

Knowledge management in environmental sustainability practices of third-party logistics service providers

Knowledge
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Abstract

Purpose – The purpose of this paper is to provide a structured literature review on knowledge management (KM) and KM strategy in environmental sustainability practices of logistics service providers. The paper highlights the nature and scope of existing research and identifies areas for future research.

Design/methodology/approach – The study consists of a systematic review of existing research regarding KM in sustainable logistics. In all, 38 refereed research papers formed the basis of analysis. This methodology allows for the minimization of researcher bias and the maximization of reliability and replicability.

Findings – The literature review made possible the identification of three basic elements through which building-up appropriate KM approaches and KM strategies in the area of environmental sustainability by third-party logistics service companies will be enhanced: customer relationship management, quality of human resources and the adoption of information and communication technology tools and systems.

Research limitations/implications – This study may not have enabled a complete coverage of all articles in the field of KM in the context of environmental sustainability practices of logistics service companies. Yet, it seems reasonable to assume that the review process covered a large share of studies available. The main research implications deriving from the study concern research methods, analysis of factors hampering/supporting the implementation of KM in practices related to environmental sustainability, development of measures to demonstrate the impact of KM on sustainability practices and role of different stakeholders in the implementation of KM in environmental sustainability practices.

Originality/value – To the best of the authors' knowledge, no systematic literature review on this topic has previously been published in academic journals.

Keywords Environmental sustainability, Knowledge management, Systematic literature review, Knowledge management strategy, Logistics service providers

Paper type Literature review



1. Introduction

An increasing number of companies have started to transform into more sustainable ones (Tideman *et al.*, 2013). Investments in sustainable practices are expected to increase

both firm competitiveness and operational performance (Schoenherr, 2012; Iasevoli and Massi, 2012). Regarding the latter, performance is not only considered in terms of economic performance (e.g. savings or profitability) but also in non-economic terms such as eco-efficiency (Iasevoli and Massi, 2012). Given the interconnectedness of economic, environmental and social issues that form the pillars of sustainability, organizations have to attune to an even stronger involvement of the different stakeholders (Van Kleef and Roome, 2007).

To reach the sustainability aims, knowledge management (KM) may be regarded as central (Gloet, 2006; Robinson *et al.*, 2006). There are many different perspectives as how to define KM. One of the practical definitions is to see KM as a systematic way of creating, sharing and leveraging knowledge within and around organizations (Bounfour, 2003). This clarifies that KM has a long-term orientation and therefore fits nicely with one of the underlying assumptions of sustainability and sustainable management, namely, durability (Chow and Chen, 2012). KM practices, such as knowledge creation, knowledge dissemination, knowledge storage and knowledge application, are expected to support a continued development of knowledge that is up-to-date and relevant. Hence, sustainable KM can be regarded as a synopsis of KM and sustainability; where the primary role of KM is to treat current and future knowledge resources sustainably by considering social, economic and environmental aspects (Ansari *et al.*, 2010). This brief discussion also leads us to the importance of formulating suitable KM strategies to achieve the aims set. It would also underline the critical need of having incorporated these KM strategies in the overall company strategy (Hansen *et al.*, 1999).

In today's dynamic competitive environment, logistics services become increasingly complex and knowledge-intensive. Knowledge assets have become particularly critical for third-party logistics service companies (3PLs) to achieve performance goals. Thus, it is crucial to implement a KM approach for developing environmental sustainable service strategies in particular. KM research and implementation have grown rapidly in recent years. Even though several disciplines have studied KM from their own perspectives, there are only limited systematic efforts to study the interfaces of KM from an interdisciplinary perspective. Against this background, it might be interesting to study how the logistics service industry, and 3PLs in particular, deals with the aspects outlined above. Recent research has shown that there is increasing research activities that study KM in logistics (Fugate *et al.*, 2012) as well as environmental sustainable practices in logistics outsourcing (Colicchia *et al.*, 2013; Evangelista, 2014). As regards KM in logistics, one can determine a focus on knowledge sharing (Li *et al.*, 2012; Breite and Koskinen, 2014). Given the important role that logistics play in national and international markets (World Bank, 2014), it would be useful to find out how this sector is taking advantage of KM to meet its environmental sustainability aims. More precisely, we are interested in the adoption of KM approaches supporting and improving environmental sustainable practices of logistics service companies. Having this in mind, the aim of this paper is to review existing research on KM activities in the context of environmental sustainable practices of 3PLs to establish the current body of knowledge. The main research question is:

RQ1. What is the role of KM in the environmental sustainability strategies of 3PLs?

The above research question has been addressed through a structured review of the extant literature on the above topic. The review allows the establishment of the current body of knowledge and, on this basis, to identify gaps in our understanding. Based on this, the present paper will list a number of promising future research avenues.

The remainder of the paper is organized as follows. The next section briefly summarizes extant literature on KM strategies. Then, in Section 3, the theoretical background and motivation behind the present research is described. Thereby, the focus is on the link between KM strategies and environmental sustainability practices in the logistics service industry. Section 4 provides details about the method used to carry out the literature review together with a presentation of the main findings achieved. Section 5 discusses the findings achieved and highlights useful implications. The final section terminates with the conclusions of the paper.

2. KM strategies

There is a general consensus in extant literature that KM is the basis on which companies can transform knowledge into useful actions. KM supports in delivering knowledge to the right people at the right time to enhance productivity and decrease supply chain cost and thus can improve the competitive advantage of companies. Consequently, KM forms the necessary fundament for developing and executing KM strategies. As a result, by having a proper KM strategy in place, companies can manage their knowledge more effectively. KM strategies are used to help companies in determining “what to do” with their knowledge to reach certain objectives. KM strategies address the “how to do it” question as well ([Asoh et al., 2003](#)).

When dealing with KM strategies, it is important to distinguish between different types of strategies.

[Zack \(1999\)](#), for example, proposed a framework of KM strategies that he contends should be aligned with the company’s business strategies. Zack argues that exploiting internal knowledge is the most conservative knowledge strategy companies can apply. These companies (so-called internal exploiters) have sufficient knowledge resources to keep themselves competitive in their industries. On the other hand, companies that focus both on exploring external knowledge resources to develop new knowledge bases and exploiting internal knowledge bases to seek business opportunities can be thought of as using the most aggressive knowledge strategies. These companies (“unbounded innovators”) focus on both acquiring knowledge capitals from their external environment and creating benefits by utilizing it. Zack argues that companies operating in knowledge-intensive industries would have better performance compared to their competitors if they use relatively aggressive knowledge strategies.

[Hansen et al. \(1999\)](#) identified two kinds of KM strategies: “codification” and “personalization” strategies. A codification strategy is IT-oriented, it emphasizes the codification of knowledge and its storage into databases, so people working in the company can easily retrieve it. Personalization strategy is human-oriented, it is focused on knowledge sharing between people, and IT systems are used for helping people communicate knowledge, thus their application goes beyond pure knowledge storage. The utilization of a personalization strategy is a kind of strategic thinking that starts from and around people. The business activities of companies adopting this strategy mainly depend on their employees’ tacit knowledge rather than on their existing explicit knowledge.

The work of [Choi and Lee \(2002\)](#) investigated the influences of knowledge strategy to knowledge creation processes in a sample of 58 Korean companies. The authors identified “system” and “human” KM-oriented strategies. The system strategy emphasizes knowledge codification, storing, information system, etc., and tries to share knowledge formally with IT network, software, documents, etc. The human strategy focuses on dialogues between people in social networks, and tries to recruit knowledgeable and experienced employees and emphasizes informally shared knowledge in knowledge communities, discussion teams/confrontation meetings, etc.

Many studies have also highlighted the steps required to develop “system”- or “human”-oriented strategies. These studies can be divided into three categories: balanced, dynamic and focused. These studies recommend companies to choose a type of strategy that is predominant or one which best serves the knowledge creation, sharing and utilization requirements and use the other one as a form of support.

The balanced view suggests that firms need to strike a balance between the two strategies. [Kumar and Ganesh \(2011\)](#) found that companies that combine “human”-oriented strategies with a “system”-oriented strategy for obtaining and sharing knowledge are more profitable. [Liu et al. \(2013\)](#) stated that companies adopting an aggressive strategy which integrates a human resource orientation and a system orientation achieved higher performance than firms with a less aggressive strategy.

The dynamic perspective suggests that firms adjust their strategies according to the characteristics of the knowledge present. For example, managers should align KM strategies with tasks characteristics. The focused perspective suggests companies to focus on a single strategy. By contrast, the balanced and dynamic visions insist that companies should apply both types of strategies. The concentrated and balanced perspectives, however, do not take into account the dynamic nature of knowledge. The dynamic perspective suggests that the choice of the strategy type will vary depending on the characteristics of knowledge [Choi and Lee \(2002\)](#). When a firm attempts to implement both strategies, with equal emphasis given to both, the consequences can result in risking a complete strategy failure. Both strategies can in fact be implemented, but this argument is apparently valid only for multinational corporations that have relatively complex and information and communication technology (ICT)-intensive functions to link the two strategies, but it is not valid for small and medium-sized enterprises (SMEs; [Shackelford and Sun, 2009](#)). In sum, one can conclude that any KM strategy should be implemented in accordance with the structure and characteristics of the company concerned.

Some authors ([Asoh et al., 2003](#); [Sabherwal and Chan, 2001](#)) argued that companies can improve organizational performance by strategically aligning their business strategies with their KM strategies. Such authors concluded that using different KM strategies at different stages of the business life cycle is also essential, as companies have different knowledge needs in different stages. As such, the adoption of KM strategies can lead to better performance.

3. KM in environmental sustainability practices of logistics service providers

In today’s competitive scenario, the outsourcing of logistics activities to 3PLs has become increasingly complex due to an evolutionary process that has shifted the

business model of these companies from an asset-based configuration (e.g. vehicles, warehouses and facilities) towards a more information and knowledge-based model (e.g. providing supply chain information through the use of several ICT tools and systems) (Evangalista *et al.*, 2013).

As a result, the management of knowledge is increasingly considered a strategic resource for improving the performance of logistics processes and services. In this scenario, the use of sophisticated and integrated KM systems is essential to support 3PLs' specific needs as well as collaboration with other supply chain actors and networks (e.g. customers and suppliers) (Rajesh *et al.*, 2011).

The evolving process of 3PLs has validated their role in every aspect of logistics, including environmental sustainability of their service offering (Lin and Ho, 2011). For 3PLs, environmental sustainability is an area of increasing importance, as their core activities often have a strong environmental impact (e.g. transport-related activities) (Lieb and Lieb, 2010b). As a consequence, an increasing number of 3PLs have started to transform their operations and strategies to be more effective from a green perspective (Jumadi and Zailani, 2010).

Environmental concerns in the transport and logistics service sector have become more stringent and prevailing due to the demand for goods that has grown dramatically in recent decades and, according to forecasts, it will continue to grow in the coming years (ITF-OECD, 2013). Therefore, it is necessary for the 3PL companies to make greater efforts to mitigate the negative consequences for the environment coming from the transport and logistics activities. Accordingly, 3PLs are increasingly requested to drastically reduce their externalities through effective actions (WEF, 2009).

It is also well-known that to increase the environmental benefits of a company's activities and service offerings, it is necessary to have a strategic commitment and integration of sustainable aspects into the company's existing business system and strategy (Maxwell *et al.*, 2007). An environmental strategy will require an integrated thinking at strategic, tactical and operational levels and cooperation within and across organizational functions. Furthermore, individual's skills, capacities and knowledge are expected to positively affect the degree of green considerations in the company and thus the business strategy, and therefore, a successful integration of green concerns into the business strategy will not occur without clear leadership, resources commitment and active support from the company's management (Fugate *et al.*, 2012). The absence of such an explicit strategy is likely to affect the company twofold, i.e. externally and internally. It can lead to difficulties in terms of informing employees about the company's green standpoint as well as managing and structuring the environmental work within and across the company.

Generally, companies have passed from the internal perspective in managing knowledge to spreading such knowledge to the whole supply chain to improve the sustainability efforts of all other supply chain partners as well. Sharing knowledge on sustainable aspects (e.g. process optimization applied to the entire supply chain) may lead to more effective and sustainable supply chains. Consequently, managing knowledge in an integral way is a fundamental enabler for reducing the negative effect of transport and logistics activities in the supply chain.

This is often interlinked to or influenced by a company's individual or supply chain's strategy, as strategy describes the roadmap to the company's future. On the other side,

the company's supply chain strategy needs to be defined in conjunction with the appropriate KM strategy where the relevant fields of knowledge have to be developed. This means that a strong interrelation between existing knowledge and the fields to be developed can be assumed. These existing fields are then developed according to the aim of the company.

In this context, another important element to generate, achieve and maintain a sustainable company is the creation of organizational architectures and KM systems that are capable of capturing, processing and making sense of environmental data and information. Given the fact that KM has a long-term orientation, it fits nicely with sustainability and sustainable management (Chow and Chen, 2012).

Considering the link between KM and innovation, when it comes to implementing logistics service innovation, the lines between traditional functional areas have blurred, while at the same time, an even greater need for extensive collaborative interactions between organization members has been asked for (Esper *et al.*, 2007). In addition, a mere employee specialization may not be a suitable approach to knowledge and its management; instead, a broad knowledge base is needed that is supported by all organization members and their different types of knowledge. As a consequence, 3PL firms can derive performance improvements through appropriate KM systems to support organizational learning as an important parameter in contributing towards logistics service innovation (Baumgarten and Thoms, 2002). Thereby, an appropriate KM system is defined as a system that comprises a set of procedures, infrastructures, technical and managerial tools, which are designed towards the creation, sharing and leverage of information and knowledge within and around organizations (Bounfour, 2003).

From a research point of view, most studies on environmental sustainability issues have focused on manufacturing sectors (Ramus and Montiel, 2005; Ostrom *et al.*, 2010), and little attention has been paid to other service sectors, such as the logistics service industry (Lin and Ho, 2011). There seems to be a great deal of uncertainty concerning green strategies by 3PLs, especially in relation with the initiatives and related motivators and barriers influencing their implementation. In addition, little is known about the implementation of KM in green strategies of 3PLs (Rajesh *et al.*, 2011).

In conclusion, logistics services are increasingly complex and knowledge-intensive in today's dynamic competitive environment. Knowledge assets have become critical for 3PLs to attain performance goals. Thus, it is crucial to implement KM approach for developing environmental sustainable service strategy. It seems that a strategic approach to KM has the potential to help 3PLs addressing the complexity connected with environmental challenges. In particular, the management and understanding of knowledge processes may support the integration, rapid development and exploitation of environmental knowledge by organization members (internally) and other supply chain participants (externally) to meet the challenges ahead. Consequently, the main research question of this paper is: What is the role of KM in the environmental sustainability strategies of 3PLs?

In the next section, the methodology adopted to carry out the systematic literature review will be described. After that, the results of the descriptive and content analysis are provided.

4. A systematic literature review on KM in sustainable logistics outsourcing

To address the research question, a systematic literature review has been conducted. A systematic literature review differs from traditional narrative review in several ways. Narrative review is mainly descriptive and do not involve a systematic search of the literature and thereby often focus on a subset of studies in an area chosen based on availability or author selection. This type of approach can often include an element of selection bias and can be confusing if similar studies have diverging results and conclusions. Systematic review typically involve a detailed and comprehensive plan and search strategy derived a priori, with the goal to reduce bias by identifying, evaluating and synthesizing all relevant studies on a particular topic (Tranfield *et al.*, 2003).

The methodology used, which represents an adaptation of the framework proposed by Ahi and Searcy (2013) and Seuring and Müller (2008), has been organized into the following three steps:

- (1) *Material search strategy*: In this step, research material has been retrieved and selected through an appropriate search strategy. The output is a sample of articles in which the single article is the unit of analysis.
- (2) *Descriptive analysis*: The selected material has been analysed for outlining formal characteristics, for example, in terms of distribution of articles over time, journals in which articles have been published, methodology adopted, theories, etc. This step allows an identification of some key features of the sample of articles selected.
- (3) *Content analysis*: In this phase, structural dimensions and related topic areas have been identified mainly using an inductive approach. The articles included in each topic area identified are analysed. The aim is to detect relevant issues and provide the base for interpreting results.

The following subsections provide details concerning the steps from 1 to 3 indicated above. In particular, it will be described the search strategy adopted (Step 1), the results of the descriptive analysis in terms of literature over time, literature across journals, literature by research methods (Step 2) and the categorization of papers through the identification of the topic areas in which the selected papers have been grouped together with the results of the content analysis for each of the papers included in the topic areas identified (Step 3).

4.1 Material search strategy

The search of the bibliographic material has been conducted using four different databases (Web of Science, ABI Inform, Premier Source and Scopus) from 2000 until 2014. A set of selected keywords has been used, such as: “Knowledge management”, “KM” and “Knowledge management strategy” in combination with “green”, “sustainab*” and “logistic*”, “logistics service providers”, “third-party logistics”, “3PL” and “LSP”. This allows obtaining 134 papers in total. The output obtained from the four databases was then compared. This led to the elimination of 39 duplicate papers, leaving a total of 95 papers. Subsequently, two inclusion/exclusion criteria were established. The first criterion related to the inclusion of peer-reviewed journals articles published in scientific journals only. As a result, conference papers, prefaces, editorial notes, reviews, research reports and other editorial materials, in addition to any articles from magazines

or industry publications, were excluded. The second criterion involved the specific inclusion of papers with a management focus (i.e. papers with a focus on technical or political science aspects were excluded). Taking the above two criteria into account and following consideration of the title, abstract and keywords of each paper, 38 articles were included in the final sample.

4.2 Descriptive analysis

The article retrieved have been analysed using the following three dimensions: papers over time, papers across journals and research methodology used.

The distribution of papers per year across the period 2000-2014 (Figure 1) shows an increasing interest of researchers towards the topic. The trend in the literature from 2000 to 2014 reveals two different phases. In the first phase – from 2000 until 2007 – there is a pattern characterized by a low number of articles, including some years in which no articles appeared. From 2008 onward, the number of published papers increased, reaching the peak of eight papers published in 2012.

The 38 selected papers were published in 24 international scientific journals. The articles were grouped by homogeneous journal categories as shown in Table I. The vast majority of papers have been published in transport, logistics and supply chain management (SCM) journals (20 papers) and innovation and management-related

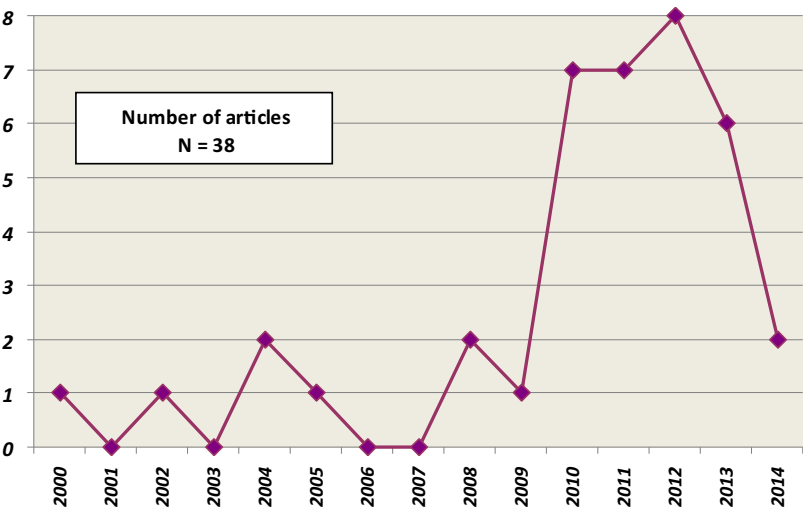


Figure 1.
Selected articles over
time

Table I.

Selected articles by
journal type

Journal type	No. of articles
Transport, logistics and SCM journals	20
Innovation and management journals	9
Environmental-related journals	7
Engineering journals	2
Knowledge management-related journals	0
Total	38

journals (nine papers). A smaller number of works appeared in environmental journals (seven) and engineering journals (two papers), while no articles were published in KM-related journals.

Looking at the research methodology adopted in the selected sample articles (Table II), most of them are based on quantitative methodologies (21 papers accounting for 53.8 per cent). Among these, 16 papers are based on questionnaire survey, while five papers used mathematical models/simulation. Fewer papers used qualitative methods, specifically case study analysis (ten papers accounting for 25.6 per cent), while five papers proposed theoretical/conceptual frameworks (accounting for 12.8 per cent). Only one paper published a literature review, and one paper used mixed research methods.

4.3 Content analysis

The selected articles have been studied in detail and grouped into four topic areas as shown in Table III.

The following sub-sections provide an overview of the content of the selected papers for each of the four topic areas identified above.

4.3.1 Green initiatives and influencing factors. Papers in this topic area focus on two different approaches. The first approach relates to single measures in the implementation of green initiatives, while the second discusses the adoption of multiple measures by logistics companies.

Papers belonging to the first approach emphasized the role of multimodal transport in minimizing the environmental impact of 3PLs' operations. Rondinelli and Berry (2000) argued that 3PL companies should adopt strategies based on proactive environmental management and provide a conceptual framework for understanding the interactions among multimodal transport activities and their impact on the environment. Lammgard (2012) indicates that the role of customers and competitors is crucial in driving the adoption of intermodal road–rail transport services for reducing carbon emissions and improving environmental performance.

Research method	No. of articles
Questionnaire survey	16
Mathematical model and simulation	5
Case study	10
Theoretical and conceptual	5
Literature review	1
Mixed methods	1
Total	38

Table II.
Selected articles by
research method

Topic area	No. of articles
A. Green initiatives and influencing factors	20
B. Energy efficiency in road freight transport companies	7
C. Buyer's perspective and collaboration	5
D. KM in 3PLs' environmental sustainability	6
Total	38

Table III.
Selected articles by
topic area

Studies adopting the second approach include the paper by [Lieb and Lieb \(2010b\)](#). The results show that, despite the global recession, many large 3PLs increased their commitment to building environmental sustainability programmes. [Pieters *et al.* \(2012\)](#) investigated how changes in the 3PLs' sustainability strategy influence the development of new types of physical distribution network in the Dutch market. The authors surveyed 145 logistics companies. The survey results show that most of the initiatives adopted were focused internally.

The work of [Perotti *et al.* \(2012\)](#) explores the relationship between the implementation of green supply chain practices (GSCPs) and company performance in the Italian 3PL market through investigating 15 case companies. The authors identified eight different categories of GSCP (green supply, distribution strategies and transportation, warehousing and green building, reverse logistics, cooperation with customers, investment recovery, eco-design and packaging and internal management) and three different levels of performance (environmental, economic and operational). It was found that the adoption of GSCP was low and the impact on performance limited. A similar study was conducted by [Colicchia *et al.* \(2013\)](#). It classified environmental practices implemented by the surveyed companies into two macro categories: "intra-organizational" practices (including distribution strategies and transportation execution, warehousing and green building, reverse logistics, packaging management and internal management) and "inter-organizational" practices (including collaboration with customers and other external collaborations). The results showed that initiatives related to distribution strategies and transportation activities were the most widely implemented, while initiatives involving internal management are much less common. This study also found that the lack of a standard methodology for environmental performance measurement was inhibiting companies from sharing the costs and benefits of environmental initiatives. Finally, [Isaksson and Huge-Brodin \(2013\)](#) investigated how a logistics service offering was affected by green initiatives in a sample of six 3PL companies operating in the Swedish market. The results indicated that initiatives to address green issues were at different stages in their development among the case companies.

[Wong and Fryxell \(2004\)](#) examined the influence of stakeholders on the environmental management practices in fleet management in Hong Kong. The study found that environmental management practices among fleet managers appeared to be significantly influenced by stakeholders and they were mainly driven by internal considerations rather than external pressures. [Lieb and Lieb \(2010a\)](#) surveyed 20 CEOs of large logistics companies operating in the North American market. The findings indicate that the most important factors triggering their involvement were sustainable corporate targets and customer pressures. The paper of [Jumadi and Zailani \(2010\)](#) highlighted the importance of customer influence on the green practices of 3PLs. They argued that customer relationships have a positive influence on the adoption of green actions in the logistics service sector in Malaysia. The survey carried out by [Lin and Ho \(2011\)](#) on a sample of 322 logistics service companies in China reveals that the adoption of green practices is affected by factors both internal and external to company. Their analysis indicates a number of influencing factors, such as regulatory pressures, governmental support, organizational support and the quality of human resources, having significantly positive influences in driving green practice. On the other hand, environmental uncertainty and the complexity of green practices act as barriers.

Interestingly, the influence of customers was not found to be significant for Chinese 3PLs. The survey conducted by [Zailani et al. \(2011\)](#) on a sample of 70 Malaysian 3PLs assessed the importance of green innovation in logistics outsourcing. The results showed that the vast majority of these companies considered information technology to be an important tool in mitigating the environmental impact of transport and logistics activities. A similar conclusion was reached by [Ho and Lin \(2012\)](#), who analysed the factors that affected willingness to implement green innovations in a sample of 162 logistics companies in Taiwan.

4.3.2 Energy efficiency in road freight transport companies. [Liimatainen et al. \(2014\)](#) explore the energy efficiency practices of road freight hauliers in some Nordic countries (i.e. Finland, Denmark, Norway and Sweden) through a questionnaire survey. The survey revealed that the implementation of several energy efficiency actions is rather similar between the four countries. The objective of the work of [Liimatainen et al. \(2012\)](#) was to investigate the energy efficiency practices of a sample of 295 road transport companies in Finland. This research indicated that road hauliers are aware of energy efficiency actions but they require more resources and knowledge to fully exploit them. The carbon intensity of last-mile deliveries and personal shopping trips is the focus of the paper by [Edwards et al. \(2010\)](#). This research suggested that, on average, the home delivery operation is likely to generate less CO₂ than the typical shopping trip.

The work of [Vujanović et al. \(2010\)](#) investigated activities that can enhance road freight vehicles' energy efficiency. The authors conducted a survey to evaluate the impact of vehicle load factor on specific fuel consumption. Measures for improving operational efficiency were defined and assessed. Other studies have examined the extent to which computerized routing and scheduling and/or vehicle telematics can reduce fuel consumption and CO₂ emissions in the road freight transport industry ([Leonardi et al., 2004](#); [Baumgartner et al., 2008](#)). The latter study involved a survey in 50 haulage companies operating in the German market. It found the low levels of vehicle usage and loading, limited adoption of lightweight vehicle design, poorly selected vehicles and a high percentage of empty runs. This study also indicated that the adoption of IT-based scheduling systems can have positive effect on efficiency.

Finally, the work of [Ang-Olson and Schroeder \(2002\)](#) investigated potential measures that may improve the environmental performance and energy efficiency of road transport companies. They focused on eight fuel efficiency initiatives including a mixture of technological and behavioural changes. The authors assessed the potential market penetration of each initiative as well as the potential reductions of greenhouse gas emissions in the USA that would result from their adoption at a national level.

4.3.3 Buyer's perspective and collaboration. The fifth topic area contains four papers discussing buyer perspectives and collaboration when sourcing more environmentally sustainable 3PL services. The paper of [Wolf and Seuring \(2010\)](#) asks if environmental issues are taken into consideration as supplier selection criteria when companies are sourcing 3PL services. The results highlight that while 3PLs are showing an increasing interest in environmental issues, buying decisions are still made mainly on the basis of traditional criteria such as price, quality and timely delivery. The authors conclude that environmental concerns have not been formally incorporated into the service buying decision-making process. The study shows that transport buyers and 3PLs are only sporadically taking the first steps towards the development of cooperative partnerships on environmental issues.

Bjorklund (2011) used the factor analysis to investigate factors affecting the purchase of green transportation services. The results indicate that the most important factors are internal management, image, resources of the firm, customer demands and governmental intervention. Martinsen and Bjorklund (2012) assessed the degree of alignment between the supply of green services by logistics companies and shippers' demand for these services using gap analysis. Internal and external gaps were found to exist. There was an internal gap between the 3PLs' view of their offering and how they perceived the demand from the shippers. This gap indicated that the 3PLs perceived themselves to be ahead of market requirements. There was also an external gap between the 3PLs' offering and the shippers' perception of the offers, indicating that even if the 3PLs are aware of their over-provision of green services, the shippers are not.

Kudla and Klaas-Wissing (2012) investigated how shippers stimulate their 3PLs and how 3PLs respond by adopting green initiatives. The findings show significant differences between the sustainability efforts of small and large 3PLs. In addition, a tentative taxonomy of the sustainability response types is proposed. The authors found that shippers' stimuli for sustainability (i.e. through selection criteria and incentives) are at an early stage. They also found that the sustainability initiatives of 3PLs have a stronger environmental focus in comparison with the other two social and economic dimensions of sustainability. Finally, Large *et al.* (2013) explored how far purchasers of logistics services take into account aspects of sustainable development. Propositions were developed and tested by surveying 750 purchasing and logistics managers. It was found that purchasing companies place high value on ecological and social aspects, but this did not translate into them getting involved in the logistics service providers (LSPs)' sustainability initiatives. The authors also argued that purchasing companies exert only a minor influence on 3PLs' sustainability initiatives.

4.3.4 KM in 3PLs' environmental sustainability. Only six papers were identified that deal with KM in environmental sustainability practices of logistics service companies. This small number is not really surprising, given the topicality of the subject. In the following, the main findings of the six papers are highlighted.

Sandberg and Aman (2010) explored the relationship between logistics capabilities and sustainable competitive advantage by using the notion of learning mechanisms. Based on a longitudinal case study approach that involved two Swedish examples of best-practice companies within logistics, the results suggest that the origin of the sustainability of a logistics-based company's competitive advantage might be found in the area of organizational learning. This learning thereby is the outcome of trial and error and experience accumulation.

Rajesh *et al.*'s (2011) aim was to develop a generic taxonomy component framework for the implementation of KM solution for 3PL service providers. According to the authors, the main strengths of the framework are:

- it identifies the key components for the KM framework for 3PL service providers by explicitly links the defining components and sub-components;
- it formulates a generic KM taxonomy framework; and
- it determines the weightage of each component and sub-component with the respective appropriate management instruments.

Rollins *et al.* (2011) examined customer knowledge sharing between a buyer of a logistics service and the LSP. The findings show the importance of building close relationships and having open and fluent communication in inter-firm knowledge sharing between a buyer and provider of logistic services. The findings suggest that this is more beneficial than relationship-specific investments. In addition, the findings stress that buyers and LSPs should invest in the sharing of customer knowledge.

Winter and Knemeyer (2013) deliver a snapshot of the existing research and suggest potential opportunities for academic inquiry related to the concept of sustainable SCM. The primary finding of the authors' work is that most of the existing approaches focus on narrowly defined aspects of the concept rather than taking a holistic view.

Mihi-Ramirez and Girdauskiene (2013) analysed the relationship of possible implication between creation of knowledge and reverse logistics. In addition, the authors examined its influence on the flexibility of distribution of information and the organizational performance. The theoretical analysis demonstrates, among others, how relationship among the four modes of knowledge creation affects the activities of reverse logistics. In addition, the analysis highlights how the interaction of knowledge and reverse logistics affects flexibility.

Wu and Hassis (2013) developed a knowledge-related approach to promote sustainability performance of freight villages. The authors present, among others, a very promising roadmap of organizing KM actions (e.g. knowledge acquisition, knowledge sharing and knowledge utilization) to build freight villages' sustainability capability, which should be tested in future research.

5. Discussion and implications

KM research and implementation have grown rapidly in recent years. However, little research has been conducted to study the interfaces of KM with environmental sustainability practices in the logistics service industry. Despite the fact that KM is expected to provide a relevant contribution for enhancing logistics service provision, the adoption of KM approaches is not widespread in the 3PL industry (Neuman and Tomè, 2005).

This is evident considering the findings which emerged from the bibliographic survey that clearly highlight a substantial gap in the existing literature regarding the contribution of KM in environmental sustainability practices of 3PLs.

With specific reference to the topic areas identified in this study, it is possible to derive some implications for KM strategies to be adopted by 3PLs to improve their environmental works.

The articles analysed in the first topic area show that extant literature is quite limited and offers only a fragmented picture of green initiatives undertaken by 3PLs. This suggests that 3PLs have not a well-defined strategy to reduce the environmental impact of logistics activities. A number of both internal and external factors influence the success of green initiatives. Some authors pointed out the importance of customer influence (Lieb and Lieb, 2010b; Jumadi and Zailani, 2010), the quality of human resources (Lin and Ho, 2011) and information technology as an important tool in supporting green initiatives (Zailani *et al.*, 2011). Consequently, one can argue that the impact of all these factors could facilitate or hinder the setting up of specific KM strategies. Generally, the green initiatives adopted by 3PLs vary from customer-to-customer depending on their level of awareness and sustainability

programmes they are adopting. Additionally, the environmental knowledge and skills of 3PLs' staff rely on personal experience and knowledge to execute green actions. The level of education and the perception of the importance of environmental issues play also a critical role in ensuring the success of green initiatives. Finally, the adoption of ICT tools and systems could help to create, store, access, use and reuse the environmental-related information and knowledge that may be disseminated internally and shared with other supply chain partners (e.g. customer).

The importance of ICT tools and systems has also been stressed in the second topic area concerning energy efficiency in road freight transport. Some of the authors concluded that information technology applications may have a positive effect in reducing fuel consumption, CO₂ emissions and efficiency in road transport (Baumgartner *et al.*, 2008; Léonardi and Baumgartner, 2004).

The third topic area relates to the customer perspective and collaboration when sourcing involves more environmentally sustainable 3PL services. The papers assigned to this area show that customer influence on 3PLs' green initiatives is limited and sustainability has not been fully incorporated in the sourcing decision-making process yet. For example, Large *et al.* (2013) found that buyer companies have a low involvement in the LSPs' sustainability initiatives. Martinsen and Bjorklund (2012) discovered internal and external gaps between the green services provided by 3PLs and buyers' demand for these services. Finally, Wolf and Seuring (2010) argued that buyer companies and 3PLs are only sporadically taking the first steps towards the development of cooperative partnerships on environmental issues. All these research contributions put in evidence that further efforts are needed to identify and implement mechanisms required to set-up collaborative green initiatives based on dyadic buyer–3PLs relationships.

Some of the papers included in the fourth topic area, dealing with KM in 3PLs' environmental sustainability, provide some responses to the existing gap between buyers and suppliers in this area. Sandberg and Aman (2010) argued that organizational learning is a key element to achieve a competitive advantage based on sustainability. On the other side, Rajesh *et al.* (2011) developed a framework for the implementation of KM solutions for 3PLs. More interestingly, Rollins *et al.* (2011) stated the importance of setting-up close relationships that are based on inter-firm knowledge sharing between a buyer and 3PLs.

Considering the above analysis, it seems that customer relationship management, quality of human resources and the adoption of ICT tools and systems may be considered the three basic areas through which an appropriate KM strategy that may enhance sustainability performance of 3PLs in this area can be build-up. For each of the three areas, it is possible to identify KM solutions that may be used.

5.1 Customer relationship management

It is widely recognized that customer plays a critical role in driving environmental sustainability programmes and actions by logistics service companies. To reach this objective, KM is essential to manage and maintain effective relationship with customer. Firstly, it is necessary for 3PL companies to have an appropriate level of knowledge on green issues to better understand the customer green requirements. Secondly, collaborative programmes among customers and 3PLs require a shared stock of knowledge on environmental sustainability issues that may be build-up through mixed

teams comprising managers and employees of both customer and 3PL companies. These teams may work through periodic meetings aimed at exchanging knowledge and experiences on actions undertaken in collaboration to understand which kind of improvements are needed to overcome programme weaknesses. Finally, customers are even more interested in performance measurement of collaborative initiatives undertaken with 3PLs' partner. Communication skills and know-how hereby serve as a means for facilitating the exchange and share information about green performance.

5.2 Quality of human resources

The adoption of successful environmental sustainability programmes in any company as well as in LSPs is dependant on leveraging employees' knowledge. From this perspective, education and training of employees play a critical role in the creation and development of environmental knowledge within and outside the company. It is then important to provide employees with training and education programmes to anchor environmental sustainability thinking into the staff's minds. This may also facilitate the integration of sustainability issues in the service design and development process. Such programmes should be focused on different aspects (economic, ecological and social) and functions (e.g. sales and marketing). Another solution may be the implementation of job rotation approach allowing employees to switch jobs with colleagues to understand the main characteristics of different kind of works and establish the conditions for creating new solutions through the exchange and transfer of knowledge. This may also facilitate the service innovation process and transfer of useful knowledge from one division to another. To support efforts to sustain and enhance the quality of human resource, a number of tools may be used such as e-learning tools through the use of digital media for presenting and distributing learning materials between employees. The use of knowledge-database platforms can be also used to guarantee the easy access to relevant environmental knowledge and information to employees at all levels in the company.

5.3 Adoption of ICT tools and systems

Technologies are important too for supporting the environmental sustainability orientation of a logistics service companies. The transfer of information is crucial for sharing knowledge within and outside the company. The use of appropriate ICT tools is essential for spreading knowledge. For example, the use of fleet management systems may not only provide accurate information on truck fleet but also stimulate truck drivers to save fuels and lorry wear out. The use of KM ICT systems and tools supports the exchange of information and sharing of knowledge and experiences among 3PLs and other supply chain participants, facilitating a common understanding of the most appropriate actions to be implemented and the setting-up of collaborative initiatives and decision-making as well. Moreover, the adoption of ICT tools and systems may allow for the monitoring and improvement of environmental performance at both company and supply chain level.

The expected benefits that KM can bring in the area of environmental sustainability for 3PLs open up a huge potential for researchers from different disciplines. In the following, a number of promising research opportunities are presented.

5.4 Research methods

Given the situation that the topic under investigation is in its infancy, we need to apply research methods that can support theory development. Qualitative research methods are particularly suitable for meeting this aim. Qualitative methods would also give the opportunity to better understand the motives behind any actions or non-actions regarding the linkages between KM and environmental sustainability practices.

5.5 Analysis of factors hampering/supporting the implementation of KM in practices related to environmental sustainability

There is research in the field of KM that has focused on factors supporting or hampering the introduction of KM practices in organizations. An understanding of these factors is a basis condition for any further steps and can increase the probability of success. Given the present focus on environmental sustainability practices of 3PLs, there might be additional factors that may need to be considered.

5.6 Development of measures to demonstrate the impact of KM on sustainability practices

To support the implementation of KM in general and with regard to environmental sustainability specifically, research should focus on the development of suitable measures. The outcomes of these activities will definitely support in reaching a stronger perception of the value of KM. Additionally, it will also contribute to a stronger commitment among practitioners.

5.7 Role of different stakeholders in the implementation of KM in environmental sustainability practices

The topic of environmental sustainability is one that cannot be addressed by a single actor alone. This means that to increase the success of any activities, 3PLs have to try and involve other stakeholders as well (customers, state, competitors, etc.). As KM should not have an internal focus, logistics companies should also think of how to best integrate different stakeholders in the KM approach to improve the effective use of existing and future knowledge. An example would be the creation of communities of practice that are attended by different stakeholders that are active in the logistics and transportation sector to advance KM as indicated by [Bedford and Harrison \(2015\)](#). Thus, research could focus on suitable governance models to meet this issue. This will also raise the questions of suitable KM strategies that can help in improving the management of this issue.

6. Conclusions

This paper has reviewed existing papers on KM in environmental sustainability practices of LSPs. Against the expected benefits KM approaches can bring to these activities, more specific provision for research is called for. The review conducted reveals that the body of knowledge regarding the topic chosen is rather poor. Indeed, one can argue that the topic that resembles a white spot on the map which can be assessed be considered unacceptable. To address this situation, the analysis made possible the identification of three fundamental issues (customer relationship, quality of human resources and ICT adoption) that seem to have the potential to support the implementation of suitable KM approaches and strategies.

Given the fact that extant research provides only fragmented insights into KM in environmental sustainability practices of LSPs, the topic offers scholars a variety of promising research avenues. In the present paper, the areas *research methods, analysis of factors hampering/supporting the implementation of KM in practices related to environmental sustainability, development of measures to demonstrate the impact of KM on sustainability practices and role of different stakeholders in the implementation of KM in environmental sustainability practices* are proposed as promising avenues.

The paper has also identified the *customer relationship management, the quality of human resources and the adoption of ICT tools and systems* as the three main areas that managers of 3PL company need to consider to build-up appropriate KM strategies supporting their strategy in the field of environmental sustainability.

The authors are aware of the fact that the present study is not without limitations. By restricting the review to the databases Web of Science, ABI Inform, Business Premier Source and Scopus, this study may not have allowed complete coverage of all articles in the topic under investigation. Yet, it seems reasonable to assume that the review process covered a large proportion of the studies available. In addition, reviewing the literature was sometimes disconcerting, as many papers do not specify whether they are discussing SMEs or large firms. Finally, this paper proposes some research directions, which are not exhaustive but represent initial stages.

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