APPLYING 3-DCE FOR VALUE CREATION IN SECOND-HAND CLOTHING CHAIN: A SWEDISH STUDY

Rudrajeet Pal1
1Department of Business Administration and Textile Management, University of Borås

ABSTRACT

The paper explores the antecedents of value creation in second-hand clothing value chains in Sweden along 3-DCE perspective. It identified the value generating stages as collection, sorting, refurbishing, reselling of used clothes and redesigning. These stages have various enablers and challenges at the intra-organizational and value chain levels. At the intra-organizational level, key antecedents are strategic logistics infrastructure for collection, sorting, transportation as well as creative retailing. Effective merchandise planning is another critical enabler for reuse and redesign, while right market knowledge is yet another essential enabler. At the value chain level, key antecedents are process integration, well-designed collection network and collaborative collector-sorter partnerships along with product design for durability. Further, supporting sustainability communication also enables higher value generation in the organization. These antecedents were further mapped in the paper along 3-DCE drivers to identify their foci. Design for durability, sustainable communication and creative redesigning with users were the key antecedents demanding 3-DCE attention.

Key words: Reverse value chain, three-dimensional concurrent engineering, second-hand clothing, Sweden

INTRODUCTION

In majority of the second-hand clothing value chains in western countries the extended responsibilities of various involved actors are limited to voluntary involvement with low levels of strategic collaboration thus making the system fragmented and complex (Ekström and Salomonsson 2014, Brooks 2013). As in the case of Sweden, only around 20% of consumed clothing are collected in channels for reuse and recycling through various individually run take-back schemes by retailers and charities for creating value through post-retail initiatives (e.g. by H&M, Kappahl, Boomerang, Red Cross among many others) (Ekvall et al. 2014, Hvass 2014). Further majority of these collected garments are not kept for value creation in the country of collection but are exported by charity organizations for commercial use in developing countries (Palm et al. 2013), leading to low realization of potential value in the system.

Overall, the current system leads to low value creation (in terms of financial performance and resource efficiency) even though many organizations have already adopted two main strategies, viz. product take-back schemes and resell/reuse over various platforms for prolonging the life of the garments and to capture the resell value (Hvass 2014). Further the responsibility of supply of second-hand stock lying in the hands of the private consumers introduces uncertainties in the quality, quantity and timing of product returns (Anderson and Brodin 2005, Halldorsson et al. 2009).

In this context, various attributes of product design, process and supply chain decisions are essential to enhance return rate, generate higher profits, improve product durability and end-of-use (EOU) quality, in short result in higher value creation (Subramanian et al. 2009, Savaskan et al. 2004). More specifically these design attributes can be deemed to be essential to counter loss of value from “value outsourcing” to “local value generation”. For example, new product take-back schemes can result in more resource efficient and consolidated collection through process reengineering (Savaskan et al. 2004). In addition, effective schemes for reuse and redesign would result in higher reuse/resell value (Ekström and Salomonsson 2014), thus redesigning the existing product

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architecture. In addition, close coordination among various actors in the network can be also crucial to complement in skills and expertise (Hvass 2014). Thus these activities need to be synchronized to redesign products, processes and associated value chains independently and more necessarily simultaneously thus calling for three-dimensional concurrent engineering (3-DCE) as a critical lens to explore the existing value creation activities. Thus the paper explores how designing of products, processes and supply chains offers an interesting lens to explore the antecedents of value creation in second-hand clothing value chains.

LITERATURE REVIEW
The conceptual framework of the paper is based on (i) value creation activities in second-hand clothing network, and (ii) 3-DCE in reverse value chain.

Value creation activities in second-hand clothing network
A 'source of value' is defined by Amit and Zott (2001) as any factor that enhances the total value created by a business. The notion of stakeholder value comprises of responsibilities and commitments in terms of value creation towards a broad spectrum of stakeholders, ranging from owners and investors, employees, suppliers, customers, to society and the environment (Mathur and Kenyon 1997).

A commercial chain for used garments requires several steps of value creating activities. According to Jayaraman and Luo (2007), the reverse logistics system enhances the value of returned products through upgrading and/or maintenance. It consists of collection strategies as well as recovery processes such as sorting, cleaning and mending or reuse of the material (van Hillegersberg et al. 2001). Once an unwanted garment has passed through collection, sorting, and possibly further steps of labour practices, it has regained exchange-value and re-entered the commodity form. Thus, it can be sold or exchanged either as a reused item or as a redesigned product. While on the other hand, used garments those still having potential exchange-value to their first owners are directly redistributed in the market and thus do not need reproduction processes (Brooks 2013). Besides reuse in terms of second-hand retailing, some charity organizations perform small-scale redesigning or remaking of used garments. The residues those cannot be exported, sold or redesigned are consequently incinerated (Ekström and Salomonsson 2014). However, Kumar and Putnam (2008) have researched cases where the recovery of used product is economically more attractive than disposal or incineration.

3-DCE in reverse value chain
Two main problems in the reverse logistics are in terms of difficulties in predicting the amount and quality of returned products (thus affecting the resell/reuse potential), and issues related to the collection- and transportation process, more specifically how to control and plan inventory and production (Jayaraman and Luo 2007). To handle these problems both expertise and specialization is required, alongside cooperation with suppliers holding the right capabilities for managing the complexity of the system (Kumar and Putnam 2008).

Various processes involved in reverse logistics rely on the logistics architecture; how products are collected, separated or sorted, remanufactured and later distributed to customers (Rogers and Tibben-Lembke 1998, Fleischmann et al. 2004). Depending on where the products are collected, from the consumer or another member of the value chain, the reverse logistics system is planned accordingly. Hence, this is an important factor to determine the subsequent reverse logistics activities. Fleischmann et al. (2004), in this context, argues that the main distinction between forward and reverse logistics is the network design; the former consisting of separate structures between production and distribution and the latter, encompassing both separate and connecting links in a highly complex structure. By considering network design when planning for reverse logistics, great benefits in terms of reduced costs and use of new resources can be achieved.
(Ellram et al. 2008). However, this complexity may also give rise to issues concerning strategy and logistics operations (Jayaraman and Luo 2007).

In addition, companies working with reverse logistics identify integration with other actors in the value chain as another important factor to make the operations profitable (Jayaraman and Luo 2007). Further, Blumberg (1999) and Debo et al. (2004) acknowledge coordination between the different actors involved in the reversed value chain as a critical task, which directly affects the efficiency of the whole system. This result in lower price and higher total profits in a coordinated channels compared to decentralized channels (Savaskan et al. 2004). Key factors related to coordination in the reverse logistic system is the flow of information between the network actors to enable efficient planning of returned products with regards to timing and quality (Kumar and Putnam 2008, Debo et al. 2004, Fleischmann et al. 2004).

The management of product within the supply chain for optimized recovery is yet another subject of many research papers pertaining to reverse logistics (Pilar et al. 2004, Fleischmann and Kuik 2003). Most of these papers highlight a strong linkage between product designs and reuse options. For instance, Abraham (2011) has mapped how the reconditioning processes comprising of minor-major deconstruction of the used garments resulted in value addition through product development in the apparel aftermarket in India. In this context, design for durability and design for EOU activities are also essential activities those alter the product architecture and supply chain responsibilities of the actors through extended product stewardship (Hvass 2014). Table 1 summarizes the deductive framework for reverse value chain attributes in connection to 3-DCE.

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<thead>
<tr>
<th><strong>Reverse value chain attributes</strong></th>
<th><strong>Key supporting authors</strong></th>
<th><strong>3-DCE linkages</strong></th>
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</thead>
</table>

Table 1: Deductive framework for reverse value chain activities in connection to 3-DCE

In summary, reverse logistics enable firms to attain a closed-loop system and thereby reclaim value from the returned products along the processes of collection, inspection, processing, consolidation and remanufacturing (Ellram et al. 2007, Jayaraman and Luo 2007, Kumar and Putnam 2008). Numerous studies have addressed and advanced the research and practice in the area of reverse logistics, while some have specifically addressed reverse logistics in the textile and clothing industry (Tibben-Lembke and Rogers 2002, Svensson 2007, Sinha et al. 2012). However, its explicit connection to value creation, in context to the second-hand clothing network, is still under-explored.

**METHODOLOGY**

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The research adopts a mixed method approach. Data is collected, in the first phase, through desk research to map the Swedish second-hand clothing value chains along their value creation stages and activities. A couple of interviews were also conducted with key actors in the network to gather information. Author has been a board member of a regional project on this topic and has discussed with experts in the field to gather supplementary data. In the second phase, twelve semi-structured interviews were conducted with five Swedish retailers and fashion brands, two second-hand retailers, two charities, and three small redesign brands. The interviews explored the key antecedents of the value creation activities they are engaged with. The interviews lasted between 60-90 minutes and were recorded, and later transcribed. Data analysis was done through thematic analysis. At first the interviews were deconstructed into value creation activities and their antecedents, followed by categorizing them into reverse value chain attributes and finally re-categorizing them into 3-DCE drivers.

RESULTS AND ANALYSIS
In this section we analyse the value generating operations identified in the existing second-hand clothing network in Sweden to explore their key antecedents along the deduced reverse value chain attributes (as summarized in Table 2).

Value generation in second-hand clothing chain

Collection
It was evident from the empirical data that the potential for reuse and other forms of value creation is facilitated by effective collection processes, enabling further value creation activities by diverting products disposed by the first user from the general waste stream. Fashion retailers revealed that collection is only financially viable in areas with high density of population as well as popular places for container placement. Further closeness to the retail stores and sorting centres is also strategic for location. However, due to the high fragmentation, centralization is not a viable alternative. I:Co highlighted its collaboration with Kappahl and H&M in arranging collection of used or unwanted clothes through computerized machines at retailer shops to be a key step in for appropriating value. These systems not only give the information about clothes it also counts the money that is charged for each piece of clothes. Most of the collected clothing is transported to other sorting locations accounting for a loss of value creation potential inside Sweden. Most of the fashion retailers involved with collection operate in collaboration with international sorters, like I:Co or Kicki, hence the second-hand clothing leaving the country. Further collection by commercial actors is to some extent perceived as competition to charity organisations. However, recently partnership between fashion brands and charities has emerged as a new phenomenon, as can be seen between Filippa K and Stadsmissionen. Further in order to increase the amount of collection for reuse and redesign purposes, consumer information and convenience need to be prioritised, as collection builds on donation partnerships and consumer involvement. This demands support in the collection process by the municipalities. The charity organisations also requested sharing of the economic burden of collection, on the condition that it does not hamper reuse and activities of existing legitimate actors.

Sort
Sorting provided organizations, like I:Co with merchandise for reuse that is sellable in various markets. Thus familiarity with different markets is identified as a critical success factor for sorting apart from the necessary skills and infrastructure for sorting. The logistics is arranged by I:Co from the retailer’s consolidated facility to its own sorting facility in Germany. The monetization for I:Co is through purchase of second-hand clothing from the collaborating retailers and its subsequent sales outside the country of collection, leaving not much value realized within the local country’s boundary. On the other hand, second-hand retailers (e.g. Myrorna, Emmaus) and second-hand luxury brands engage with very specialized selection and sorting of consignment providing more certainties and thus appeal to consumers. Sometimes the second-hand retailers exports
the collected material (sorted or unsorted) to its customers which demands long-term relationships with these clients. In addition, sorting activities provide employment opportunities and promote the use of second-hand clothing as was indicated by the second-hand retailers. Fashion brands like Boomerang and Filippa K who resell their own brand of second-hand clothes are also engaged with higher value-added manual sorting to segregate the collected clothes into three categories, viz. (i) those sold at own store, (ii) those sold to charities, and (iii) those to be sent for recycling. This categorization depends upon the quality of the second-hand clothing; only the best quality is sold in own stores making the sorting activity extremely crucial and value-adding.

Refurbish
The purpose of repairing as observed in fashion brand, like Nudie Repair Shop, is to bring used products back to functionality through mending or replacement processes. The required level of disassembly or reassembly is usually low in repaired items. These activities offer value to the customers by extending the life and durability, either through repairing or altering it to a different size. Allied activities sometimes include cleaning to be more cost-effective (a common phenomenon in laundries). These services are sometimes add-on to the purchase of high-quality relatively expensive clothes (shifting the focus from product to product-service). The marketed concept is augmented through neck labels, embroidery, hang tags, marketing and visual merchandizing in the retail space. On the other hand, such services are also offered to original users in return of service charges. Nudie sometimes organizes training workshops, on basic mending and repairing activities as well. The environmental gain is dependent upon the increase in the usage time resulting from the repair and has been assumed to be significant in a prior study by Ekvall et al. (2014). However, the economic gains are still low primarily due to challenges from cheap high-street fashion and high labour costs resulting in ~10 years of payback time, however sometimes having considerable displacement effect.

Reuse by user
Empirical evidence suggested that normally the garments of the highest quality collected via take-back schemes are resold by fashion brands in their own stores, as was evident in case of the Swedish brands Boomerang and Filippa K. Key activities organized by these brands included picking & packing, laundering, receiving & storing, and finally restyling if necessary thus highlighting a vertically integrated structure. Nudie, for example, washes and repairs each pair and puts them back in the shop as second-hand articles which are then sold as “used own brand”. In this context, the durability and longevity (hence the quality) of the collected clothes needs to be high. In addition, creative retail store formats are used as marketing tactics to showcase the products. For example, Boomerang Effect was communicated in-store visually through presentation of the vintage garments on the defined area. One challenge is however in terms of stock availability. This demands high level of sustainability communication to ensure continuous flow of old stock at sufficient volume. Nudie, for instance, ensures this through a story telling technique via its websites, shops and other advertising channels. Such sustainable corporate image enhances the brand image, e.g. Nudie is ranked as one of the most sustainable fashion brands by www.rankabrand.org. Reused clothes are also exchanged through second hand-retail, leasing-services or informal channels such as swapping events and consumer to consumer sales as was observed in a separate business model of collaborative consumption.

Redesign
Redesign aim at changing collected clothes through design characteristics that create new value for the consumer, turning collected and sorted textile material into new, usable products. Respondents perceived redesign activities could be done along three levels, with options for scalability and profitability. Some can by simple means be washed (refurbished) before they are resold, as was evident in Nudie and Boomerang. Key processes include disassembly, inspection, mending and reassembly to extend the service life of products. The intermediate stage of design aims at raising the value of the
garment. It can be cut to size, sew on labels, pockets, buttons, rivets, etc. It can also be about washing the garment so that it gets a special look etc. Nudie Jeans, on the other hand, is also involved in collaborations with designers and other creatives under the “Denim Maniacs” to give worn-out jeans a second life. Respondents valued time, skills and network with actors who can take an active role in the re-design process to be the critical success factors, both in design and production engineering. Further at the highest level is total redesign of the garment to create something new. For instance, Stormie Poodle is a small designer brand that manufactures children clothes out of either reused terry cloth or high quality hotel linen. The owner states, “it is an expensive process demanding a lot of time to be added, allowing the garments to be sold at high prices.” Another redesign business conferred that ensuring the logistics of the incoming used products is the key to success, which they try to solve through story-telling about their brand. Micromanaging the design process, keeping the product constraints in mind, was also essential for such redesign activities.

<table>
<thead>
<tr>
<th>Value generating stages</th>
<th>Supporting empirical evidences</th>
<th>Key antecedents along reverse value chain attributes</th>
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<tbody>
<tr>
<td>Collection of second-hand garments (Some observed Cases: Kappahl, Filippa K)</td>
<td>Enablers -collection is only financially viable in areas with high density of population as well as closeness to the retail stores and sorting centres -strategic collection points</td>
<td>a. Supply chain planning: Strategic collection network b. Logistics architecture: Well-developed automatic collection systems e. Network collaboration: Long-term collaboration with sorters Information integration: Consumer information to increase collection volume and quality</td>
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<td>Sort (Some observed Cases: I:Collect in collaboration with fashion retailers; Fashion Brands -Filippa K, Boomerang)</td>
<td>Enablers - familiarity with different markets - transportation from the retailer's consolidated facility to own sorting facility - very specialized selection and sorting of consignment - long-term relationships with these clients Challenges - manual sorting - informed quality-based categorization</td>
<td>a. Supply chain planning: Optimized collection and transportation network b. Logistics architecture: Strategic sorting and appropriation e. Cooperation and sharing expertise: with collectors Information integration: Market knowledge</td>
</tr>
<tr>
<td>Refurbish: Mending, Re-labelling and washing (Some observed Cases: Nudie Repair Shop)</td>
<td>Enablers - cost-effective processes, like washing etc. - innovative product-service concept - marketing concept - repairing to extend life and durability of garment - organize training workshops Challenges - cheap high-street fashion and high labour costs</td>
<td>b. Logistics architecture: Cost-effective repairing, etc. c. Product architecture: design for durability, extended usage, product-service system (PSS) d. Product architecture: repair skills f. Collaboration with user: repair education</td>
</tr>
<tr>
<td>Reuse by user (Some observed Cases: Boomerang, Filippa K, Nudie)</td>
<td>Enablers - vertically integrated structure - product durability and longevity - creative retail store formats - high level of sustainability communication Challenges</td>
<td>b. Logistics architecture: vertical process integration, creative retailing, sustainability communication c. Product architecture: design for durability e. Information integration:</td>
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**DISCUSSION: EVIDENT PATTERNS IN ANTECEDENTS**

Several key antecedents of value creation and appropriation are emergent through the data analysis following the interviews. These antecedents can be categorized into two levels, viz. intra-organizational and value chain.

At the intra-organizational level, one of the key enablers was strategic collection network for ensuring quality and volume of collection, as also highlighted by Ekström and Salomonsson (2014). In addition transportation of the collected clothes from individual collection points to intermediate warehouses and distribution centres and finally to the sorting facility (of the sorter) demands coordination of a well-networked transportation and distribution system as organized by the large sorting companies. Further merchandize planning both after the sorting and for redesigning purposes were crucial to appropriate the right value to the product. In addition, improvement in reverse logistics through automatized in-store collection, strategic sorting, cost-effective repairing/mending and creative retailing (like second-hand concept stores, shop-in-shops, etc.) were identified as key enablers of value creation. However, most of these operations were undertaken by individual value chain actors. The infrastructural enablers when complemented by the right market knowledge of the actors resulted in rendering critical success factors in value generation.

At the value chain level, long-term collaboration between collector and sorter emerged to be one of the key antecedents of successful value appropriation and grading, in line with findings of Blumberg (1999) and Debo et al. (2004). Such a commercial chain requires collection and sorting networks that provide ample and consistent flows of second-hand clothing in a cost efficient way, followed by operations to produce a variety of marketable products. Similarly, the fashion brands also collaborated with various designers for product redesign to achieve higher level of value creation. In addition, collaboration with end-user was also identified as a key antecedent for rendering innovative value chain models. Such collaborations could be observed through organization of various swapping events and renting services by fashion brands and other actors to enable collaborative usage. Further, some brands also incorporated users in the co-design process, as was observed in case of Nudie Jeans Repair toolkit. However some actors, predominantly the fashion brands were able to organize, coordinate, monitor, and execute complex reverse logistics by integrating through all value chain operations thus constituting distinctive capability or strategic resource, as also highlighted by Jayaraman and Luo (2007). Another key antecedent for higher value generation was identified along the product architecture to ensure durable design both during the product development and reuse phases, either by working with long living products with a high quality, design of products that make it easier to reuse, repurpose or recycle, or by finding out different ways to work with reuse mind set, etc. (Lifset and Lindhqvist 2008). Finally, it was observed that sustainability communication was also critical as an antecedent to value.
generation (in terms of both tangible profits and intangible brand value) across the entire reverse value chain which demanded the actors to communicate transparently their environmental friendly practices and solutions in terms of product, process and supply chain impacts. Such communication demands careful redesigning of product, process and supply chains to support sustainable practices in all frontiers.

CONCLUSION

The paper shows that various actors are engaged in the second-hand clothing value chain in Sweden, by adding/appropriating value in five ways, viz. collection, sorting, refurbishing, reselling of used clothes or redesigning, in varying degrees. In particular collection is still fragmented and less strategic, sorting is outsourced, and redesigning is still at the state of infancy. These stages have various enablers and challenges at the intra-organizational or value chain levels. At the intra-organizational level, key antecedents are strategic logistics infrastructure for collection, sorting, transportation and creative retailing. Further, it emerged crucial to support communication of sustainability efforts as practiced along the value chain. These antecedents of value creation in second-hand clothing network when mapped along 3-DCE also enabled to visualize the focus and driver of each reverse value chain attribute as shown in Figure 1. Design for durability, sustainable communication and creative redesigning with users were the key antecedents demanding 3-DCE attention.

Limitations exist in terms of internal validity of the research. Author has delimited the discussion from mentioning other external value enablers, like legislation, product directive etc. In addition, explanation to the value creating activities and their antecedents apart from the 3-DCE linkages is not considered. Further, the paper does not address value creation in terms of its level, instead in terms of various stages. Future research is essential to develop quantitative measures of value creation along the identified activities for subsequent modelling. Further the effects of the identified antecedents needs to be investigated in connection to the measurable levels of value to explore their effects. Further the 3-DCE linkages needs to be monitored to propose solutions for higher value generation. The implications of the paper are vital for major actors in the second-hand clothing value chain to take efforts towards higher value creation by concentrating specifically on the various enablers. Further, the 3-DCE lens provides explicit understanding and categorization of the value creation activities, and ‘where’ and ‘how’ to invest.

Figure 1: Antecedents of value creation along 3-DCE drivers

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REFERENCES


20th ISL, Bologna, Italy, July 5-8, 2015


