Performance Indicators of Textile Reverse Logistics

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Abstract. The reverse supply chain has gained increased attention across industries due to the high product return rates. Many strategic and economic benefits can be reaped by efficiently managing the reverse supply chain, such as; cost reduction and enhanced environmental performance. Despite the acknowledgement of the available advantages that can be reaped, there is an overall lack of academic research concerning performance metrics, in particular KPIs (Key Performance Indicators), that can help in managing reverse supply chains. Moreover, industry-specific KPIs have not been explored thoroughly. The apparel industry is currently plagued by high return rates, which suggests that it is even more important for clothing retailers to look over their reverse supply chains. The conceptual framework presented in this report seeks to diminish the gap in literature and provide clothing retailers with KPIs with a focus on environmental sustainability that can help in the decision-making process. The framework is expected to promote sustainability as a more central decision-making criterion within reverse supply chains, especially within the apparel industry.

1. Introduction

As a result of a heightened level of product returns across various industries, the reverse supply chains have become more strained. It seems large retailers need to formulate and implement an efficient reverse supply chain strategy in order to maintain and ensure competitive advantages on a relentlessly competitive global market. Costs that can be derived from reverse supply chain activities have been estimated to around 9.5% of a firm’s total logistics costs which highlights the potential in cost reduction through the implementation of efficient reverse supply chain practices [1]. Moreover, augmented environmental performance has been identified as another benefit that can be reaped [2-5]. Moreover, Vedpal and Jain [6] made evident that both strategic and economic advantages can be acquired by implementing efficient reverse supply chain practices, but the question is how companies can develop these reverse supply chain practices and more importantly, continuously improve them.

In order to manage and develop efficient practices, it is crucial to measure performance as it facilitates and stimulates the decision making process. Performance measurement is the collection of information and data and can lead to a more informed decision-making process which aids in developing and improving strategies. Measuring performance can be done in various manners, but a typical manner is to identify and formulate a number of key performance indicators, also referred to as KPIs, aimed to help in achieving an intended result. The selection of indicators is based on what is intended to be accomplished, and the more precisely the KPIs measure the intended result, the better [7].

An industry particularly affected by high return rates is the clothing industry which have had detrimental effects on the environment [8]. This development can be explained by the emergence of the try before you buy mentality which sees consumers trying on clothing at home rather than in-store, and sending back the pieces that they do not like [9]. Despite this, consumers still demand sustainable
products and practices to a large extent [10]. Formulating and implementing KPIs which focus on environmental sustainability is thereby especially relevant within the clothing industry in order to meet consumer demand and reduce emissions.

The conceptual framework presented in this report will be industry-specific because after an extensive literature review it was made evident that formulating a framework that is applicable across industries in relation to KPIs and reverse supply chain has already been explored in earlier research. While some key activities within reverse supply chain have been identified across industries, these activities can differ slightly in importance and structure depending on industry which suggests that industry-specific KPIs can be alluring to delve into. Industry-specific KPIs of reverse supply chain within the clothing industry have not been thoroughly defined. The high return rates within the clothing industry highlight the importance for particularly clothing retailers to implement efficient return management processes. Based on this reasoning, it was deemed appropriate to pinpoint reverse supply chain key activities within the clothing industry and through these formulate a conceptual framework by selecting appropriate KPIs.

In order to ensure the preciseness of the KPIs, a decision was made to focus on environmental sustainability. Environmental sustainability was chosen due to its relevancy and the urgency for companies to reduce their environmental footprints. One way to explain environmental sustainability is economic activities within environmental limits and using natural resources in a sustainable way [11]. This is particularly important for the logistics sector which has been identified as a huge contributor to gas emissions [12]. A conceptual framework of industry-specific reverse supply chain KPIs with a focus on environmental sustainability has not been formulated thoroughly in previous research, and this report seeks to close this gap in literature, or at least diminish it. The aim is to identify what KPIs should be used by a clothing retailer to enhance environmental sustainability within the reverse supply chain.

2. Performance Indicators of Reverse Logistics

The enzymatic hydrolysis process was conducted in the There is no universally accepted definition of reverse supply chain and the activities that are said to be included vary slightly across sources. According to Guide and Wassenhove [13] a reverse supply chain is defined as all the activities from product collection to remanufacturing or disposing processes. Blackburn et al. [14] claim there are five key processes that all reverse supply chains include. These are; 1) product acquisition, 2) reverse logistics, 3) inspection and disposition 4) remanufacturing and 5) marketing – creating a new and secondary market for the returned product. These processes can be compared to Sangwan [15] three activities sum up the activities Blackburn et al. [14] describes as collection, inspection and sorting, and product recovery. Sangwan [15] argues that there is no definite generic definition for reverse supply chain, but that all reverse supply chains include these three activities. Depending on industry and business model, the framework for the KPIs for each activity presented by Sangwan [15], can be adapted and used differently. Sangwan [15] includes disassembly as a sub activity within sorting. Reverse logistics is the practice of planning, implementing and controlling the flow of products and raw materials in a cost effective and efficient way from the consumer back in the supply chain, with the goal of capturing value or disposal [16].

Reverse logistics has been defined to include four key activities by several sources, such as Rogers and Tibben-Lembke [17], Schwartz [18], Lambert et al. [19] and Daaboul et al. [20]. These activities are gatekeeping, collection, sorting and disposal. Lembke and Rogers [16] define reverse logistics as the products movement in the opposite direction compared to forward logistics. The alternative for disposal is product recovery which can be done in various manners; reuse, repair, refurbish, remanufacturing, retrieval and recycle, as presented by Jayaraman [21].

Literature concerning reverse supply chain and reverse logistics in the clothing retail context is not extensive, and the literature that is available focuses primarily on return management. The importance
of handling returns swiftly and efficient return management is of utmost importance within the apparel industry, as made evident by Schwartz [18]. An inefficient return process can lead to decline in customer satisfaction and enhanced storage costs. This indicates how vital efficient return management and appropriate return policies are for apparel retailers on a competitive market. Return management can be a pitfall of costs for apparel retailers, but also a source of various benefits if implemented correctly [18]. The need for efficient return management among clothing retailers is a result of a preeminent shift in consumer consumption behaviour. This is further highlighted by Cullinane et al. [22] which present the shift in consumer consumption behaviour from catalogue shopping to internet purchasing as one of the main explanations for the increase in online shopping, and thus, increased return rates. Other factors that have affected the shift in consumer consumption behaviour presented by Cullinane et al. [22] consist of developments in the technological landscape, the emergence of social media and the provision of free deliveries and returns.

As the consumption patterns have changed, customers have started to demand a swift, and in some cases free returns, which further burdens the reverse logistics of apparel retailers. Free deliveries and returns do not solely have detrimental consequences for the environment, but are also posing issues for large clothing retailers in terms of profitability. This further highlighted by Jack et al. [23] which identified product returns as a major source of financial losses for companies. It is for this reason that large clothing retailers usually have a minimum order threshold for free delivery and returns as it strains their margins. Recently, H&M had to reduce their minimum order threshold for returns in an attempt to reduce the amount of smaller orders and increase profitability [24].

The ability for apparel retailers to capture value in their reverse supply chain activities can be complicated, which is highlighted [25]. Hawley [25] explains that closed loop supply chains which are typically found in classic manufacturing companies, have their focal point in returning used products in the forward supply chain quickly in order to capture value. Remanufacturing is difficult within the clothing industry due to the technological assets required. Another manner for corporations to capture value is through recycling. The ability to capture value through recycling for an apparel retailer is more complex, since recycling apparel products is harder to apply on a larger scale. Furthermore, the feasibility of recycling within the apparel industry is doubtful as it results in high costs for retailers. The economic incentive to recycle is thereby weak, and can only be organised by larger clothing retailers [25].

Based on the studies of Hawley [25], remanufacturing and recycling within the clothing retailing context is straining, which brings forth the question on how apparel retailers should aim to capture value in their reverse supply chain. Abraham [26] and Hvass [27] explored the idea of second hand retailing within the fashion industry. Depending on the goal set by the corporation in relation to their reverse logistics processes, the key activities within a reverse logistics chain will differ in importance. Collection and storage is important if a corporation seeks to put back returned products in the forward supply chain quickly. If the goal is rather to salvage component parts, in an aim to reduce the environmental footprint, then sorting is more vital. Through sorting, the returned apparel products can be redistributed to secondary markets which does not merely have sustainability implications, in terms of less waste, but also helps to democratise fashion. Outlets and off-price retailers would then receive these products, where consumers with less financial stability can purchase clothing which contributes to a wider consumer base for apparel retailers. However, creating the secondary markets can require a large amount of capital that smaller retailers do to possess. Thereby, Abraham [26] and Hvass [27] argues that reuse is a significantly important activity in terms of sustainability.

The high return rates currently tormenting the clothing industry have gained a lot of attention due to the environmental consequences that they impose. This brings forth questions on how clothing retailers can incorporate sustainable practices in their reverse supply chains. It is of interest to identify activities
within the reverse supply chain that have great potential in enhancing environmental sustainability if managed correctly. However, literature concerning the reverse supply chains of apparel retailers in relation to sustainability are scarce, which is highly problematic since the textile industry is a major contributor to gas emissions [28]. An explanation as to why such high numbers of emissions can be derived from the clothing industry is due to poor waste management across the industry and issues with inserting used products in the supply chain. Closing the supply chain loop within the apparel industry has received very little attention. Nonetheless, there are a few notable authors who have plunged in this subject matter.

A recent case study conducted by Cullinane et al [29], maps out the reverse logistics of the Swedish clothing e-tailer Nudie Jeans and relates these to sustainability. The typical activities which are included in the reverse logistics of a clothing retailer; gatekeeping, collection, sorting and disposal. Gatekeeping refers to the entrance point of the reverse logistics chain, and implies what products are eligible to return. The activity has sustainability implications since the amount of returns can be controlled through this activity if the threshold for returning is high. Setting a minimum monetary purchase value for the returned products is a manner to reduce return rates through gatekeeping. Within collection it is difficult to ensure sustainability because it is hard to measure the performance of the parcel carriers in sustainability terms, but consolidation possibilities and vehicle type used can be assessed. Sorting has sustainability implications due to the energy and resource use connected to warehousing. Product disposal can have detrimental effects on the environment in form of landfill and incineration processes. A fifth activity is also presented, mitigation, which refers to the need for clothing retailers to avoid returns in general. Charging for returns and ensuring quality of products can diminish the amount of returns [29].

Moreover, Cullinane et al [29] identified a few typical obstacles for ensuring sustainability within the reverse logistics of a clothing retailer. These consisted of; lack of control of the reverse supply chain, the hardship of evaluating the parcel carriers in terms of sustainability, differences in return behaviour depending on country of origin among consumers, packaging problems, lack of economies of scale due to the omni-channel approach, knowing what to charge consumers for their returns and managing the return practices in the B2B channel.

It is evident that clothing retailers face a considerable challenge in implementing sustainable practices within their reverse supply chain. Approaches to do this have been presented by Cullinane et al [22] who compared a weak sustainability approach to a strong one in relation to return management. A weak sustainability approach implies coordination and consolidation of returns while a strong sustainability approach puts more responsibility on the consumer by charging them for returns. Ensuring that consumers make more informed purchase decisions in order to reduce the risks of them returning their products due to misinformation is also included in the strong sustainability approach [22].

In practice, operational managers often use customer satisfaction as a KPI as well as operational drivers for the reverse supply chain [30]. The KPIs presented in research are either very industry specific or very general. Traditionally the focus has been on cost, time, customer satisfaction, volume and absolute number indicators within the reverse supply chain as collecting cost, testing cost, labour cost, return volume, volume of collection, bounce rate among others [14, 15]. There are also general environmental performance indicators for the reverse supply chain which are; overall environmental compliance, materials utilization, energy utilization and disposing capacity [31]. Looking at the whole supply chain, Rao [32] suggest an easy KPI to follow; the percentage of regained output from customer returns put back in the supply chain at any stage. Other general KPIs that are connected to return management are; the percentage of returned or exchanged items divided by percentage of bought items, the cost per return or exchange, time is taken for defect detection to correction, bounce rate, total repair/refurbishment costs.
KPIs have traditionally been financial numbers, created to be a benchmark towards other companies in the same industry, but also for the company to evaluate its own performance. It's common for each department (eg. marketing, sales, human resources) to have their own KPIs, developed to find the key indicators for their performance.

For companies to achieve their environmental objectives, environmental performance indicators are commonly used. These are often used in environmental management systems to help companies to set goals and targets within the environmental standards. The main goal according to Rao [32] is to reduce the waste, minimize and prevent pollution and to use different resources as good as possible. Reporting on the EPIS are usually done through following international standard measures as ISO 14001, as a separate report and separate from financial and other traditionally industry-bound KPIs used by the company. EPIS has traditional to be developed to contribute with information to different stakeholders, to engage in environmental efforts and to create a common accepted foundation of information for companies to engage in the national and local governments [33]. By dividing the purpose of KPIs and EPIS, the integration and intersection of the two becomes more difficult to align. If combined, the two traditional ways of measuring, the company can put the both measurements as successful key indicators to their company and both achieve cost savings and reduce their environmental impact.

The following section will explore various KPIs that can be used to enhance environmental sustainability across the supply chain and will be based on the typical activities of a clothing retailers’ reverse supply chain; mitigation, gatekeeping, collection, sorting and disposal.

Mitigation: KPIs connected to mitigation is hard to define since it includes preventing the number of returned products. The number of returns are hard to predict and since returns are made by various reasons, the overall goal should be to minimize the number of returns. KPIs to adapt according to Cullinane et al. [29] can be, number of returned products and tracking typical reasons for returns.

Gatekeeping: With an effective gatekeeping the product can be sent to the right place in the reverse supply chain and thereby reduce cost and improve the customer service [34]. A relevant KPI within gatekeeping is comparing the number of fulfilled returns versus unfulfilled returns could be adapted. Found from Hjort [34], an information flow between the different activities to find if the gatekeeping system fulfilled its purpose with “wanted” returns. From that a KPI can be put in place by determining the difference between correct assessments compared to the wrong assessments. Doing the right judgment from the beginning is a cost saving mechanism which in the end saves a lot of unnecessary transports and by that less environmental impact [34].

Collection: KPIs with a focus on environmental sustainability within collection are as mentioned by Sangwan [15]; energy use, waste generation, environmental impact. The energy use to be connected to the fuel consumption from the transports, waste generated from damaged package and environmental impact from the storage of the product including warehouse.

Sorting and disposal: The sorting process is important because it refers to process of deciding what to do with the product. An effect on the environment can be the energy and material needed for warehouses where the sorting occurs [29]. Sangwan [15] presents the following useful KPIs in relation to sorting; location of waste disposal sites, waste handling and energy and resource use connected to the warehouse.

Sangwan [15] further presents that the relevant KPIs for the disposal activity are; environmental impact of processing, landfill and incineration. The environmental impacts of either disposing or recovering products can be compared. The value for each of the recycled, restocked or resold products could be calculated as an additional income if successful put back in the forward supply chain. The
economic metric could be a driver for companies to make additional efforts to try to capture as much value as possible and by that, a possible increase in environmental impact [35].

3. Conceptual Framework

Based on the extensive literature review presented in this report, it would be deemed favorable if the KPIs implemented by clothing retailers within their reverse supply chain focus on avoiding the pitfalls of costs and unsustainable practices in relation to return management. This due to several reasons, but first and foremost in order to balance meeting consumer demands of swift and free returns and the increasing demand for sustainable practices. Consumers demand sustainable practices to a large extent whilst simultaneously contributing to the high return rates currently tormenting the clothing industry. Maintaining sustainable practices in an industry where consumers consume in an unsustainable manner can be quite problematic since it can become harder to implement such practices. It is evident that clothing retailers should include environmental sustainability as a decision-making criteria when formulating their KPIs in order to efficiently develop a return management process that meets customer expectations. The question is though, if it is possible to merge sustainable practices whilst providing consumers with a free and swift return process, or if it is merely a tradeoff when consumers’ consumption patterns are unsustainable. The threshold to return a product is so low, which incentivizes consumers to return more products. One could argue that more responsibility needs to be put on consumers when it comes to their unsustainable consumption. Boozt’s choice to banish consumers who order huge amount of clothing to then merely return them is an example of a retailer aiming to shift the responsibility onto the consumer [36]. This is also an indication of a strong sustainability approach presented by Cullinane et al [22], which implies to financially burden consumers that consume in an unsustainable fashion. It seems clothing retailers can affect the purchasing behaviour of consumers in order to reduce the high return rates, and thus disburden their reverse supply chain. KPIs focusing on customer satisfaction as explained by Wiggins et al. [30] are very prevalent within the clothing industry but maybe the main focus cannot withstand on solely customer satisfaction due to the changes in consumer consumption behaviour.

As can be depicted through the literature review, scholars separate KPIs from environmental performance indicators, named EPIs. EPIs are distinctively detached from KPIs, and is an different subject matter. While a performance indicator should be specific to ensure precision, completely detaching EPIs from KPIs can bring forth a discussion on if environmental sustainability should be incorporated when formulating; key performance indicators. This particularly relevant in an industry where the environmental ramifications are so severe. It could be argued that it is more appropriate for sustainability to be a central decision-making criteria in the formulation of KPIs. Separating the two concepts so restrictedly and characterizing EPIs as a nisched subject all together, might give the impression that there is a tradeoff between environmental sustainability and other sources of performance. Moreover, it could reinforce the idea that environmentally sustainable practices are merely to be kept in the periphery and not be central in performance measurement. EPIs are also formulated in accordance with environmental standards which suggests that these are merely formulated and implemented for the sake of compliance. For clothing retailers, environmental sustainability needs to be given more attention, if not to meet consumer demand, then for the sake of reducing emissions. One cannot manage something that it does not effectively measure. This further highlights the relevance of this framework, industry-specific KPIs with a focus on environmental sustainability in relation to the reverse supply chain. Nonetheless, the separation of the two could be to ensure the precision of the KPIs as mentioned before, but it is still a discussion worth having.

Based on the studies of Rogers and Tibben-Lembke [17], Schwartz [18], Lambert et al. [19], Daaboul et al. [20] and Cullinane et al. [29], the most frequent and important activities found in the reverse logistics of a clothing retailer are; mitigation, gatekeeping, collection, sorting and disposal. Some options to disposal will also be considered which as presented by Jayaraman [21] are; reuse,
remanufacturing, and recycle. The KPIs that should be implemented to enhance environmental sustainability across the reverse supply chain should thereby be linked to these activities which will be presented below.

Mitigation: Mitigation is the avoidance of returns as presented by Cullinane et al. [29] which could be seen as a precedent to the other activities within the reverse logistics chain. The reverse logistics of a clothing retailer will differ in burden depending on the amount of returns, therefore it is of interest to reduce the amount of returns. The amount of returns has sustainability implications in the sense that high return rates within the clothing industry have environmental ramifications and highlights further the necessity to monitor this development in order to enhance sustainability across the reverse logistics chain. To ensure that the amount of returns remain on a rather low level, it could be deemed appropriate to formulate some KPIs in relation to quality control. If delivered products are not defective, consumers are less prone to return them. Moreover, KPIs relevant to monitor the performance in relation to mitigation are the number of returned products as well as identifying the typical reasons for return. By pinpointing the reasons as to why consumers return, more efforts and resources can be allocated to prevent this in relation to the given reasons.

The KPIs can be used during the decision-making process by comparing how different mitigation options affect the amount of returns and reasons for returning. Charging for returns can be a manner to reduce return rates, but considering the high demand for free returns, this might not be the optimal solution as it could result in a loss of market shares. Comparing the amount of returns and reasons for returning depending on different solutions can give clothing retailers an indication on which solution should be applied.

However, a major problem with return management is that consumers’ typical reasons for returns are not because the products themselves are defective, but rather a result of the try before you buy mentality among consumers, which puts clothing retailers in a rather compromising position. Boozt recent banishment of consumers who purchase large amounts of clothing to merely return them is an example of efforts to reduce return rates. Boozt must have identified these consumers and tracked their return patterns. This could be favorable when some consumers are consuming in an unreasonable fashion. By conducting the activity of mitigation in an efficient manner, the precedent activities within the reverse logistics chain could be less strained, and costs could be reduced.

Gatekeeping: Gatekeeping as presented by Rogers and Tibben-Lembke [17], Schwartz [18], Lambert et al. [19], Daaboul et al. [20] is the point of entry in the reverse logistics chain. As the name indicates, it refers to what criteria that dictate what is allowed in the reverse logistics chain, in other words, what products are eligible for return? Gatekeeping is closely intertwined with regulating the number of returns, if the thresholds to return a product are low, the amount of returned products will naturally increase as a result. The sustainability implications here are much like in the mitigation activity, that high return rates have detrimental environmental consequences. Based on this reasoning, relevant KPIs are to measure the amount of returned products and tracking the most common reasons for returning.

Cullinane et al. [29] presented a few manners to perform efficient gatekeeping, one manner is to have strict thresholds on what is allowed to enter the reverse logistics chain. This can be implementing a monetary minimum value of the purchase price of the returned products in an aim to reduce the amount of returns. Different thresholds can be assessed and compared in relation to the chosen KPIs and give clothing retailers a base for decision-making in order to limit the amount of products eligible for return. Hjort [34], highlighted that there are other benefits of an efficient gatekeeping process, such as the reduction of cost and improved customer service.

Collection
The collection activity refers to the pick-up and transport of returned products as presented by Rogers and Tibben-Lembke [17], Schwartz [18], Lambert et al. [19] and Daaboul et al. [20]. According to Cullinane et al. [29], collection can have sustainability implications depending on the vehicle type used, the possibilities to consolidate and parcel carrier selection. Appropriate KPIs related to collection and sustainability are; monitoring energy use, waste generation and the environmental impact [15].

The KPIs can be used in comparing different vehicle types, consolidation possibilities and selection of carrier or 3PL provider. Cullinane et al. [29] explains the hardship in measuring the performance of different parcel carriers in relation to sustainability and that clothing retailers often do not have much leverage. Nonetheless, the KPIs can assist clothing retailers in assessing how to organise the collection activity in order to enhance sustainability.

Sorting: Sorting refers to the individual inspection of returned products and the sorting of those products accordingly as explained by Rogers and Tibben-Lembke [17], Schwartz [18], Lambert et al. [19] and Daaboul et al. [20]. It is the inspection of quality of the returned products to determine if they can be reinserted into the supply chain or if they should be disposed of. Sorting strategies can differ in environmental impact, so if a company seeks to increase their sustainable practices, it would be appropriate to implement a sorting strategy with the lowest environmental impact.

The relevant KPIs to implement to monitor the environmental impact within sorting are; location of waste disposal sites, waste handling and energy and resource use connected to warehouse [15,29]. These KPIs will aid in determining which sorting strategy should be applied. If the location of the waste disposal sites are far away from the each other, this could result in a larger environmental impact. The environmental impact of the localisation of the disposal sites can then be compared to the environmental impact of the energy and resource usage in the warehouse. This will help in decisions related to distance - a disposal site might be further away, which increase the transport distance, but if the warehouse has a low energy and resource usage, the extra transport distance can have a nettoeffect. Waste handling of different sorting strategies can also be explored.

Disposal: Disposal, as explained by Rogers and Tibben-Lembke [17], Schwartz [18], Lambert et al. [19] and Daaboul et al. [20], refers to the manner in which products exit the reverse logistics chain. Jayaraman [21] presents alternatives to disposal which aim to reinsert the returned products into the logistics chain. This can be done in various ways for example remanufacturing, recycling and reuse [21]. Sangwan [15] calls this activity product recovery. Waste management within the clothing industry is an issue which suggests that disposal is not the most favorable activity. Remanufacturing and recycling can be complicated within a clothing logistics chain as described by Hawley [25]. Abraham [26] and Hvass [27] state that creating value is more easily done through reuse. Salvaging components and selling these on secondary markets is the most value capturing activity due to its feasibility on a larger scale in comparison to remanufacturing and recycling [27]. Reuse and increasing the lifespan of clothing is thereby important and more feasible. This suggests that recovering products to then resell them is favorable if possible.

The relevant KPIs related to disposal and product recovery are; environmental impact of processing, landfill and incineration [15]. The KPIs can be used by comparing the environmental impacts to determine if it is more sustainable to dispose or recover the returned products. By doing this, the waste management can be enhanced in the process. Table 1., maps out the different activities specified above, the chosen KPIs and their relevance to environmental sustainability.

Table 1. Effect of Variables on the Degree of Hydrolysis.
| Activity          | Definition                                                                 | KPIs                                                                                          | Environmental Sustainability relevance                                                                 |
|-------------------|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Mitigation        | Return avoidance [29]                                                      | Quality control, number of returned products, tracking typical reasons for returns [29]       | High return rates lead to severe environmental ramifications                                              |
| Gatekeeping       | Point of entry in the reverse logistics chain [17-20]                     | Number of returned products, tracking typical reasons for returns [29]                         | High return rates lead to severe environmental ramifications                                              |
| Collection        | Pick-up and transport [17-20]                                             | Energy use, waste generation, environmental impact [15]                                       | Vehicle types used, consolidation possibilities, choice of parcel carrier affect the environmental impact |
|                   | Returned products inspected individually and sorted accordingly [17-20]   | Location of waste disposal sites, waste handling[15]                                           | Sorting strategies differ in environmental impact                                                        |
|                   |                                                                            | Energy and resource use connected to warehouse[29]                                            |                                                                                                         |
| Sorting           | Disposal (alternative; reuse, remanufacture, recycle.) [17-21]            | Environmental impact of processing, landfill and incineration[15]                              | Waste management an issue, reuse and increasing the lifespan of clothing important.                      |

4. Conclusions
Based on an extensive literature review, a conceptual framework of industry-specific KPIs related to environmental sustainability has been formulated. The KPIs can be used by clothing retailers who seek to manage and monitor their environmental sustainability across their reverse supply chain. Five key activities within a reverse logistics chain of clothing retailers were identified, and through these KPIs were developed in terms of sustainability. The KPIs formulated have a focus on environmental sustainability, but should naturally only be implemented if it is feasible for a clothing retailer in terms of cost. The main idea of the framework is to shift the focal point slightly away from cost-reduction. Several of the KPIs can also lead to cost-reduction which highlights the potential in combining environmental sustainability with cost-reduction. While this report acknowledges that earlier research separates KPIs from EPIs distinctively, it questions whether this reinforces the misconception that environmental impacts should not be in the center of business decisions. Comparing the implementation of KPIs with a focus on environmental sustainability and EPIs could be alluring for future research in
order to explore the actual differences in environmental performance. Considering the worrying developments within consumer purchase behaviour and the increased demand for more environmentally sustainable practices, it seems appropriate for clothing retailers to incorporate and focus more on environmental sustainability across their reverse supply chains.

Acknowledgement
This work was part of assignments for MSC studies in logistics management program by the first three authors. The forth author was tutor for the course and have edited the work.

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