Remanufactured Fashions: A pathway to sustainability

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Abstract

There has been a significant increase in volume of new clothing sales over the last ten years; indeed it is the fastest growing waste in household waste stream, raising the potential for a similar increase in volume of textile waste dispose in landfill sites and the resultant harm to the environment. As volume of throwaway fashion increases and quality of fabric decreases, there is a need for an innovative approach to generating and managing this type of waste. Prior work on managing post-consumer textiles concurs with the Waste Hierarchy, ie, that reusing and remanufacturing fashion items makes the least impact on energy use. A number of fashion designers have developed businesses using this approach but are usually niche market, and the environmental benefit may not be as significant as the mass markets that are currently catered for by the large retailers using the current conventional design processes and supply chains. This paper will present and examine empirical data regarding design and remanufacturing processes as practiced by fashion designers in the niche market and the design processes within the large mass market retailers and manufacturers. The paper will then consider the current fashion supply and value chain, particularly issues around design and the use of technology within it to explore opportunities for incorporating remanufacturing approach within the conventional supply chain, identifying issues and providing recommendations. This examination will identify issues around design for social sustainability and design for sustainable behavior. The paper concludes with suggestions for future areas of study.

Keywords

Recycle, remanufacturing, sustainability, fashion, design process

1. Introduction

Following the Rio Earth Summit (1992) and Johannesburg World Summit (2002), sustainable consumption and production (SCP) has become an important aspect of
sustainable development agenda. SCP aims at waste reduction, resource conservation and minimizing greenhouse gas emissions (Ferrara and Serret 2008, UNDSA and UNDP 2008). Development of SC practices not only minimises the environmental and social impacts, but also offers a market for sustainable products (OECD, 2008), and provides a social and personal reflection of human consumption (Cohen, 2005).

Fashion consumption and sustainability are often opposing ideas. Fashion consumption is a highly resource intensive, wasteful practice and sustainability is not in favor of wasteful consumption. Sustainability in fashion business is still an emerging agenda, and many authors have recognised the importance of investigating how fashion sustainability could be achieved. In a sustainable environment, products are recovered at the end of life without disposing at landfill sites. Product recovery could be achieved in three ways; material recovery for recycling or reuse, value added recovery for remanufacturing, or energy recovery for incineration (Guide et al, 2003). Reuse or recycle of used cloths reduce the environmental impact significantly in comparison to the purchase of new garment. It is found that approximately 65kWh energy is saved for every kilogram of cotton replaced by used clothing, and 90 kWh for every kilogram of polyester replaced (Woolridge et al, 2006). As closing the materials and product cycles is one objective of sustainable consumption and production, remanufacturing is becoming an increasingly important aspect among the recovery options (Michaud and Llerena, 2006).

This paper contributes to our understanding about fashion remanufacturing process with compared to the standard design process. We briefly review the relevant literature and examine the process of remanufacturing developed by niche market fashion remanufacturers. We formulate a model to explain the process and main activities involved in remanufacturing process.

2.0 Research Literature

2.1 Wasteful consumption and reuse

Post-consumer textile waste is defined as any type of garment or household textile no longer needed and discarded (Hawely, 2006). Textile waste, identified as the fastest growing stream in the household waste (Defra, 2007), causes significant damage to the environment at landfill sites. Defra (2009) reports that annual textile waste within UK is 2.3 million tonnes, of which only 24% is recovered for reuse. Around 1 million tonnes of textile waste ends up in landfill due to variety of reasons such as insufficient recyclers, non-availability of technology
and highly labour intensive sorting processes. Moreover, consumers are increasingly adopting wasteful consumption practices as the throwaway fashion culture encourages consumers to dispose a garment after few weeks of purchase.

2.2 Remanufacturing and closed-loop systems

The importance of remanufacturing used products is widely acknowledged in the literature in terms of solid waste recovery and economical benefits. Remanufacturing can offer a sustainable business model with significant reduction of carbon emissions and energy use and diverts materials form landfill sites, reduce solid waste and recovers much of the intrinsic value of the used product. However the process of design for remanufacturing is relatively novel in research terms, still under-studied and therefore poorly understood (Ijomah et al 2007, Gray and Charter 2008).

The term remanufacturing is often confused by most people with reuse and recycling. Remanufacturing differs from repairing or reuse as the remanufactured product is upgraded to the quality standard of a new product (Savaskan et al, 2004) with expected life span of an original product (Fleischmann et al, 1997). Remanufacturing also differs from recycling. Recycling converts materials to a different product with different functions (Michaud and Llerena, 2006). Remanufacturing is a process of disassembling, cleaning, inspecting, repairing, replacing, and reassembling the components of a part or product in order to restore it to new condition (Narsar and Thurston 2006, Michaud and Llerena, 2006, Majumder and Groenevelt 2001).

Remanufacturing is typically a more efficient means of material recirculation than recycling. In an open-loop system, products are manufactured, consumed and discarded after use. Remanufacturing process closes the loop of material flow by converting waste into resources and feeding them back into the manufacturing process (Narsar and Thurston 2006). The recovered products replace the primary sources in forward supply chain and save the energy associated with production of virgin materials. Thus, closed-loop remanufacturing is an ideal solution for products which have short life cycle, consume large amount of energy and other natural resources.

Remanufacture can be twice as profitable as manufacture, and the design process has a key role to play in profit maximization, however, the profitable link between design and remanufacture is poorly understood by majority of remanufactures. The full benefit of
remanufacturing cannot be achieved unless the design for remanufacturing becomes an integral part of the product development process (Narsar and Thurston 2006). Sudin (2004) proposed a remanufacturing property matrix (RemPro-matrix) for the generic remanufacturing process and preferable product properties, as presented in table 1. The matrix illustrates which product properties are preferable for each step of remanufacturing process.

Table 1: The RemPro-matrix showing the relationship between the preferable properties and the generic remanufacturing process steps (Sudin, 2004)

<table>
<thead>
<tr>
<th>Remanufacturing Step</th>
<th>Inspection</th>
<th>Cleaning</th>
<th>Disassembly</th>
<th>Storage</th>
<th>Reprocess</th>
<th>Reassembly</th>
<th>Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Property</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease of Identification</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease of Verification</td>
<td>x</td>
<td></td>
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<td></td>
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<tr>
<td>Ease of Access</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease of Handling</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease of Separation</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease of Securing</td>
<td></td>
<td></td>
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<td></td>
<td>x</td>
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<tr>
<td>Ease of Alignment</td>
<td></td>
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<td>x</td>
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<tr>
<td>Ease of Stacking</td>
<td></td>
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<td>x</td>
<td></td>
<td></td>
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<tr>
<td>Wear Resistance</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<td></td>
</tr>
</tbody>
</table>

2.3 Fashion design process
Many authors have explained industrial fashion design process as a sequence of activities which occurs in a logical order, from idea generation to the final product. Lawson (1997) argued that the design process is a negotiation between problem and solution through the activities of analysis, synthesis and evaluation. Common stages of designing as identified by LaBat and Sokolowski (1999) are the problem definition and research, creative exploration, and implementation. Wickett et al (1999) detailed the activities of product development process as trend analysis, concept development, fabrication selection, palette selection, fabric design, silhouette and style direction, prototype construction and analysis, and line
presentation. Based on multiple case studies conducted with UK fashion designers, Sinha (2000) suggested five key phases of design process to be: research and analysis, synthesis, selection, manufacturing, and distribution. Burns and Bryant (2002) also present a similar process to those described, and provide eight detailed stages as research, design, design development and style selection, marketing and apparel line, preproduction process, sourcing, apparel production, and distribution and retailing.

Even though the number of activities defined in the design process varies by author, there are no major conflicting views of general design process. The common thread is that the design process consists of universal identifiable activities which occur in a logical order. The sequence presented by Sinha (2000a) reveal an explanatory analysis of whole design process in five key stages, and any definition of design processes could rather fit into these five phases.

**Phase 1- Research and analysis**

The research phase generally includes market research and fashion research (Burns and Bryant 2002, Rosenau and Wilson 2006). Market research collects information about general market trends, need of the target market consumers and preferred product characteristics. Fashion research focuses on forthcoming trends on colours, fabrics, silhouette, trims and design details (Sinha 2000a, Burns and Bryant 2002, Keiser and Garner 2008). Designers conduct fashion research by visiting international trade fairs, attending fashion events and reading publications on fashion trends. The source of inspiration can come as a part of the research conducted, or variety of other sources such as studying images, conducting research on different cultures, history etc. Based on the inspiration and market research, designer starts to translate trend into fashion by creating mood boards and colour boards, which generate a theme for the designs and explains the direction the designer has taken. (Studd 2002, McKelvey and Munslow 2003).

**Phase 2- Synthesis**

Synthesis is the stage of design development where the designer transforms inspiration and mood into designs. The process starts with developing garment sketches and technical drawings manually as a paperwork, or by using computer-aided design techniques. The sketches are reviewed, selected for processing to have flat patterns created for them. Next prototype samples for each design are made and tried on for fit, appearance, measurement and overall performance (Burns and Bryant 2002, McKelvey and Munslow 2003). sometimes,
instead of using sketches, some designers use draping technique, where the designer works with the actual fabric on mannequin to create the design and then transfer it into a two dimensional pattern piece. This enables the designer a great deal of creativity and freedom to explore three dimensional shapes with actual fabric, however this process consumes more time and fabric than the former (Burns and Bryant 2002).

Phase 3- Selection
Company prepares a sample range of designs to show to the selection committee in order to select the styles for bulk manufacturing (Sinha, 2000a). The company may produce a fashion show or visual representation of the products to the buyers or the sales representatives (Burns and Bryant 2002). The representing committee decides on style numbers, colours, sizes and quantities to be manufactured for the coming season.

Phase 4- Manufacturing
The bulk manufacturing is taken place for the selected styles. Production numbers, quality level, and size ranges are planned according to the buyer requirements. Sourcing decisions on whether the production will be domestic or offshore is determined by the factors such as manufacturing capacities, cost, quality control standards, expected turnaround time etc (Burns and Bryant 2002).

Phase 5- Distribution
 Manufactured orders are delivered to the retail outlets for selling to the public. Distribution strategies can be classified as mass distribution, selective distribution and exclusive distribution in which the decision is based on the type of marketing channel the company belongs (Burns and Bryant, 2002). With mass distribution, products are made available to many customers as possible through variety of channels, yet selective distribution allows the products through certain stores only. Exclusive distribution limits the distribution to very few stores to create an image of exclusiveness.

Figure 1 represents an IDEFo model of generalized fashion design process as practiced by industry (Sinha, 2000b).
2.4 Fashion supply and value chain

Fashion supply chain explains the activities associated with moving goods from its raw material stage to the final product (Quinn, 1997). The value chain describes the process of creating value of the product from concept development through the design, sourcing materials, production, and distribution up to selling of final product to the consumer. Fashion value chain is identified as buyer-driven which is led by the large retailers and branded manufacturers. Buyer-driven value chains are highly competitive and the power is exercised at the design and retailing stages (Gereffi and Memedovic, 2003). According to McCormick and Schmiz (2001), the main areas to consider about the value chain are:

1. Input output structure of product flow form conceptual idea to final outcome and the invisible structure which explains the flow of knowledge for value chain to function.
2. Geographic spread for value adding activities due to demanding low production cost.
3. The control exercised by different parties throughout the value chain.

2.4.1 Competition in mass fashion market

Fashion market is characterised by short life-cycles, high volatility, low predictability and high impulse purchasing (Christopher et al, 2004). Today, competition in the value chain is mostly...
governed by timing factors; retailers need to spot trends quickly and translate them into the products for the shop floor in the shortest possible time (Christopher et al, 2004, Richardson, 1996). Rather than spending time on new designs, competitors quickly imitate others and produce only what sells in the market (Richardson, 1996) in order to sustain their competitive advantage. Time constraints led to firms adopting manufacturing strategies such as just-in-time, quick response and lean systems to become flexible and respond quickly. Vertically integrated supply chains provide flexibility and opportunity to react efficiently and cost effectively in volatile markets to achieve quick response (Cao et al 2008, Richardson 1996). Quick response requires technologies such as computer aided design and manufacturing (CAD-CAM) and automated machines to improve manufacturing speed, electronic data interchange (EDI) for efficient communication throughout the supply chain, and point of scale (POS) for data transmission from retailer to manufacturer.

The implications for remanufactured fashion within a mass market audience are that the supply of fashion should concentrate on design and re-evaluate ‘the relationship between designer and maker and the product and wearer’ (Fletcher 2008, p.172) and produce in a manner reversing the speeds of the current supply chain. As the remanufacture of fashion can develop many more variants in patterns than is currently developed in the fashion industry, technology that supplies ‘fast fashion’ is available and may be used to help develop ‘slow fashion’ for a larger audience.

3.0 Methodology
We conducted on site visits and in-depth interviews with two fashion remanufacturers based in UK, who operate in niche market level. The primary objective of the case studies was to increase the understanding about how remanufacturing process is in practice. The process was examined and drawn up according to IDEF0 modelling principles where each process is labelled as an activity with inputs, outputs, constraints and drivers the process (Jayaraman, 1990).

Company A
Company A in Brick Lane, London (a ‘hub’ for new fashion businesses) operates solely as a fashion remanufacturing business. There are six people employed in the business who deconstruct best quality second hand garments and rework them into unique, timeless
fashions. The interview took place on 28th January 2010 with the business manager of the company.

Company B
Company B in Leeds operates as a social enterprise which focuses on remanufacturing and local community development. It aims at recycling discarded garments by transforming them into new styles, and teaching local community the skills of extending the life of garments in their wardrobe. The company is owned and operated by a designer and the interview took place with her on 13th July 2010.

Each interview was recorded and transcribed. The product development processes were examined and compared with that currently practiced in fashion industry to identify opportunities to develop the remanufacturing process (currently practiced at niche market level) into one that could be involved in a mass manufacturing/retailing scale.

4.0 Results
Both remanufacturers have common activities with some variations. Pre-design and design activities are discussed bellow by considering the commonalities and the variations in the companies’ processes. The pre-design activities of the remanufacturing process are illustrated in table 2 and may be described as the following:

Collection
Discarded garments are collected from charity shops or household waste bins. They also prefer public –donations directly made to the design studio. Neither of the remanufacturers currently deals with textile recyclers to obtain discarded garments. Therefore, the return flow is not efficient or smooth at the moment.

Sorting
Sorting process is well organised in company A as they mainly deal with suiting materials. Collected garments are sorted either by design, colours or the type of fabric and stored in the design studio accordingly. Company B does not follow an organised sorting process and rather a quick separation of items could be noticed according to the type of the item which was collected. For instance, there were separate spaces allocated for garments, household textiles, and dead stock such as factory off-cuts and unsold garments. The designer picks couple of items of her choice from the stock just before she starts the design process.
Cleaning
All the garments that company A receives are dry-cleaned before reuse. Company B does not clean the pre-stock, however the remanufactured garments will be thoroughly cleaned before sending them off for selling.

Disassembly
Either full or partial deconstruction of the garment takes place according to the design idea that designer has in his/her mind. Although disassembly is categorised as a pre-design activity, it is rather a parallel process with the synthesis phase discussed below where the designer experiments with remanufacturing possibilities. Company A designer prefers to keep disassembly to a minimum and therefore maintains the original shape of the garment in re-designing. Company B designer stated a preference for flat patterns and therefore tends to deconstruct certain garments such as t-shirts to make a flat fabric.

Table 2: Summary of pre-design activities

<table>
<thead>
<tr>
<th>Process</th>
<th>Company A</th>
<th>Company B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection</td>
<td>Garments are collected from charity shops or public donations. Main source of fabric is from men’s’ suits.</td>
<td>Discarded textiles are collected from charity shops, public donations or waste-bins. Main sources of fabric are garments and household textiles.</td>
</tr>
<tr>
<td>Sorting</td>
<td>Sorting process is well organized. Sorting is done according to the colour and type of fabric.</td>
<td>Quick separation is carried out according to the type of textile.</td>
</tr>
<tr>
<td>Cleaning</td>
<td>All garments are gone through a dry-cleaning process before re-use.</td>
<td>Remanufactured garments are washed before send them for selling.</td>
</tr>
<tr>
<td>Disassembly</td>
<td>Prefers to keep deconstruction minimal and therefore original construction of garment is maintained whenever possible.</td>
<td>Prefers to work with flat patterns and therefore tends to deconstruct garments to make flat fabrics.</td>
</tr>
</tbody>
</table>
The design process for remanufacturing was analyzed according to the five steps presented in standard design process (Sinha, 2000b) and illustrated in figure 1.

Research and analysis phase
Research does not focus on trends as the whole idea is to promote non-seasonal, timeless fashions. The collection is always derived from what the designers’ feel and what they want to do under the umbrella of sustainability. Inspiration for the designs comes from the fabric itself or other features. However, the design ideas largely depend upon the original shape of the discarded garment. As both manufacturers cater for individual customer needs, information is collected on customer needs and interests. This information is collected as a part of ‘wardrobe surgery’ service they provide for the customers, where customers bring their old garments and get it remade into new fashions. The analysis is focused on the investigation of material types and availability, shapes of the discarded garments, and exploring re-designing possibilities.

Synthesis phase
It is found to be difficult to start the design process with sketches and to transfer them into flat patterns as the design is largely depend on the original shape and the usable space of discarded garment. In company A, design ideas are mainly generated thorough draping and trial and error method. Designer follows a creative approach to discover new designs with less disassembly, by experimenting a trouser or coat on the mannequin upside down, mixing suit jackets with ties to form dresses, or draping a shirt on the mannequin to form a skirt. Designer in company B also uses draping, yet mostly works with fully disassembled flat fabrics. Discarded, low quality garments are used to experiment with sample designs.

Selection
Sample rage of designs is produced to present in a fashion show under the themes of recycling, sustainable or ethical fashions. Sample garments are produced with a theme of colours and with a limited size range.

Manufacturing
At the moment, company A receives very few orders from buyers after presenting sample garments. Majority of the business in both companies continue to be operated by creating one-off pieces to sell in the shops. No two garments are same, even if cut form the same pattern, because the fabric is always different form one garment to the other. Some of the
clothes are ‘multi way’, i.e. one design could be worn in different ways. For example, a top was designed in a way that it could be worn as a dress or skirt as well.

Both companies provide a made-to-measure service to its customers where the customers can bring their worn out, old garments to the shop to make it to a new, wearable fashion. This service also facilitate customers to discuss their own ideas with the designer about the transformation of garment, allows individual fitting sessions and slight adjustment of the final design according to their requirements.

Distribution and selling
Both remanufacturers sell their products through their own shops or distribute products to sell in sustainable and ethical fashion shops. Price of a garment can vary from £10 to £400 depend on the type and quality of the garment.

Figure 2 represents a summary of design process in remanufacturing drawn up according to the IDEFo principles. Each function is represented in a box and the inputs, outputs, controls and mechanisms associated with the function are connected by arrows. Each main activity is decomposed into more detail level of analysis.

Some remanufactured fashions have been successful in mass market, e.g. Company A sold its products through major high street mass market retailer, but was compelled to pull out due to following commercial pressures;
(1) Volume of sales was not enough to achieve required sale figures (target set by retailer).
(2) The fashions were not price sensitive to the market.

These issues are further associated with the fact that remanufacturing is new to the wholesale market and just being in a wrong arena of non-seasonal fashions. The summary of problems associated with remanufacturing process and possible solutions are discussed in table 3.
Figure 2: Summary of design process in remanufacturing
Table 3: Issues in remanufacturing process and possible solutions

<table>
<thead>
<tr>
<th>Phases</th>
<th>Problem</th>
<th>Why is it a problem</th>
<th>Possible Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research and analysis</td>
<td>Research does not focus on trends.</td>
<td>There is a less market opportunity for non-seasonal products.</td>
<td>Use high level of design skills to transfer trend information into fashions</td>
</tr>
<tr>
<td>Synthesis</td>
<td>It is difficult to start the design development with sketches and transfer those into flat patterns due to the limitations of fabrics and colours. Draping techniques is used as an alternative</td>
<td>Draping is time consuming technique and utilize more fabric than flat pattern cutting using sketches. Designer has to spend significant time on mannequin and also has to take the lead role in both designing and pattern creation processes. This increases the length of synthesis phase.</td>
<td>Use of CAD/CAM software tools such as Lectra system which helps the designer to enhance creativity, reduce designing time and effective utilization of fabric.</td>
</tr>
<tr>
<td>Selection</td>
<td>Non-seasonal fashions. No two garments are same. Limited size and colour range.</td>
<td>Uncertainty of buyer response as; -fashions are non-seasonal -limited size and colour range produce incoherent fashion stories.</td>
<td>Market the products as a recycling range in store under the label of sustainable fashions. Utilise the retailer’s need of being sustainable.</td>
</tr>
<tr>
<td>Manufacture</td>
<td>Component parts are in different sizes and shapes. Each garment needs to be individually cut by hand. Construction of every garment is different to the other.</td>
<td>Cutting each garment by hand is labour intensive and time consuming task. Efficiency in cut order planning is less possible to achieve. Machine operator needs an extra time to understand the style and adjust the machine accordingly, which affects the production efficiency.</td>
<td>Component parts of similar shapes need to be planned to cut as multi-layers with small makers to save time and minimize fabric waste. Use of multi skilled operators in a modular production system.</td>
</tr>
<tr>
<td>Distribution</td>
<td>It is difficult to establish network or distribution channels. High selling price.</td>
<td>It is difficult to market the product without having strong network with well established retailers and distributors. There is a trade-off between price and quality of used fabrics.</td>
<td>Use of marketing strategies to increase the consumer demand for products. Need to be price sensitive to the market.</td>
</tr>
</tbody>
</table>
5.0 Discussion

Remanufacturing is a process that provides benefits to many entities. It converts waste into a resource, provides employment and new market opportunities, helps charity and supports the consumer to develop sustainable lifestyles. However, this is still an emerging area and every step in the process needs to be improved, from collecting textile waste up to the selling point of remanufactured product. Efficiency and effectiveness of material return flow is very important and if the returns are uncertain and vary, it makes the production plans complex.

The study suggests that the main steps of design process in remanufacturing are not dissimilar to the activities followed in industrial design process. However design process in remanufacturing suffers some barriers such as material restrictions, lack of technology applications, lack of technical skill in re-design process and uncertain market demand. Product design and development skill appears to have a great influence on success of remanufacturing business and there is a requirement of talented designers who could combine high skill and innovation to deal with complexity in re-design process. Tacit knowledge and technical know-how appear to be the critical success factors in the design process.

Additionally, the remanufacturing process discovered in the study is comparable to the RemPro matrix presented by Sudin (2004). Return flow comprises collection of discarded garment, delivering to the site where those are sorted, cleaning and disassembly. The efficiency of reverse supply chain affects the availability of remanufactured products to the customers. Remanufacturer does not have entire control over reverse supply chain and managing whole supply chain is difficult due to cost factors. Remanufacturers depend upon the general waste stream to collect the material, however the quality and quantity of the recovered waste is an issue. It is beneficial for remanufacturers to build collaborative network with established textile recyclers to obtain efficient reverse flow of materials. Both sorting and disassembly are labour intensive tasks, which might be possible disjoint from remanufacturer and pass to the recycler.

The feasibility of an economically viable remanufacturing operation is depended upon following key factors;

- The efficiency and effectiveness of reverse supply chain.
- The optimum level of disassembly and rework needed for the recoverable garments.
- Recovery and rework cost as compared with the cost of virgin materials.
The level of skill of labour forces for sorting, disassembly and re-design processes.
- Product strategy (sales, marketing) and design strategy.
- Efficiency of production process.
- Possibility of generating a demand for remanufactured fashions.

6.0 Conclusion

This study provides a useful model for understanding the remanufacturing process practiced by niche market fashion remanufacturers. We argue that the remanufacturing process operates in niche market level is not dissimilar to the standard design process, and there is a potential of incorporating remanufacturing into conventional manufacturing process. Additionally, the characteristics of remanufacturing industry and existing problems were discussed, and possible solutions were suggested with respect to incorporating into the mainstream fashion design process. Given the fact that remanufacturers have failed to succeed at a whole sale range, those activities that need to be addressed to gain the mass market access have been identified. Further studies need to be carried out to refine the model and improve the understanding of the process knowledge and information transfer across the value chain. It is vital to identify how and what profits a remanufacturing process can bring to a company and how it can truly be incorporated in the current system.
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