Greening logistics by introducing process management– a viable tool for freight transport companies going green

Priscilla Navarro, Peter Cronemyr & Maria Huge-Brodin

To cite this article: Priscilla Navarro, Peter Cronemyr & Maria Huge-Brodin (2018) Greening logistics by introducing process management– a viable tool for freight transport companies going green, Supply Chain Forum: An International Journal, 19:3, 204-218, DOI: 10.1080/16258312.2018.1486141

To link to this article: https://doi.org/10.1080/16258312.2018.1486141
Greening logistics by introducing process management— a viable tool for freight transport companies going green

Priscilla Navarro a, Peter Cronemyr a and Maria Huge-Brodin a

Division of Logistics and Quality Management, Department of Management and Engineering, Linköping University, Linköping, Sweden

ABSTRACT
While the usage of process management within the freight transport industry is unknown and presumed low, it has been used within other sectors as an efficient approach for dealing with and fulfilling customer demands as well as environmental requirements. The purpose of this paper is to investigate how process management can enhance a customer focused greening in the transport and logistics sector. We present a literature review of the intersections of process management, freight transport and environmental sustainability. Furthermore, we conducted a case study of how two environmentally ambitious Swedish freight transport companies use process management to enhance environmental sustainability. We found that environmentally ambitious freight transport companies do not proactively use process management, and that workshops with topical experts and practitioners can be a way for introducing process management to enhance environmental sustainability in such companies.

KEYWORDS
Green logistics; freight transport; process management; environmental sustainability

Introduction
Freight transport plays an important role in logistics systems and supply chains (Mangan et al. 2011), and the logistics and transport sector contributes largely to the environmental footprint. In consequence, the EU listed sustainable transports as a primary environmental goal (Márquez-Ramos 2015).

Green Logistics is a research field that aim to assess and reduce the environmental impact of logistics (McKinnon 2015). It comprises various overlapping topics such as logistics systems for recycling, corporate environmental strategies, green supply chain management, and city logistics (ibid.). Among the benefits of implementing green logistics Carbone and Moatti (2008) mention the optimisation of logistics flows and improving the company’s image. However, freight transport is an important factor with high influence on the logistics systems’ environmental sustainability (Mitra 2014; McKinnon 2015).

The greening of logistics has proved to be relatively slow, and logistics service providers (LSPs), overall, act reactively (Isaksson 2012). Isaksson refers to LSPs including various types and sizes of companies, including hauliers, forwarders and other providers of logistics services. LSPs partly attribute this slowness in adopting green initiatives to an ambiguity in the perception of customers’ requirements – while customers demand increased environmental sustainability, these demands are often implicit and do not include a willingness to pay more or invest in new solutions (Evangelista et al. 2013). It is also suggested that a more strategic view on customers could enable benefits such as increased market shares (Colicchia et al. 2013; Sallnäs 2016). Another reason for the slow greening among LSPs is a lack of tools that support LSPs in going greener (Evangelista et al. 2013), including what to do and how to do it, while focusing on customers.

One way to achieve higher customer satisfaction and quality is to focus on processes (Bergman and Klefsjö 2010). Process maps show activities as well as relations with suppliers and customers, focusing on external goals like fulfilling customer satisfaction (Cronemyr and Witell 2010).

The importance of adopting a process view and continuously improving processes can be traced back to total quality management (TQM) authorities Shewhart and Juran (Shewhart 1931, 1939; Juran and Godfrey 1998). The ISO9001 standard, which is based on TQM and requires a process orientation, is supposed to help organisations building and certifying quality management systems. However, several failed attempts of introducing process oriented management systems, with or without the support of ISO9001, have been caused by the lack of understanding of the basic ideas behind the words, e.g. systems thinking, customer focus and theory of variation, as well as the consequences for management activities (Bergman and Klefsjö 2010). This structured way to manage processes is referred to as Process Management and implicates a far more conscious approach than mere process...
orientation (Bergman and Klefsjö 2010). Management commitment is one of the most commonly mentioned success criteria for implementing new management ideas like process management (see e.g. Antony and Banuelas 2002; Cronemyr 2007).

Process management has been used within several sectors, e.g. industrial production, service and healthcare, for efficiently dealing with and fulfilling customer demands and environmental requirements. While the challenges for the transport and logistics sector going greener include both a better insight in customers’ requirements and supporting tools, process management could potentially be a way for those actors to become more sustainable. The purpose of this paper is to investigate how process management can enhance a customer focused greening in the transport and logistics sector.

Hence the first research question is:

RQ1: How is the use of process management to enhance environmental sustainability in the freight transport industry described in current research?

In order to grasp the current state of development and capture potentially successful outcomes, we focus on environmentally ambitious companies and hence:

RQ2: How is process management applied in environmentally ambitious freight transport companies?

From prior projects, we are aware that freight transport companies to some extent apply process orientation, particularly as it is needed for ISO9001 certification, which many freight transport companies possess. Nevertheless, the full extent of process management is unknown, and we are interested in how

this can be introduced among freight transport firms, as well as its potential to support green initiatives thus enhancing environmental sustainability.

RQ3: How can process management be introduced to enhance environmental sustainability in freight transport business?

Cronemyr and Danielsson (2013) presented a step-wise approach, Process Management 1-2-3, for achieving a successful implementation and full effect of process management. The steps are: (1) process mapping and development, (2) process analysis and improvements, and (3) process control. They showed that, by doing ‘the right things’ in ‘the right order’, risks of failing are reduced. This paper relates to all three steps; however the empirical data reflect deeper the first of them.

Conceptual model

To address RQ1, RQ2 and RQ3 we developed a conceptual model, presented below. The model illustrates the intersections between process management, freight transport and environmental sustainability. The first domain, process management, is part of Quality Management (QM) and considered a method or tool for achieving goals and fulfilling demands. The second domain is freight transport, a core component of logistics, which is the business area for which a method of including environmental sustainability is needed. The third domain is environmental sustainability, as part of sustainability, and constitutes the demands and future possibilities that need or could be fulfilled. The intersection of the second and third

Figure 1. Conceptual model.
domains represents a part of the research field of green logistics, and it focuses on freight transport and activities directly related to it. We used this conceptual model, presented in Figure 1, for structuring the literature review.

Outline of the paper

The paper continues with presenting the research design and used methods for literature review, data collection and analysis. This is followed by the findings of the literature review and the empirical investigation. We analyse the findings, based on the research questions outlined in the introduction. Finally, we present the conclusions and suggestions for further research.

Methodology

This study used a research design in three steps (see Figure 2). Firstly, we performed a literature review, that formed a theoretical basis for our analysis. Secondly, we conducted a case study and workshops with an action research approach. Lastly, we analysed the findings from the empirical results against the literature review findings.

Literature review

The review approach was to research the intersections of process management, freight transport and environmental sustainability. The literature review was initially performed with the database Scopus, providing a content of 69 million records and selected due to the extensive collection of 21950 peer-reviewed journals. The overall literature review was designed as a three-stage process, described in Figure 3.

The systematic review

Systematic reviews adopt scientific, transparent and replicable processes (Tranfield, Denyer, and Smart 2003). This literature review was based in the conceptual model, its domains and intersections. First, we determined keywords, search strings and filters. For the search strings, we combined preliminary keywords relevant for the search. Area experts reviewed these words and we performed a test search in Scopus, to ensure relevant results. The preliminary keywords were improved by iteration, leading to the final keywords. Based on those, the strings were designed for each intersection of the domains, see Table 1.

This literature review included the design, search and first selection of results (filtered by title), the results are presented in Table 2.
Table 1. Strings for systematic review.

<table>
<thead>
<tr>
<th>Intersection</th>
<th>String</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process management and freight transport</td>
<td>process management or business process or activity flow or value stream or quality management AND goods transport* or freight* or logistics.</td>
</tr>
<tr>
<td>Freight transport and environmental sustainability</td>
<td>goods transport* or freight* or logistics AND green or sustainab* or evirnom*</td>
</tr>
<tr>
<td>Process management and environmental sustainability</td>
<td>process management or business process or activity flow or value stream or quality management AND green or sustainab* or evirnom*</td>
</tr>
</tbody>
</table>

Note: * is a wild-card

Table 2. Results of systematic review.

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Initial search, #articles</th>
<th>After first selection, #articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process management and freight transport</td>
<td>2768</td>
<td>85</td>
</tr>
<tr>
<td>Freight transport and environmental sustainability</td>
<td>612</td>
<td>41</td>
</tr>
<tr>
<td>Process management and environmental sustainability</td>
<td>1382</td>
<td>46</td>
</tr>
</tbody>
</table>

The narrative review
Narrative reviews provide a broad perspective on a subject with a topical approach (Smith 2012). We used a snowball approach for this narrative review, where we found new articles from the references and results from the systematic review. In a second selection, all identified articles were filtered by abstract and content. In addition, a few new articles were added based on peer advice.

The analysis of results
We conducted a narrative analysis of the review results (Tranfield, Denyer, and Smart 2003), by reading the articles from the two reviews, aiming at detecting how the authors addressed the topics of the intersections. The focus was on finding information to answer RQ1.

Case study
Due to the nature of research questions we designed a multiple case study (Yin 2013). Mitra (2014) mentions the need of research in sustainable supply chain management, where transport provision is an important part, requires a more exploratory and case study based approach. The main case study was conducted at two Swedish freight transport companies, designated Haulier and Forwarder. The companies were selected due to their interest and efforts towards environmental sustainability. We conducted the case study of the two companies by onsite interviews, document studies and observations. Finally, we analysed the data.

Interviews
The interviews were personal and semi-structured, due to the nature of our purpose (Westlander 2000). An interview guide was used to control the amount and subject of the data. We did one set of interviews for process management and another for green logistics with administrative and operative personnel. The interviewees were designated by the CEOs according to their role in the company.

Each interview was recorded with permission of the interviewee. The information was summarized in ‘semi-transcript’ documents and sent to each interviewee for reflections and confirmation of the veracity of the information. Hence, we ensured the level of the information gathered and strengthen the validity of the collected data (Yin 2013).

Documents and observations
We directly observed the companies through field visits, where we studied documentation, routines and tasks. We visited each company five full days and the observations were done by the three researchers to increase the reliability of the observational evidence (Yin 2013).

Analysis
The area of interest is sparsely addressed by prior research, and therefore we base our research in a conceptual model (See Figure 1) capturing the research area and problem. Because of the novelty of this area, the empirical research presented in this paper is of explorative and descriptive nature. Rather than confirming a hypothesis, this research aims at formulating propositions for future research efforts (Eisenhardt 1989).

The two cases were analysed according to the conceptual model, following the intersections of the three domains in a theory-building structure (Yin 2013). For each of the intersections, the cases were analysed between the two case companies, and in relation to literature. In this pattern-matching analysis (Yin 2013), empirical patterns were identified and compared to theory.

Case study
Due to the nature of research questions we designed a multiple case study (Yin 2013). Mitra (2014) mentions the need of research in sustainable supply chain management, where transport provision is an important part, requires a more exploratory and case study based approach. The main case study was conducted at two Swedish freight transport companies, designated Haulier and Forwarder. The companies were selected due to their interest and efforts towards environmental sustainability. We conducted the case study of the two companies by onsite interviews, document studies and observations. Finally, we analysed the data.

Workshops
All information from the interviews and observations was gathered and analysed from the perspectives of process management, freight transport and environmental sustainability, and the current and potential overlap of the three domains. We documented the information in process maps and lists of green logistics aspects. Process maps were constructed based on current process descriptions, either documented in existing ‘process descriptions’ and/or on oral information acquired during interviews. Some suggestions of process improvements were also given, mainly to the operative processes.
At the workshops at each company the process maps were presented, and the personnel discussed the overview, the process design, process details, and vocabulary used. In the second part of the workshop the personnel were given the list of green logistics aspects identified at the company. The items in the list were put into the process maps as an activity, a demand, a goal or a measurement. The workshop resulted in updated process maps with integrated green logistics aspects at each company.

In a final workshop, the companies met and presented their processes, and the integration of green logistics aspects to each other; thereby sharing ideas that could be adopted by the other company.

As we, the researchers, took on an active role in preparing and conducting the workshops, we suggested actions to the companies based on research, this was clearly an action research approach (see e.g. Lewin 1947; Gummesson 2000; Westlander 2006; Cronemyr 2007). At a later stage we received feedback from the companies on the actions taken.

Findings from the literature review

In line with the conceptual model, we investigated the three two-domain intersections, and the three-domain intersection.

Intersection 1: how is process management used in the freight transport sector?

No source found addresses the intersection between process management and freight transport. Some sources were found that address the larger intersection between process management and logistics, and they are included in this section and summarized in Table 3.

Mangan and Christopher (2005) identify logistics management as flow-oriented, a main concept within process management. They state that by focusing on processes and flows, organizations can avoid a narrow focus on specific sectors and functions, creating cross-functional teams. The authors see processes as a means to create value and cross-functional teams to have value creation as focus. Näslund (2002) mentions that the concept of process is not new to logisticians and the process orientation is the means to achieve efficiency and effectiveness in logistics. Näslund further states that the use of logistics know-how can be used when managing and improving processes. However, neither of the above-mentioned authors refer specifically to freight transport.

Brah and Lim (2006) investigated the relation between TQM and logistics performance, concluding that using TQM’s general constructs, including customer focus and process management have a positive effect on business performance. For a large part of the studied companies freight transport was part of their business focus. They found a strong and positive correlation between top management leadership and several TQM practices, including process management.

Bellah, Zelbst, and Green (2013) tried to improve logistics by studying the effect various TQM practices have on logistics performance. Customer focus was found to have a directly positive relation to logistics performance.

Even thought none of these studies focused on the effect of process management in freight transport, their authors consider process management and/or customer focus to be important for success within logistics business. We conclude that the methodology has high potential also for the freight transport industry.

Intersection 2: how is environmental sustainability addressed in the freight transport sector?

The second intersection is between logistics and environmental sustainability, specifically between the freight transport sector and environmental aspects. This intersection is sparsely addressed in research, while the wider areas of supply chain management and traffic are more ambitiously addressed in connection to environmental sustainability. The results are shown in Table 4.

Srivastava (2007) presents the emergence of the green paradigm within supply chain management, including freight transport, a merge between the environment and supply chain management for decreasing pollution.

Dekker, Bloemhof, and Mallidis (2012) refer to four important decisions in logistics for the environmental impact: mode choice; intermodal transport; equipment choice and efficiency; and fuel choice and carbon intensity. Several other authors also refer to these decisions factors (e.g. Martinsen and Hug-Brodin 2014). Like Dekker, Bloemhof, and Mallidis (2012), many studies focus on reducing CO₂ emissions (e.g. McKinnon and Pieczyk 2009) while others include resource optimization (e.g. Aronsson and Brodin 2006). Bask and Rajahonka (2017) study the increase of environmental sustainability by the use of intermodal transports. They consider this area to have a big research potential. Pålsson et al.
can have integrated management systems, incorporating the quality management system from ISO9001 and the environmental system from ISO14000.

Cassels, Lewis, and Findlater (2012) studied success factors for the implementation of ISO14000, and process management proved to be one of them. They suggest that long-term focus and management commitment and involvement positively contribute to this factor. They concluded that implementing ISO14000 could improve an organisation’s environmental performance. Poksinska, Dahlgaard, and Eklund (2003) make the distinction that several factors are needed to provide this benefit, such as structure and management commitment, both included in process management.

Garvare and Isaksson (2001) proposed a sustainable development (SD) model, where process management enables and provides foundation for a systemic view. Later, Isaksson and Garvare (2003) presented process management as the means for measuring sustainable development. The proposed methodology allows determining performance indicators the environmental dimension, which includes obtaining environmental impact, rating and image as measurements of the SD. Isaksson (2006) adds to this result by proposing a TQM-SD management system.

Ghose et al. (2009) noticed the potential of relating process orientation and environmental sustainability. They designed a model to assess CO₂ emission with a process perspective. By identifying the process steps with high environmental footprint, efforts can be focused for decreasing the overall CO₂ emissions of the process. On a similar note, Hall and Wagner (2012) also found the potential for a process approach to enable environmental sustainability. They state that there is a more positive relation between companies using a management by processes approach and environmental sustainability then those that do not use this kind of approach. Holm et al. (2015) presented process management as key factor for the implementation of ISO14000 sustainable development with management systems.

**Table 4. Results of the intersection 2.**

<table>
<thead>
<tr>
<th>Authors</th>
<th>Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Richardson (2005)</td>
<td>Freight factors that affect environmental sustainability</td>
</tr>
<tr>
<td>Aronsson and Brodin (2006)</td>
<td>Resource optimization</td>
</tr>
<tr>
<td>Srivastava (2007)</td>
<td>Emergence of green supply chain management systems.</td>
</tr>
<tr>
<td>Demir, Bektas, and Laporte (2011, 2014)</td>
<td>Gas emissions vary with the size of the vehicle.</td>
</tr>
<tr>
<td>Martinsen and Hug-Brodin (2014)</td>
<td>Environmental practices within green logistics.</td>
</tr>
<tr>
<td>Evangelista, Coliccia, and Creazza (2017)</td>
<td>Lack of strategic importance of environmental sustainability among logistics service providers (including transport companies).</td>
</tr>
<tr>
<td>Pålsson et al. (2017)</td>
<td>The net effects of introducing HCVs in CO₂ emissions are positive.</td>
</tr>
<tr>
<td>Bask and Rajahonka (2017)</td>
<td>Intermodal transports might enhance environmental sustainability.</td>
</tr>
</tbody>
</table>

(2017) have studied strategies for introducing HCVs (high capacity vehicles) to the freight transport market in Sweden. They conclude, that the net effects in terms of CO₂ emissions are positive (i.e. the emission levels can be reduced). While this article highlights the effect on a freight transport industry level, the consequences for freight transport companies are not addressed. Evangelista, Coliccia, and Creazza (2017) suggest, based on studies among Italian and UK logistics service providers (including freight transport companies), that for medium-sized companies environmental sustainability is not consistently integrated in their strategic statements. According to the authors, this demonstrates a lack of strategic importance of environmental sustainability among these companies.

Other studies mention different factors within freight transport that could influence environmental sustainability. For example, Demir, Bektas, and Laporte (2011, 2014) analysed fuel consumption and the emission of greenhouse gases from the road transport sector. They concluded that the emissions of these gases vary with the size of the vehicle. Richardson (2005) presents fuel consumption, congestion and environment as freight factors that affect environmental sustainability and influence each other.

**Intersection 3: how are environmental demands fulfilled by using process management?**

Process management has provided organisations with various benefits and some studies have focused in determining if environmental sustainability could be one of them. Some of these studies are shown in Table 5.

The ISO9001 standard, which is based in TQM and requires a process approach, helps organisations building and certifying quality management systems. ISO14000 is a certification for environmental systems. Poksinska, Dahlgaard, and Eklund (2003) mention that organizations

**Table 5. Results for intersection 3.**

<table>
<thead>
<tr>
<th>Authors</th>
<th>Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garvare and Isaksson (2001)</td>
<td>Process management provides a systemic view to environmental sustainability, as part of sustainable development.</td>
</tr>
<tr>
<td>Poksinska, Dahlgaard, and Eklund (2003)</td>
<td>ISO14000 requires structure and management commitment. Integrated management systems.</td>
</tr>
<tr>
<td>Ghose et al. (2009)</td>
<td>Process management as key factor for the implementation of ISO14000.</td>
</tr>
<tr>
<td>Cassels, Lewis, and Findlater (2012)</td>
<td>Companies that involve management by processes have a more positive relation to environmental sustainability.</td>
</tr>
<tr>
<td>Holm et al. (2015)</td>
<td>Process management as key factor for the implementation of ISO14000.</td>
</tr>
</tbody>
</table>
et al. (2015) present a process framework for enhancing sustainable development with management systems in higher education. They use the process improvement cycle as a base for their framework.

‘Balanced Scorecards’, can be a way for an organisation to show their goals and measurements. Hervani, Helms, and Sarkis (2005) consider that this method requires a process perspective and that environmental performance measures could be included if implemented correctly.

**The three-domain intersection: how is process management used to achieve sustainable freight transports?**

Few sources refer to the intersection between process management, freight transport and environmental sustainability. All three domains are present in Cosimato and Troisi (2015), who studied the efforts a leading logistics company did to improve environmental sustainability. In that company, the core activities were based in ISO14001 and ISO9001, with a process focus. The authors suggest that ISO9001 enabled green initiatives which positively affected the organisation’s competitiveness.

As little evidence was found in this intersection, some results were considered from the broader intersection between QM, logistics and environmental sustainability. In this area, Azevedo et al. (2012) state that some QM methodologies led to improved environmental performance. Those methodologies allowed companies to implement supplier requirements for environmental sustainability and actions for detecting environmental risks within logistics processes. Mitra (2014) states that some companies proactively and voluntarily incorporate environmental practices into their operations. The author mentions that these actions presume ‘implementation of an environment management system (EMS) and/or ISO 9000/14000 certification, top management support and commitment [and] employee participation’ (Mitra 2014, 38). These elements are also central to process management. Table 6 provides a summary of these results.

In sum, process management, alongside other tools, emerges as a viable tool for a wide variety of industries in improving environmental, as well as general, sustainability. It is also evident, that customer focus would be supported by using process management, and the freight transport would be a potential industry where using process management would enhance environmental sustainability based on a will to meet customers’ needs and demands.

**Findings from the case study**

The presentation of findings starts by more detailed presentations of the two cases, Haulier and Forwarder.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azevedo et al. (2012)</td>
<td>QM methodologies enable programs for environmental sustainability within logistics processes</td>
</tr>
<tr>
<td>Mitra (2014)</td>
<td>Some companies proactively and voluntarily incorporate environmental practices, which require elements present in process management</td>
</tr>
<tr>
<td>Cosimato and Troisi (2015)</td>
<td>ISO14000 and ISO9001 helps green initiatives increase competitiveness</td>
</tr>
</tbody>
</table>

**Haulier**

Haulier is a small company, established eight decades ago and managed by the founding family. Haulier has 100 employees, of which five are administrative employees. It performs road-based freight transport and operates primarily inside Sweden and sometimes internationally. Of the company’s operations, 40 % are transports for a large LSP and 60 % relate to direct customers. Haulier has a reputation of providing high quality transports, and the management focuses on decreasing the company’s environmental effects. They have done several efforts towards this; the current research project is but one.

**Process management – results from interviews and observations**

Each administrative employee at Haulier sets their personal work routines, even when they perform ‘the same’ tasks. Neither operations nor flow of resources are documented, so there are no documents supporting Haulier’s operations. Haulier is clearly customer oriented and strives towards offering customers solutions according to their needs. As mentioned by several employees:

“We deliver the right things to the right destination on time.”

The employees explain that focusing on the customer requires flexibility, reason for which the processes are not documented, nor standardized, as well as the reason for not incorporating ISO certifications. Management believes that implementing ISO requires significant documentation resources. Additionally, no customers have required this; former customers consider Haulier’s system and reputation as sufficient for buying their services.

However, among the employees, there is a belief that implementing process management would increase the uniformity and make the operations more consistent. Miscommunications and misunderstandings could decrease, especially during the planning and booking of the transports, hence decreasing Haulier’s vulnerability.
Management are managing in an operational way. No measurements or goals have been set for the company. However, the mission and vision for the company has been set. These are easily visible for the drivers but not so for the administrators. As a result, the employees work towards individual goals according to their everyday tasks instead of working towards a common goal.

**Green logistics – results from interviews and observations**

We found several environmental practices at Haulier, shown in Table 7 and explained below.

To decrease costs, time and environmental effect Haulier uses groupage (transporting goods from several customers in the same vehicle), used when the customer has not specifically asked for dedicated transport, as well as high fill rates and decrease of empty running.

In addition to Swedish mandatory eco-driving education for freight transport drivers every five years, Haulier follows-up the performance of each driver by the means of a mobile application, which provides information on fuel consumption, acceleration and braking.

Haulier has had several projects for decreasing the environmental impact, by itself and together with academics. Some projects include the development of a schedule and requirements for the use of tires in the vehicles, and a project for improving the vehicles’ technology, focusing on aerodynamics and design. Haulier also strives towards acquiring efficient and modern vehicles, as well as using hydrogenated vegetable oil (HVO) in the entire fleet, as an alternative fuel. For buying HVO, Haulier has selected a supplier that ensures availability at a lower price. Using HVO in all the vehicles have made all their transport services a ‘cleaner’ service.

Even with all these practices in place, Haulier has no method to measure their environmental effect in a way that could be useful for determining their performance. Some of the customers require emission data reports from Haulier, for certification purposes. This report is done on a web-based tool provided by the Swedish Freight Transport Association for the calculation of environmental impact based on load, type of vehicle and distance. The emission data is not used internally.

**The overlap – results from the workshop**

During the workshop, the researchers presented a main process map of the company, developed from information gathered during interviews and observations. Since Haulier did not have any processes defined and consequently no process maps before this, the main process map was totally new. The layout was based on ‘a typical main process map’ as used in many companies, with three layers of processes – management processes, core processes and support processes – but adapted to the actual business of the company (See Figure 4). All nine main processes were discussed, while two core processes were described in detail.

Haulier uses two different processes for booking and conducting transports; one for customers of a specific large LSP and another process for the company’s own direct customers. Maps for both processes were presented to the company. The activities and boundary objects were discussed by the personnel and some changes were made in the wording. The map describing booking and transportation of goods for direct customers is presented in Figure 5. In the map each activity is supposed to be described by text and document links (templates, checklists, instructions, policies, and IT guidelines). Goals and measurements for green logistics aspects that were integrated into this specific process are given in the figure. During the workshop, more green logistics aspects were identified and integrated into other management, core and support processes.

During the joint (third) workshop, Haulier presented the process maps to Forwarder personnel and declared that they had decided to incorporate process management into their operations, including environmental measurements during the year 2017. Haulier considers process management as a useful tool for four important reasons: improve its operating structure, improve its organisation, reduce the vulnerability of their operations, and for external presentations.

**Forwarder**

Forwarder is a cooperative association of approximately 120 hauliers with some 20 administrative employees. They dedicate to the road transport of goods, construction and recycling material. The company’s customers include multinational companies and smaller Swedish service providers. Among the priority elements for this company are innovation, quality, safety and environmental thinking. Therefore, they direct efforts towards decreasing

<table>
<thead>
<tr>
<th>Environmental practices</th>
<th>Specific practices at Haulier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logistics system design</td>
<td>Groupage</td>
</tr>
<tr>
<td>Transport management</td>
<td>Fill rates</td>
</tr>
<tr>
<td>Vehicle technology</td>
<td>Aerodynamic design</td>
</tr>
<tr>
<td>Behavioural aspects (Eco-driving)</td>
<td>Eco-driving education Mobile application project</td>
</tr>
<tr>
<td>Alternative fuels</td>
<td>HVO</td>
</tr>
<tr>
<td>Choice of partners</td>
<td>Indirect partners choice</td>
</tr>
<tr>
<td>Emission data</td>
<td>CO₂ reports</td>
</tr>
<tr>
<td>Efficient buildings</td>
<td>District heating</td>
</tr>
</tbody>
</table>

*Table 7. Haulier’s environmental practices, structured according to the framework by Martinsen and Hauge-Brodin (2014).*
their environmental impact and having customer focus. There is a strong management commitment and involvement in the operation of the company, as well as an interest in improvements.

**Process management – results from interviews and observations**
Forwarder is ISO9001 and ISO14001 certified, which has enabled a documentation culture for many of their processes. It has a management system, which includes goals, policies, basic process maps and routine descriptions. The documentation indicates an interest towards environmental sustainability, high quality and continuous improvement. The documents are accessible to all the employees through an online platform.

Even though the process maps include the steps for providing the services, they are used for certification purposes only and are not considered useful by the employees for everyday use. Inputs and outputs are sometimes not defined, nor are the internal and external customers of each process.

Even though employees think the current management system provides structure for operations, they suggest the system could be improved by making it more useful for operations instead of using it for certification purposes only. Some employees see Forwarder as a small company and therefore think that standardizing and documenting their procedures could be unnecessary for achieving their goals.

**Green logistics – results from interviews and observations**
Forwarder uses several environmental practices in their operations, as presented in Table 8.

Forwarder uses groupage, for higher fill rates and fewer empty running, when the customer has not asked for exclusivity; due to economical, operational, environmental reasons. They strive for using modern and efficient vehicles, however not all associate hauliers found the means to invest in new vehicles.

Forwarder focuses on using HVO as an alternative fuel. They have invested in a HVO tank exclusive for their hauliers. This represented a large investment but also ensured that the cost for HVO would equal to using diesel. However, due to restrictions from the vehicle manufacturers for warranty, and the location of the tank, only 20% of the vehicles use HVO.

Forwarder provides eco-driving education for drivers every five years and a driver’s manual including information about safety and environmentally friendly driving.

**The overlap – results from the workshop**
During the workshop at Forwarder the researchers presented a main process map of the company, developed from information gathered in interviews and observations and from existing ‘process maps’. These were of different formats, not clearly linked to each other, used different inconsistent symbols and were not easily located (hence not used) by personnel. The
presented main process map was totally new but adapted to the actual business at Forwarder (Figure 6). All nine main processes were discussed, and several processes were described in detail. Some changes were made during the workshop in the main process map by the personnel, mainly on a wording level. Some changes were made in wording, but not to the process itself. The map describing booking and transporting customers’ goods is presented in Figure 7.

Green logistics aspects were integrated into this specific process (summarised in the figure) and into other management, core and support processes.

During the workshop, management realized the importance of applying requirements to their associates for decreasing the environmental impact. As a result, two new policies were put in place. The first one was that the entire fleet must use HVO as fuel, and that could be justified by only selling services with HVO. The second was that new associates needed to have modern vehicles to ensure less fuel consumption and the use of HVO.

Forwarder has already started incorporating process management in their operations and introducing environmental indicators in their processes. They will develop web-based process maps as a part of a modernised management system and their objective is to finalise this before the coming certification audits. They consider the developed process maps easier to understand and use while they also identify an opportunity for using them for training purposes for new employees.

Analysis

The analysis aims to respond to the three research questions and is hence split accordingly. The analysis takes off from the conceptual model, and relates the findings from the literature review to the empirical evidence.

RQ1: How is the use of process management to enhance environmental sustainability in the freight transport sector described in current research?

In the existing literature, we have not found references showing if process management could be used as a methodology or tool specifically in the freight transport sector to enhance environmental sustainability. However, our findings suggest that process management could provide the structure needed for implementing a beneficial environmental system (Pokinska, Dahlgaard, and Eklund 2003; Cassells, Lewis, and Findlater 2012; Hall and Wagner 2012), due to its systemic view (Garvare and Isaksson 2001).

In particular, logistics is suited for process management (Mangan and Christopher, 2005) which also reflects on the freight transport sector (Mangan et al. 2011; Näslund 2002). A customer focus (Brah and Lim...
2006; Bellah, Zelbst, and Green 2013) ensures that the environmental efforts are based on a market drive, hence avoiding the problems of customers unwilling to pay for green freight (Evangelista et al. 2013). Additionally, process management might work as a tool to determine the right areas for improve (Ghose et al. 2009).

From the limited results found in the intersection of the three domains, we suggest that how process management could benefit organisations within the freight transport sector in a green context needs to be further investigated, and in particular, there is a need for case-based research to understand the complexity of the operations and the context.
RQ2: How is process management applied in environmentally ambitious freight transport companies?

From Haulier and Forwarder, we found several common features like management commitment and customer focus, which are important preconditions for process management (Brah and Lim 2006; Bergman and Klefsjö 2010), and for logistics performance (Bellah, Zelbst, and Green 2013). Our case companies demonstrate both clear action and clear strategic statements in connection to environmental sustainability, which distinguishes them from some previous studies (Evangelista, Coliccia, and Creaizza 2017). Their operations are flow-oriented, in line with Näslund (2002) and Mangan and Christopher (2005). However, neither of the companies have proactively used process management. Although Forwarder had some documented processes, those documents were not actively used. The documents were mainly used for ISO9001 certification. Both companies have innovative cultures but with different foci, based on their respective businesses, Haulier on technical and Forwarder on administrative innovation. One important difference between the companies is the existence of documentation. Haulier’s lack of documentation makes them vulnerable to loss of knowledge vested only in individuals.

As environmentally ambitious companies, Haulier and Forwarder demonstrate high environmental awareness, which permeates the entire organisation from management to employees, in line with Evangelista et al. (2013) and Mitra (2014). Among the environmental practices (Martinsen and Hugue-Brodin 2014), the use of HVO is the most commonly mentioned. Additionally, they strive for high fill rates, decrease of empty running and group-age as ways to save money and reduce the environmental impact. By using 100% HVO, Haulier does not offer differentiated services; therefore, they indirectly choose their customers, i.e. those willing to buy green transports. Both use mainly modern vehicles but to different extent. While Haulier has direct power over the investments, Forwarder depends on its associated hauliers. Eco-driving is another common environmental practice, due to Swedish law requirements. Haulier and Forwarder offer emission reports per customer request only. However, the emission data are not used internally. Haulier uses driving data to follow up their drivers’ performances.

The companies use their green initiatives as selling arguments, whether it is requested by customers or not. Haulier has a mobile application, which supports the execution of the transports by registering factors that represent an environmental impact. These factors include speed, combustible usage and breaking among others. However, data are only used for evaluating drivers’ performances.

In response to RQ2, we conclude that the studied freight transport companies do not proactively apply process management to their operations. Some reactive practices can be traced. Albeit, we have found proactive environmental practices that could potentially be used in conjunction with process management. The case study confirms that process management could be used as a tool for enhancing environmental sustainability in the freight transport sector. Furthermore, the findings suggest that the three-domain-intersection is more advanced in practice than described in the literature.

Forwarder is ISO certified while Haulier is not, but neither Forwarder nor Haulier present quantitative emission targets. However, both companies work qualitatively towards environmental targets. Haulier and Forwarder work proactively with well-grounded environmental aspects in marketing and sales.

RQ3: How can process management be introduced to enhance environmental sustainability in freight transport business?

In this study we have conducted workshops with an action research approach, where we tried to introduced process management. This methodology proved to be an efficient way to introduce process management in freight transport companies and to integrate green logistics aspects with process management. Environmental aspects and targets were included in process maps where applicable. This methodology worked well for both companies, one with pre-existing processes and one without.

As the outcome of an action research endeavour is a description of the process to reach a target, not the target itself (Lewin 1947), the most important elements of conducting the workshops were the participants’ skills and experiences. The researchers had the expertise in process management and green logistics while the practitioners contributed with their knowledge and experiences of the companies’ (unmapped) processes. Neither party could have accomplished the same results on their own.

During the workshops, the environmental aspects were further developed based on mutual knowledge, and some new were added. The integration of environmental aspects into process maps made this development possible.

Conclusions

The literature review reveals limited and fragmented use of process management to enhance environmental sustainability in freight transport. However, those limited results indicate many positive relations between using process management in freight transport and for advancing environmental sustainability. This result indicates that there is a high potential, and a large area to cover for research. For example, using process management for supporting environmental sustainability in the freight transport sector could be done by the use of environmental performance indicators, which were not in place at the case companies.
The use of indicators and a process approach could provide a foundation for determining areas of improvement and reduction of CO₂ emissions.

The case study confirms the conclusion from the literature review; there is limited and fragmented use of process management to enhance environmental sustainability in freight transport. However, we found that in practice, the use of process management to enhance environmental sustainability is likely more advanced than presented in literature.

Additionally, we suggest that workshops with topical experts and practitioners can facilitate the introduction of process management to enhance environmental sustainability in such companies.

The integration of green logistics aspects and process management enabled a more proactive approach. However, the limited research within this area suggests a need for further conceptual development as well as empirical research. Our research is based on the study of two environmentally ambitious freight transport companies, which constitutes limited representation of the freight transport sector. Hence, more types of companies need to be studied. At the same time, the research presented here only represent the first steps towards implementing process management. Our focus, so far, has been on operative processes, our research will continue with improvement and strategic processes. At the end of the day, this is only the first step towards using process management to achieve increased environmental sustainability within freight transport.

Notes on contributors

Priscilla Navarro is a Ph.D. candidate in Quality Management at the Logistics and Quality Management division at Linköping University. She has a master’s degree in industrial engineering from Linköping University. She teaches on Process Management and Six Sigma and is currently a member of the research project Process Management for sustainable freight transports.

Peter Cronemyr is an associate professor in Quality Management and a senior lecturer at Logistics and Quality Management, Linköping University, responsible for research and teaching of Process Management and Six Sigma. He has a background within Product Development and Process Management in Swedish industry since 1984 and he is a Six Sigma Master Black Belt. He is the project leader of the ongoing research project Process Management for sustainable freight transports.

Maria Huge-Brodin is Professor of Green Logistics at the division of Logistics and Quality Management, and leader of the Sustainable Logistics research group at Linköping University Sweden. She has specialised in research on the environmental impact of logistics system design and logistics management. Her areas of interest include strategic aspects of logistics decision making and business models to support a greening of logistics. Her research has been presented on conferences and has been published in e.g.

References


ORCID

Priscilla Navarro http://orcid.org/0000-0001-5727-7260
Peter Cronemyr http://orcid.org/0000-0002-3835-9030
Maria Huge-Brodin http://orcid.org/0000-0001-8554-0687


