives relatively little attention by designers. Therefore, integrating these issues into the design process could play a pivotal role in supporting sustainability in fashion design sectors.

This PhD project has enabled the researcher to explore unstructured and complex issues in sustainable fashion design and to develop a systematic transformative model for facilitating sustainable fashion design. The research has addressed the gap between theory and practice by incorporating a theoretical framework into a practical level of a design led research. At a theoretical level, the specific knowledge contribution has been established through this research project. Specifically,

- Formulated a theoretical conceptual framework in Figure 6.3 for sustainable fashion design (chapter 6) which was established through examination of the various existing sustainable design methods and tools from other fields of design (e.g. architecture, product, industrial, engineering) as well as incorporating social science and social-psychological theory (chapter 3 and 6). As discussed in the literature review in chapter 2, sustainable fashion is a complex concept and often understood in a fragmented way which presents barriers for practitioners to implement in design practices. The suggested framework (chapter 6) could support a holistic understanding of sustainable fashion design and be implemented in design practices.

- Defined challenges and barriers of sustainable fashion design through conducting two online surveys and articulated problem situations in using rich pictures (chapter 5). Rich picture 1 (Figure 5.16) could support understanding of how different actors perceive sustainable design issues. Rich picture 2 (Figure 5.17) could assist understanding the relationship of various stakeholders to the clothing production and consumption process.

- This research offers potential for change at a system level; considered for highest level of innovation for sustainable design. The findings of the research could give knowledge to other researchers who want to tackle the idea of systemic transformation.

At the practical level, chapter 7 not only provided practical solutions for how participants tackle sustainable design challenges and generate their design concepts using the toolkit, but also employed a workshop process which can be applied to fashion and textile design education. As already examined in chapter 7, the toolkit can be used as a teaching resource for teachers and a learning tool for design students for sustainable fashion and textiles to find new alternative design solutions. Furthermore, the toolkit can be used by professional designers and design consultants in order to engage with other stakeholders to practice sustainable design. Chapter 8 provided a conceptual framework (Figure 8.6) which illustrated how different stakeholders can be engaged in synergetic ways by providing values to each actor (e.g. relationship with design students and fashion design companies, and designers and public relationships). The framework could support to initiate small-medium level design projects for sustainable fashion design and creates more new markets driven by sustainability

## 9.5  Comparison with similar studies

In comparison to other evaluation tools, including Life Cycle Analysis (LCA) and LCA related tools; the SFB toolkit facilitated the generation of new ideas and the designer's inner creativity. It considered human factors and the social side of design intervention. Although LCA and LCA-related evaluation tools are excellent for environmental impact analysis on the production side, including material or production process and whether one method was preferable to another, these can often miss the opportunity for design innovation and creativity.

While, comparing with design for behaviour change tools and methods such as 'Design with Intent toolkit' (Lockton *et al.*, 2008 and 2009) and 'Design-Behaviour' (Lilley *et al.*, 2007; Bhamra *et al.*, 2011), the SFB toolkit is designed specifically for the sustainable fashion design sector at the idea generation phase. This study has focused on a detailed exploration in order to effectively combine this tool with other idea generation techniques (e.g. future scenario building and visualisation). Further differentiation of the SFB toolkit is achieved by the toolkit contents, enabling users to take a holistic system view and integrate life cycle thinking. The designer also has

the opportunity to take a look at how this product system could potentially be implemented in society as the human factors are involved in the design process.

## 9.6  Limitations of this research

The research had been carried out and achieved various levels of outcomes from theory to practice during three and half years. However there are some limitations of this research.

### 9.6.1  Initial entering problem situation stage: preliminary study

Chapter 5 covered two surveys from a general public group and fashion design involved group. The sample size was not representative of the whole population of the UK public or UK based fashion design involved group. The data collection method used both email and social network sites which meant only computer users responded to both surveys. The respondents were mostly 20-40 year olds and based in the UK. All respondents took part voluntarily and so had some interest in sustainable design. Therefore they did not represent the total population of both the general public and fashion design involved people. Whilst the main objective of the research was to gather qualitative views, it is recognised that the sample size was relatively small and so statistical significance and conclusions are limited.

### 9.6.2  Limitation of the toolkit performances

The in-depth analysis of the strengths and weaknesses of the toolkit were described in chapter 7. Most of the weaknesses of the toolkit performance were improved and described in chapter 8. However, the improved instructions and online environment were the only suggestions which were not tested in the real-world situation due to time constraints.

### 9.6.3  Engagement with in fashion industry

At the initial problem entering stage, the researcher gathered the various opinions from the design involved group (e.g. professional designers, marketers, design students and academia) and the public group. However, the final outcome of the toolkit was mainly evaluated from the design students who were relatively novice designers. The workshop process, in particular, was more tailored to fit to design

students and their work environment. Therefore, the workshop process may not directly relate to the professional designers' environment. Due to the time constraints of the PhD, it was not possible to conduct various workshops with professional designers and multi-disciplinary design teams. In order to resolve the limitation, interviews were conducted to obtain the professional designers' and educators' perspectives at the final evaluation phase.

### 9.6.4 Limitation of the online platform

The online platform ([www.sustainblefashionbridges.com](www.sustainblefashionbridges.com)) has been available since 2012. The researcher did not update all the online information nor rigorously explore the online environment due to the time constraints. One of problems with the website was when the public group uploaded and shared their ideas, a lot of moderation was required in order to ensure the materials were related to the sustainable fashion design rather than  spam or advertisement. Furthermore, sharing of ideas is still a challenging concept due to issues around copyright or intellectual property.

## 9.7  Recommendations for future works

This research has been conducted across three and half years which was not sufficient to explore the many other directions of enabling a system for sustainable fashion design at idea generation process. The following sections suggest some recommendation for future works.

### 9.7.1  A game-based learning system for sustainable fashion design education

Various organisations and education sectors demand sustainable design education and curriculum incorporation of sustainable fashion design practices. As one interviewee suggested, the toolkit can be integrated into a more sophisticated game focusing on playful experiences where users can enjoy sustainable design practices rather than considering them as tasks or enormous challenges. Interconnection of sustainable fashion design with creativity and user experiences as a central objective, a new learning system can be developed for sustainable fashion design education, incorporating game-based learning and interactive processes.

### 9.7.2  Interactive online platform and social innovation

As stated previously, the online platform was not fully explored. Further research could investigate the effective use of the co-design online platform. It will be important to identify users' behaviours in the online environment, such as understanding their motivation for tool use and potential problems of the interaction process. Furthermore, a digital application (e.g. Mobile App) could enhance better communication by connecting with wider audiences and propose the interactive user led design innovation through utilisation of a digital app.  These applications would be helpful especially for young designers or the public, to motivate and trigger them to practice sustainable design.

### 9.7.3  Sustainable fashion design enterprise

Through rethinking existing fashion design systems and practices, new business models are required to facilitate small and medium size enterprises underpinned by sustainable fashion and textile design. As discussed in chapter 8, the research has shown that there are possible new scenarios for various stakeholders' participation in sustainable fashion design. For instance, public driven design innovation and open source design could be used as tools for linking production and consumption processes and engaging with consumers and producers. The developed idea generation toolkit could interconnect into the development of a real product or service design. Users can develop sustainable fashion design concepts through SFB toolkit and their developed design concept can be further established through micro-production online platforms or modular types of production systems. Through successfully combining the  idea generation and making processes, a new design process could bring together designers, material suppliers, product developers, DIYers and buyers in a collaborative design environment taking account of  the values chain of each actor.

### 9.7.4  Collaboration with mainstream fashion Design Companies

As stated one limitation of this research, it needs to be integrated with mainstream fashion designers and design directors or at manager level, in order to cement sustainability into the business ethos. Furthermore, the role of fashion design consultancy (e.g. trend consultancies) is important for the fashion industry, as mainstream designers commonly assess fashion design information at the early

design development process. Therefore, future research could include the mainstream fashion designers and multidisciplinary design team as central actors in the transformation process, considering them as 'change agents' that impact on fashion design practices and business operations.

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- Alternative energy: www.digitalnewsagency.com
- Alternative design process: www.bioalloy.org
- Alternative package design: www.dornob.com/shipping-eco-friendly-products-in-multifunctional-packages
- Ways of wearing: www.theuniformproject.com
- Ways of washing and design: www.5ways.info
- Ways of disposal: www. wearablecollections.com

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- Black, S (2008) Eco-chic: The Fashion Paradox. Black Dog Publishing, London www.consideratedesign.com

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- Fibres and the environment: http://www.fibersource.com/f-tutor/fib-env.htm
- Green Fibres: www.greenfibres.com
- People Tree: www.peopletree.co.uk
- Forum for the Future, 2007, Fashioning sustainability: A review of the sustainability impacts of the clothing industry www.forumforthefuture.org/sites/default/files/project/downloads/fashionsustain.pdf
- Centre for Sustainable Fashion : www.sustainable-fashion.com
- Textiles Future Research Group www.tfrg.org.uk
- The Textile Environment Design (TED) www.textiletoolbox.com

### OPTIMISATION

- Rethinking durability: www.helenstoreyfoundation.org
- Biomimicry: http://inhabitat.com/tag/biomimicry/, http://biomimicry.net
- Cradle to Cradle: www.mcdonough.com/cradle_to_cradle.htm
- Modularity: www.eunsukhur.com
- Merging: Issey Miyake and Dal Fujiwara (n.d.) A-POC Making http://www.flavourcountryfeedlot.com/2008/01/piece-of-cloth.html
- Zero-waste: Mark Liu (n.d.) www.stique.com
- Dynamic upgrade: Donna Karan (n.d.) Infinity dress, http://www.youtube.com/watch?v=xSUl-s9Ljmk
- Multi-fashion: www.azumianddavid.com
- Up-cycling system: www.upcyclingtextiles.net

- Swap and share: www.keepandshare.co.uk

[Recommended books and links]

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- Video: *Cradle to Cradle:* TED, 2005 http://www.ted.com/talks/william_mcdonough_on_cradle_to_cradle_design.html
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- Videos: Biomimicry in Action from TED 2009: http://www.ted.com/talks/janine_benyus_biomimicry_in_action.html
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## EMPOWERMENT

- Storytelling: www.marieilsebourlanges.com
- Magic: www.ezgihantalay.com
- Poetic: www.veasyble.com
- Playfulness: www.elisabethbuecher.com
- Personality: www.girlsense.com
- Partial completion: http://www.hannanyman.se
- User as maker: www.craftzine.com
- Smart craft: www.arduino.cc
- Open source fashion: http://openwear.org
- Cultivating creativities: www.studioludens.com

[Recommended books and links]

- Chapman, J. (2005) *Emotionally durable design*, London, Earthscan.
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## PERSUATION

- Information: http://www.fashioninganethicalindustry.org/home/
- Guidance: www.fairtrade.net www.ethicalfashionforum.com
- Story of use: www.dothegreenthing.com
- Transparency: www.made-by.org
- Warning: www.diffus.dk

- Reinforcement: www.earthdyeing.com
- Reward: http://www.sustainable-fashion.com/fashioning-the-future/
- Simplicity: www.behaviormodel.org/
- Commitment: www.cleanclothes.org
- Shareholder incentive: http://www.japanfs.org/en/pages/029704.html

[Recommended books and links]

- The Ethical Consumer Ethical Consumer Research Association
  www.ethicalconsumer.org
- Fogg, B.J. (2009) A Behaviour Model for Persuasive Design, Persuasive'09,
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  Research Network.
  http://hiveideas.com/attachments/044_motivatingscfinal_000.pdf

## INTERACTION

- Sensory effect: www.smartsecondskin.com
- Parameter change: www.kerriwallace.com/
- Preliminary action: www.lostvalues.com
- Reactive fashion: www.yinggao.ca
- Fairytale fashion: www.fairytalefashion.org
- Tailoring: www.jasminschaitl.com
- Notification: http://www.forumforthefuture.org/project/fashion-futures-
  2025/overview
- Feed forward: www.tii.se/static
- Behaviour feedback: www.saumadesign.net/takkianen.htm
- Environmental response: www.suzannegoodwin.com

## SOCIAL CONVERSATION

- Symbiotic relationship: www.fashion-4-development.co
- Catalysing actors: t. www.ponoko.com
- Enabling solution: http://www.instructables.com/group/sustainability
- Localisation: www.localwisdom.info/
- Community learning: www.fashionasplay.wordpress.com
- Creative enterprise: www.kickstarter.com
- Power shift: . www.selfpassage.org
- Social feedback: http://blog.fanchimp.com

- Social service: www.aidtoartisans.org
- Way of living: www.sustainable-everyday.net

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