



**GÖTEBORGS UNIVERSITET
HANDELSHÖGSKOLAN**

Sustainable Supplier Selection

*Selection and evaluation of logistics service providers based on sustainability in the
Swedish market - a qualitative approach*

Master Thesis in Logistics and Transport Management

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Abbreviations

AHP Analytic Hierarchy Process

ANP Analytic Network Process

CSR Corporate Social Responsibility

D-DEA Dynamic Data Envelopment Analysis

DEA Data Envelopment Analysis

DMs Decision Makers

DMU Decision Making Units

DUs Decision Units

GP Goal Programming

GRA Grey Relation Analysis

GSCM Green Supply Chain Management

LSP Logistics Service Providers'

MADM Multiple Attribute Decision-Making

MCDM Multi Criteria Decision Makers

MCDU Multi Criteria Decision Unit

NGOs Non-Governmental Organizations

SBM Slack-based Models

SCM Supply Chain Management

SD System Dynamic

SS Supplier Selection

SSCM Sustainable Supply Chain Management

SSM Sustainable Supplier Management

SSS Sustainable Supplier Selection

TBL Triple Bottom Line

TOPSIS Technique for Order of Preference by similarity to Ideal Solution

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Abstract

Integrating social and environmental aspects in supply chain management has received much consideration and attention from both companies and the society over the past decade. Organizations have recognized the high significance of sustainability which now has become an integral part of their business strategy. Companies have realized that they must integrate sustainability into supply chain through supplier selection. Consequently, suppliers play an important role in sustainable development through the entire supply chain. The sourcing department has the main responsibility to assure that sustainability is considered when selecting suppliers in order to have a supply chain that is truly sustainable. Therefore, purchasing managers need to include the three sustainability aspects in their supplier selection process. Despite their high significance, logistics service providers are usually not treated like the classic suppliers of goods and have not given the right attention from both academia and industry. With regard to the complexity of supplier selection process due to its wide variety of factors a systematic and sustainability-focused evaluation framework for supplier selection is needed from an organizational supply chain perspective. The usage of decision support tools/methods can help organizations and supply chain managers to make more effective decisions regarding sustainable supplier selection. By examining the four widely applied methods for sustainable supplier selection (i.e. DEA, ANP, AHP, TOPSIS), this paper aims to find out how companies in Sweden select and evaluate their logistics service providers. A case study with ten companies will be analyzed in order to fill the existing gaps and answer the research questions.

Key words: DEA; ANP; AHP; TOPSIS; sustainability; supplier selection; logistics service providers;

Introduction

1.1 Background

During the last decades business has been behold as the basic originator of economic, social and environmental problems (Porter & Kramer, 2011) and sustainability issues have drawn augmented attention from both policy makers and businesses (Tate, Ellram & Gölgeci, 2013). Strict government legislations increased public awareness and increased demands from companies' stakeholders toward sustainability issues have impelled enterprises to admit the significance of sustainability aspects in their businesses (Luthra et al., 2017). Therefore, companies are called to deal with sustainability since it is closely related to their market share and their future presence in the market. Even though, "sustainability" seems to be a term that is frequently used by governments and Non-Governmental Organizations (NGOs), it appears that there is still a lack of comprehensive understanding of this term (Sharma and Henriques, 2005; Simpson et al., 2007; Tate et al., 2010). The boost of consumption brought with it some negative consequences for nature and natural sources (O'Shea, Golden & Olander, 2013; Trucost, 2013). The environment had been deeply harmed by the increased production and movement of goods around the world. The Green Gas House Emissions is a significant threat that needs to be dealt with by all the corporations around the world. However, profitability is the main focus of the firms in the business world. There are still plenty of issues remaining such as working forces that are not treated with respect to the human rights, for example employees that are working long hours with low wages and working conditions that are not taken seriously. Such are the examples of Nike and Zara where they did not respect the social aspects of sustainability related to their factories in Asia (Girit, 2017; Wazir, 2001). Scandals regarding child labor and human trafficking are coming into light quite often and firms suffer the negative consequences. Social medias are fast way for spreading the news, hence firms need to comply with the social aspects of sustainability for protecting their reputation, keeping their market share and profits in high levels.

Purchasing plays an important role in organizations since it can contribute to business accomplishments in different ways. A big percentage of the total budget of a company is invested in purchasing due to its connection to the firm's business continuation and profitability. Moreover, purchasing varies from company to company (Knoppen & Saenz, 2015) and as a result different

actions in different stages are implemented by purchasing managers and administration. For example, innovative companies need an early supplier involvement as well as building ramp-up capacity instead of prices. Whilst, low price competing companies need a purchasing function that can minimize the price of initial/spare parts.

With the right management of the purchasing budget and through different investment actions, companies are trying to establish their presence in the market as well as their competitive advantage. Moreover, purchasing can bring resources from outside the firm which makes it a potential source of competitive advantage (Chen et al., 2004). Wrong decisions taken by purchasing managers regarding supplier selection and ignoring the sustainability aspect can affect an organization in many different ways. A company's reputation as well as the cash flow can dramatically decrease and the threat of losing customers and market share is adequately increased. Therefore, purchasing's importance should be clear for all decision makers since it is a key component of the broader supply chain management function that contains the logistics activities across all levels of the chain or network, from raw materials to final customers (Knoppen & Saenz, 2015). Considering that most of the companies spend approximately more than half of their sales turnover on purchased goods and services, well-established and efficient relationships with suppliers are of high importance for a company's short-term financial outcomes and long-term competitive position (van Weele, 2018).

Supplier selection process is an important part of the purchasing in industrial context for accomplishing the desired level of quantity and quality at a sensible cost of raw/finished material delivered at the right time (Sen et al., 2018). The core objective of supplier selection is the identification of suitable suppliers for a long-term and reliable partnership (Keskin et al., 2010). Working closely with suppliers can be a win-win situation for both parties. Having a supplier that understands the company's needs and goals will lead to several improvements in different sectors. With a closer collaboration with suppliers a firm can increase its productivity, decrease the lead time, improve the delivery and ensure a higher service level for its customers. All suppliers need to be selected and evaluated carefully because any misjudgment in the supplier selection process comes at a cost on the buying company (Rashidi & Cullinane, 2019).

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Logistics are intently connected to the increase of CO₂ emissions and some NGOs as well as the press are criticizing the logistics service providers for harming and polluting the environment. In order to protect themselves from fines, logistics service providers are called to find innovative ways and more environmentally friendly solutions for the products movement around the world. Many of them switch to green trucks in order to decrease their negative impact on the environment, but still this is not enough.

In most of the cases, logistics service providers do not seem to be treated in the same way compared to other suppliers. Firms need to realize that logistics service providers are also of high importance toward sustainable development together with the capabilities of providing solutions which result in more sustainable supply chain (Colicchia et al., 2013). The traditional logistics service provider selection, which was commodity and price-based, might not meet the requirements and is not acceptable anymore (Sarkis 2001, Seuring et al. 2008, Bryson & Lombardi 2009). Additionally, logistics service providers selection process is quite scarce since only few factors about the types of these selected providers have come into light so far (Wanke et al., 2007). Hence, selecting the best logistics service providers is not an easy task. On the contrary, this process is characterized by high complexity due to a great number of variables that need to be taken into consideration (Aguezoul, 2014). Lately, many organizations have focused on incorporating environmental, social and economic aspects of sustainability into their supplier selection processes by endorsing sustainable supply chain initiatives (Govindan et al., 2013; Seuring & Müller, 2008). Moreover, environmental sustainability and cost minimization are the two aspects that are mostly considered when selecting suppliers (Wu & Pagell, 2011; Zhu, et al. (2008). Therefore, companies have found

that there is a need to evaluate suppliers from a sustainability perspective (Dai & Blackhurst, 2012).

In order to enhance organizational performance and maintain strategically competitive position, green and sustainability-focused supplier selection is a critical decision in industrial supply chains (Govindan et al., 2013; Grimm et al., 2014). A sustainable supply chain can be achieved by selecting and evaluating all suppliers in a proper way. In order to make this process easier for the industries, academia has developed several methods and frameworks such as Data Envelopment Analysis (DEA), Technique for Order of Preference by similarity to Ideal Solution (TOPSIS), Analytical Hierarchy Process (AHP), Analytical Network Process (ANP) which can help firms select the right supplier based on sustainability criteria. These methods will be analyzed and elaborate later on in the following chapters. Considering that each industry has its own peculiarities, these models vary as for the type of the added data. They are created to adjust in different criteria as well as options that could exist. Hence, some of them are suitable for the automotive industry, some for the construction industry and so on. Even though a big number of models regarding the sustainable supplier selection exist, still there is a gap in the industry in relation to their implementation.

1.2 Problem description

Despite the fact that a big variety of researches exist regarding sustainable supplier selection, only few studies have considered the three dimensions of sustainability at the same time. Moreover, there are few studies which focused on qualitative approach which has also take into consideration three aspects of sustainability (Nourmohamadi Shalke et al., 2018). Most of the studies and frameworks today focus on quantitative approach in order to consider the different sustainability criteria and dimensions (quantified criteria such as price, quality and lead-time) in this selection but very few have made an attempt to take non-quantifiable factors connected to sustainability into account in a systematic way (Torres-Ruiz & Ravindran, 2018). Although there are few studies that have considered qualitative factors but the nature of these studies are quantitative. As a consequence, the existing methods and frameworks are not taking into consideration the social related factors which leads to the next problem. Looking into the sustainable supplier selection practice in different industries it turns out most of the companies have solely focused on the

economic factors and partly on environmental factors, but the social related criteria have got very little if no attention at all (Kannan, 2018).

The results of a subjective evaluation of suppliers are not only dependent on the selected criteria but also heavily on how the variables are evaluated by decision-makers and the models which have been applied for supplier assessment (Desanctis and Gallupe, 1987; Khan et al., 2016). Due to the rank reversal phenomenon, the validity of these models could be questionable (García-Cascales & Lamata, 2012). Depending on the order of preferences an alternative could be considered the best but adding or removing of another alternative from the process, it can become the worst. Such a phenomenon in many cases may not be acceptable (García-Cascales & Lamata, 2012). Hence, there is a possibility of achieving different outputs from different methods.

Supplier selection has been considered multi-criteria problem or better saying a kind of multi-criteria/factor decision making problem that needs a trade-off between conflicting quantitative and qualitative criteria (Kahraman, et al., 2003; Azadnia, 2012). However, due to the broad variety of tangible and intangible factors (multi-criteria nature) the measurement of supplier sustainability is not easy to be quantified. Therefore, there is a need to consider both quantitative and qualitative criteria that may even be interdependent (Faisal et al., 2017). Still, this is not applicable each time since in some cases the factors are not clearly defined and there is a 'grey' area which is involved in the evaluation scheme. (Bai & Sarkis, 2010)

There are some cases which show that wrong supplier selection process could bring negative consequences to companies such as Zara (Girit, 2017) and Nike (Wazir, 2001). Zara in Turkey had to compensate for its wrong supplier selection which led to reputation damage after the customers found some papers hidden in the clothes which stated that "you are buying these clothes but we didn't get paid for that". This brought negative publicity on the company. Through social media within a short time started a campaign with the hashtag #BravoIscileriIcinAdalet, which can be translated in english "Justice for Bravo workers". This online petition were signed by more than 270,000 people (Girit,2017).

In case of Nike, the company was accused of tolerating sweatshops. In 1996 Nike was severely embarrassed when a US magazine featured a photograph of a young Pakistani boy sewing together

a Nike ball for football games. The following year it was revealed that workers in one of its contracted factories in Vietnam were being exposed to toxic fumes at up to 177 times the Vietnamese legal limit. This scandal ruined Nike's reputation and made the company improve their supplier selection in order to prevent such scandals. Additionally, the scandal affected company financially and led to drop in profit for several years.

In the case of logistics service providers as suppliers which is the main focus of this research, without focus on a specific industry, few researches exist. The aim of this research is to bridge these gaps by implementing a qualitative method for data gathering regarding sustainable supplier selection with specific focus on logistics service providers.

1.3 Purpose and research questions

This research aims to find out how do companies evaluate/select their logistics service providers based on sustainability criteria. Considering that almost all the previous researchers have examined relevant topics based on quantitative data, this research follows a different approach by conducting a qualitative analysis. Moreover, the majority of surveys are focused on sustainable supplier selection in industries such as automotive, construction, retail etc. and only few are examining the logistics industry in general and almost none of them examine the sustainable angle of this industry. In order to fill the literature gap, this study considers the supplier selection process based on the sustainable criteria namely, economic, environment and social. To address the research gap and serve the purpose, three research questions have been formulated as follow:

RQ1: How do companies evaluate and select their sustainable logistics service providers and which methods do they use?

RQ2: Which criteria are taken mostly into consideration when selecting logistics service providers?

RQ3: What are the existing gaps between the industry and academia? To what extent the methods which have been mentioned in academia have been used by different companies?

By examining different industries and their peculiarities this research will compare the literature with real-life cases in order to find the gap between academia and industry regarding decision models which have been discussed in the literature but haven't been applied in industry. Despite

the fact that there are plenty of models which are appropriate to select and evaluate suppliers but still the managers in different industries are using traditional models in order to rank their suppliers. Furthermore, the four most preferable methods (i.e. AHP, ANP, DEA, TOPSIS) for sustainable supplier selection will be taken as a base in order to find out whether companies are evaluating their logistics service suppliers based on one of these methods or they are implementing other frameworks, if any.

By taking into account that organizations have changed their attitude by adapting a more sustainable operation, we aim to find out if they consider sustainable dimensions when selecting their logistics service providers mostly in Sweden and globally in case, they have facilities elsewhere.

2 Literature review

This paper is conducted according to previous research regarding sustainable supplier selection methods in different industries. Considering that these methods are focused on sustainable supplier selection process including logistics service suppliers, the first part of the literature review consists of analysis of sustainability and its dimensions (i.e. environmental, social and economic), followed by supplier evaluation/selection based on these three dimensions. In the second part the related articles regarding the sustainable supplier selection have been revised and briefly referred in the literature review, however only the four most applicable methods (i.e. DEA, AHP, ANP, TOPSIS) will be analyzed further in details.

2.1 What is sustainability

One of the consequences of globalization on the markets and thus supply chain and purchasing process is the increase of the need to incorporate sustainable supply chain management processes (Oelze, et al., 2016). As sustainability has become one of the key elements of supply chain management (Kleindorfer et al., 2005; Linton et al., 2007) the companies who seek for innovative solutions have to consider not only economic but also environment and social aspects (Bai & Sarkis 2010). This goes well with Kannan (2018) who argued that globalization has made the managers focus not only on economic aspect but also take into consideration environmental and social parameters. He also emphasized that the goal of sustainability achievement has been increased among profit organizations, non-profit organizations, and government agencies over the

past few decades. This calls for companies to change their traditional economic-based approach and integrate environmental and social dimensions into their operations (Kannan, 2018). Hence, in order to increase/enhance organizational performance and maintain strategically competitive position, green and sustainability-focused supplier selection is a critical decision in industrial supply chains (Govindan et al., 2013; Grimm et al., 2014). Sarkis & Dhavale (2015, pp. 178) defined sustainability as “using resources today without compromising the needs of future generations, and through the triple-bottom-line concept of integrating environmental, social, and economic dimensions into organizational decision making.”

Stoddard et al. (2012, pp. 234) stated that “Building on the concept of sustainability, a new corporate philosophy and accounting form has emerged that takes into consideration not only the traditional economic bottom line but also considers less quantifiable indicators that measure social and environmental impact”. This new framework which is used to measure corporate performance is called the triple bottom line (Elkington, 1998). Wilson (2015) stated that the Triple Bottom Line (TBL) is a term which is used to define the economic (profit), social (people), and environmental (planet) responsibility of an organization (figure 1). Triple Bottom Line is directly connected to the concepts and goals of sustainable development. (Stoddard et al., 2012, pp 235) stated that “TBL *is a relatively new measure of corporate performance that requires the public disclosure of social, economic and environmental indicators of organizational performance and is a concept that is closely related to social responsibility*”. According to the TBL concept the performance of corporations should not only be driven by the benefit of its shareholders but all of its stakeholders such as the local community within which business operations exist. According to Connie (2010) integrating the TBL concept and strategy into businesses is a complex task; yet, very critical to the success of business and corporations of 21st century.

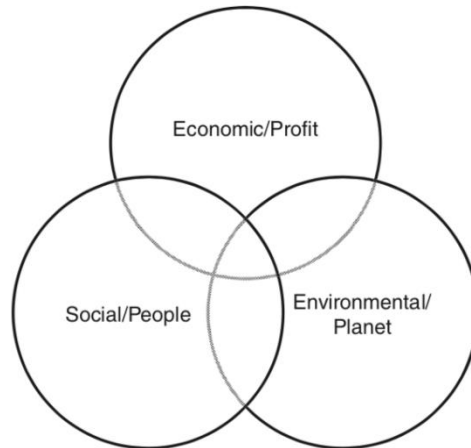


Figure 1. The 'triple bottom line' provides economic, social and environmental sustainability (Wilson, 2015.)

2.1.1 The economic dimension of triple bottom line

At the profit level, the economic aspect of triple bottom line, is the easiest aspect to evaluate since it can be evaluated by traditional economic-based indicators such as price, revenue, profit, return on investment etc. Based on Fallahpour et al. (2017) economic aspect is still on the top priority followed by environment and ultimately, social aspect. According to Fallahpour et al. (2017) findings, the most important criteria when selecting suppliers are still cost, quality, delivery and services which fall into economic dimension. This is aligned with Amindoust and Saghafinia (2017) which stated that companies must add the environmental and social parameters to the traditional supplier selection attributes which was basically emphasized/focused more on economic dimension.

Sustainability has moved from individual organization to the supply chain due to the wide variety of activities through the chain with respect to both environmental and social responsibilities aspects (Rostamzadeh et al., 2015). Dao et al. (2011) argued that due to the scarcity of natural resources and demands for greater corporate social responsibility, sustainability has become an important part of supply chain activities and companies are forced to develop/improve their decision-making processes. Hence, the integration of these three sustainability dimensions has gained considerable attention recently and has become a core strategic factor for organizations (Benn et al., 2014). Companies have realized that in order to move towards sustainable development, they have to incorporate sustainability practices into their supply chain profile (Azadnia et al., 2012). They have noticed that in addition to economic and environmental aspects

the social concerns play an important role in gaining competitive advantage. This has led to a paradigm change in companies' approach toward sustainability concept (Faisal et al., 2017) and it has become a core strategic factor for the companies (Seuring, 2012). As a result, the sustainable supply chain management (SSCM) has become a new model for organizations (Gualandris et al., 2014). The sustainability-focused supply chain is an extension of the green supply chain which considers social dimensions as well as economic and environmental dimensions from a supply chain context (Mangla et al., 2014). Ahi and Searcy (2013, pp.178) defined sustainable supply chain management as *“incorporating various dimensions of social and environmental sustainability into supply chain management”*

2.1.2 The environmental dimension of triple bottom line

At the plant level, the environmental aspect of sustainability has been defined by Gimenez, et al. (2012) as the use of energy and natural resources and also the measurement of company's footprint produced as a result of day-to-day activities. Environmental dimension is usually associated with waste reduction, pollution reduction, energy efficiency, emissions reduction, a decrease in the consumption of hazardous materials, and a decrease in the frequency of environmental impacts (Gimenez, et al., 2012, pp. 150). Mass et al. (2014) investigated the connection between competitive advantage and pollution prevention. They concluded that this relationship depends on the way companies transmit their environmental messages internally and externally. Some scholars linked the environmental sourcing with strategic topics for a firm such as new product development and risk mitigation (Bowen et al., 2001; Handfield et al., 2002; Vachon & Klassen, 2006; Zsidisin & Siferd, 2001). According to Govindan (2013) sustainable practices could have huge impact on the long-term success of a supply chain and the purchasing process becomes even more complicated when integrating with environmental and social pressures.

As Ferri and Pedrini (2018) stated, incorporating social and environmental strategies in supply chain management has drawn substantial attention from both companies and the society in general, but it has great consequences. Connie (2010) stated that the implementation of ecological and social strategies could be costly for the companies. This is an important factor for companies to take into consideration. The investment in environmental and social practices may be vital for the long-term success of the companies even though it might not bring any return of investment

directly. In addition, companies must keep their current and potential customers aware by communicating their positive environmental and societal impact.

2.1.3 The social dimensions of triple bottom line

At the people level, the social dimension of sustainability focuses on both internal communities (i.e., employees) and external ones (Pullman et al., 2009). Social sustainability means that entities provide equitable opportunities, create diverse atmosphere, improve the work-force condition and the quality of life and provide democratic processes and accountable governance structures (Elkington, 1994). Fombrun (2005) stated that organizations integrate corporate social responsibility (CSR) activities in order to increase their social reputation. In line with Faisal, et al. (2017) declared that the company won't be able to implement sustainability without considering social responsibility and compliance. Carter (2004) argued that socially irresponsible behavior by organizations lead to negative consequences on the bottom line. On the other hand, socially responsible behavior can result in higher customer loyalty and increased profit. Furthermore, by lowering the cost, socially responsible behavior can also contribute to the bottom-line. Faisal et al. (2017) emphasized that due to the consumers' awareness toward sustainability, companies have started to put more focus on socially responsible behavior of organizations. Consumers are even willing to pay higher prices and on the other hand impose penalty on those who have disregarded social traits (Faisal et al., 2017). Hence, organizations have to seriously consider the impact of socially irresponsible behavior by their suppliers as it would have severe consequences on their brand image (Amindoust & Saghafinia, 2017). Lee and Kim (2009) stated that organizations have to consider and apply social and environmental approaches due to the societal pressure of both customer and various stakeholder demands/expectations. Organizations have realized that neglecting environmental and social aspects in supplier selection will bring them not only high cost but also result in corporate reputation damage, as the customers can't distinguish between companies' sustainable practices and their suppliers. Thus, the companies have to compensate for unsustainable supply base (Dai & Blackhurst, 2012).

For achieving a sustainable supply chain, the three aspects of sustainability that are analyzed above need to be taken into account when selecting suppliers. However, when it comes to logistics service providers, the evaluation process seems to be a little bit different since only in few cases the three

aspects have been considered. The following section examines previous literature regarding the logistics service providers evaluation based on the aspects of sustainability.

2.2 Logistics service providers evaluation based on the three aspects of sustainability

2.2.1 Economic aspects in logistics service providers evaluation

According to Jung (2017) the evaluation and the selection process of the logistics service providers is one of the main steps for a manufacturer seeking to select a suitable logistics service provider as a business partner. Although a great deal of researches regarding evaluation have been done but still among widely used criteria, according to the Pareto analysis of Aguezzoul (2014) cost, relationship, services, quality, information/equipment system, flexibility and delivery are of high priority. Besides, some authors have also considered service as additional important criterion for supplier evaluation (Bhutta & Huq, 2002). Many researchers have tried to identify the most important criteria for evaluating and selecting appropriate logistics service providers.

By investigating 131 firms, Fawcett and Smith (1995) identified 5 criteria as follow: quality, delivery, flexibility, cost, and innovation in services. Besides, Dapiran et al. (1996) and Millen et al. (1997) declared that cost is the most important criterion. Murphy and Daley (1997) identified 12 criteria for international freight forwarders selection as follows: expertise, reliability, ability to provide relevant information, attention, reputation, price, financial condition, convenience of use, services, geographical specialization, product specialization, and size. By investigating 126 firms in Singapore, Bhatnagar et al. (1999) identified the key criteria of the logistics service provider selection as follow: service quality, cost, reputation, range of services, and relevant experience. Furthermore, after the examination of 134 firms in Hong Kong regarding the most important criteria when evaluating logistics service providers, cost and assets scored higher among the others (Lai et al., 2002). Yeung (2006) also conducted a survey among 72 exporters in Hong Kong and identified 4 criteria: timeliness of services, price, quality of delivery, and customized supplementary services. Meanwhile, Mortensen and Lemoine (2008) argued that the main criteria for selecting the logistics service provider are quality, reliability of delivery, market coverage, price, and competences.

As Lieb and Lieb (2011) declared, despite the importance of sustainable operations in logistics service providers, it seems that sustainable principles are not the main determining factors in the

logistics service providers contractual agreements. While more customers are now demanding sustainable operations from companies including the logistics service suppliers, the shippers' ambition/interest for sustainable operations of the logistics provider are still immature and needs more development (Kudla & Klaas-Wissing, 2012). All aforementioned indicate that most of the past researches mainly focused on price (cost) and service quality when evaluating and selecting logistics service providers.

2.2.2 Environmental aspects in logistics service providers evaluation

Despite the fact that some scholars have examined the environmental aspects of sustainability for the 3PLs (Maloni & Carter, 2006; Marasco, 2008; Selviaridis & Spring, 2007), there is still huge uncertainty on how logistic service providers apply environmental strategies and on how they put sustainability strategies into practice (Evangelista, et al., 2017). Additionally, few researches have been done regarding sustainability strategies in the logistics industry (Abbasi & Nilsson, 2016). The same was concluded by Wolf and Seuring (2010) which noticed that the researches lack of green activities adopted by third-party logistics providers. Abbasi and Nilsson (2016) tried to identify challenges regarding sustainable logistics development from a service providers' perspective in the Scandinavian countries. They concluded that for logistics service providers' (LSP) sustainability issues have a tendency toward economic/profit related issues. These issues are followed by environmental concerns thus, putting in the third place the social/people-related issues.

Taking into account that the trend regarding environmental aspects of logistics and transport is forecasted to continue (ITF, 2013), greater effort should be put in mitigating negative consequences particularly caused by freight transport (McKinnon, 2008). This also has been emphasized by Colicchia, et al. (2013) which stated that logistics service operations play an important role in environmental concerns of supply chain and impact the green supply chain management. However, further research needs to be implemented. The environmental aspects are of high importance and the negative impacts from products movement needs to be analyzed deeper, especially from logistics service providers context. Therefore, it can be concluded that regarding environmental regulation, logistics industry is still in its infancy (Lin & Ho, 2008).

2.2.3 Social aspects in logistics service providers evaluation

Social aspect of sustainability in evaluation process of logistics service provider has gained less attention in comparison with economic and environment aspect in both academia and industry Jung (2017). In their research Jumadi and Zailani (2010) concluded that customers have a positive influence on the green practices of logistics service providers in Malaysia. On the other hand, Beskovnik and Jakomin (2010) stated that long-term contracts are an important driver regarding the implementation of green measures by logistics companies in Southeast Europe. Moreover, Lin and Ho (2011) examined 322 logistics companies in China and concluded that the endorsement of green practices is affected from both internal and external factors. Besides, the definition of social sustainability is not as clear as the environmental aspect. The social aspects of sustainability have not been explored completely due to “humanness” and the difficulty in reaching tangible outcomes (Carter & Easton, 2011; Ashby et al.,2012).

Sachs (1999) and Godschalk (2004) identified a number of elements that needs to be taken into account regarding the social aspects of sustainability. Among them, the most important elements are equitable income, social homogeneity, access to goods and services. Also, the term “cultural sustainability” was pointed out as an important fact that can be adopted from different organizations which want to operate with respect to human rights and democracy (Sachs, 1999). Some other authors pointed out the social aspects regarding the sustainable supplier selection such as ethical in supplier-buyer relationship (Svensson & Baath, 2008), the establishment of code of conducts (Mamic, 2005) the prevention of child labour (Winstanley et al., 2002).

It is a fact that most of the developed countries focus more on economic aspects than the social aspects and as a result they are plagued with various social issues such as safety, living conditions, child and bonded labour (Redclift, 2005; Boone & Modarres, 2009). Taking all the above-mentioned into account it can be concluded that even though a few attempts considering the social sustainability related criteria such as the labor or management policy related issues have been implemented, the research regarding social dimensions of sustainability is quite scarce.

Sustainable supplier selection process complexity could be solved by implementing different methods that can evaluate them based on the three aspects of sustainability. Therefore, academia has proposed some methods suitable almost for all type of industries. The section below refers to

different methods regarding sustainable supplier selection, followed by the four widely applied methods.

2.3 Methods for sustainable supplier selection

According to Fallahpour et al. (2017) there are two main issues when it comes to the sustainable supplier selection process. Firstly, the selection of important criteria and corresponding sub-criteria. Secondly, an integrated model which prioritizes and ranks them in order to select the most proper suppliers among the pool of suppliers with respect to sustainable principles. Tseng, Chiang, and Lan (2009) stated that selecting proper supplier is a very difficult issue in the field of SCM because it includes criteria and decision-making tools which are characterized with complexity and uncertainty. Therefore, multi-criteria decision-making frameworks have been used from different researchers in order to select the best supplier among the candidates. There is a vast number of methods that can be adopted in different industries and take into account various criteria.

In order to find out which of these models are more suitable when selecting suppliers, different scholars have reviewed previous literatures. Quite recently Banaeian et al. (2018) identified the usage of TOPSIS, VIKOR and Grey Relation Analysis (GRA) regarding green and sustainable supplier selection. VIKOR was also applied by Wu et al., (2016) for supplier selection in the nuclear industry in China. Shaik & Abdul-Kader (2011) proposed a framework for green supplier selection that takes into consideration environmental, green and organizational factors that are required for the sustainable supplier selection process. Sarkis & Dhavale, (2015) conducted a research which had a triple-bottom-line approach. For fulfilling this research they used a Bayesian framework for supplier selection for sustainable operations. Moreover, Park et al. (2018) used a multi-attribute and multi-objective decision-making approach for sustainable supplier selection in a bicycle supply chain network. In a case-study regarding the selection of sustainable reverse logistics provider, Govindan et al. (2018) applied ELECTRE I. The examined company was from the automotive industry and it was located in India. Furthermore, Vahidi et al. (2018) proposed a QFD framework and applied DEMATEL for Sustainable supplier selection and order allocation under operational and disruption risks in the automotive industry. DEMATEL was also proposed by Song et al. (2017) for sustainable supplier selection. In their case, this method was applied in a solar air-conditioner manufacturer company. Another scholar that preferred DEMATEL for sustainable supplier selection and order allocation was Gören (2018). He took the example of an

online retailer that was located in Canada and applied this method in combination with Taguchi Loss for finding out the most suitable supplier.

Shahryari Nia et al. (2016) applied Delphi method and Fuzzy Choquet for supplier selection with environmental considerations which is mostly useful for car-manufacturing companies, however it can be also used by different firm in the real life. Yazdani et al. (2017) applied an integrated QFD-MCDM framework and implemented DEMATEL for green supplier selection in a dairy company in Iran. Ghadimi et al. (2019) conducted a research for sustainable supplier selection in one of the enabling technologies in industry 4.0. In that research a Multi-Agent Systems (MASs) approach was applied in order to provide a proper communication channel, structured information exchange and visibility among suppliers and manufacturers.

Even though researchers are trying to bring into light new methods and develop further the older ones, the literature shows that still few of them focus on logistics industry. More examples regarding methods examinations and their classification are analyzed further in the section below.

2.3.1 Multi Criteria Decision Making Methods

Due to the complexity regarding supplier selection process, comprehensive frameworks and appropriate multi-criteria models are a necessity in order to rank suppliers and evaluate their performance (de Boer et al., 1998). Decision-making methods reported by various researchers in literature for the supplier selection process can be represented as multi-criteria decision-making models (Kirytopoulos et al., 2008). Dalalah et al. (2011) defined the MCDM process as the process of selecting the best among a set of possible alternatives. The importance of multi-criteria models in supplier selection is increasingly being emphasized in the literature (Hsu & Hu, 2009). However, multi-criteria decision-making tools have been criticized from scholars because of a famous problem, namely rank reversal phenomenon (Mousavi-Nasab & Sotoudeh-Anvari, 2018).

According to García-Cascales and Lamata (2012, pp 124), *“in this phenomenon the alternatives’ order of preference changes when an alternative is added to or removed from the decision problem”*. de Boer et al. (2001) stated that MCDM approaches are of high importance since they can be used in four problem solving stages: problem definition, criteria formulation, supplier qualification, ranking and selection. As reported by Prakash and Barua (2016), incomplete and inadequate information may exist among different selected criteria. This is termed as ‘multi-

criteria decision making' (MCDM) problem. Furthermore, Trapp and Sarkis (2016) advocated the difficulty of sustainable supplier selection in terms of sustainability incorporation due to supply chain complexity.

Zhou et al. (2016) proposed the usage of a hybrid MCDM methods in the automotive industry, by implementing a use-case in China. They demonstrated their usage regarding recycling practices for selecting the best end-of-life vehicle (ELV) recycling merchant. On the other hand, Mardani et al. (2015) considered the MCDM method to be a very complex DM method but an effective tool since it consists of both qualitative and quantitative data. Regarding the establishment of GSCM, Muduli and Barve (2011) stated that it helped mining industries to lessen their environmental impacts, to improve working conditions, attract investors and reduce wastage. Hence, increasing the industry's economic benefits/profitability. However, social aspects have not been examined here. Rao et al. (2017) implemented a decision mechanism in their research which was based on a linguistic 2-tuple and the grey correlation degree, through the usage of hybrid data/information. Srivastava's (2008) definition regarding GSCM includes also the material sourcing and the final product delivery to the customer and its end-of-life management after its purpose fulfilment. In their research Padhi et al. (2018) used MCDM methods for sustainable supply chain selection processes in different industries such as pharmaceutical, agricultural and chemical.

Chai et al. (2013) stated that Multiple Attribute Decision-Making (MADM) techniques have been extensively used for supplier selection and evaluation. According to Tavana et al. (2017) the integration of different MCDM methods allows to overcome the inadequacy of the individual methods, to deal with real-world limitations/drawbacks such as processing capacity, incomplete information and fuzzy evaluations. Therefore, a number of hybrid methods have been proposed. The increase of fuzzy sets theory is obvious in the last two decades. Hence, more and more researches are applying fuzzy sets in their papers. These fuzzy sets have their roots in fuzzy logic which is a multi-value logic that permits intermediate values to be interpreted within conventional evaluations (Zadeh, 1965). According to Dalalah et al. (2011) decision-making process often occurs in fuzzy environment with imprecise/uncertain information, hence when it comes to decision-making process, subjectivity, uncertainty, and ambiguity in assessment process might make the decision makers feel confused. Orji and Wei (2015) implemented two methods in their research, a fuzzy-logic in order to solve imprecise data and ambiguous human judgment, and

system dynamic (SD) in order to investigate the dynamic behavior of the system status alteration consistent to system variable changes. Furthermore, they stated that MCDM models are not able to fully understand the complexity in the supplier selection nature regarding the three pillars of sustainability (i.e. social, environmental and economic dimensions).

Ho et al. (2010) stated that AHP and goal programming (GP) approach are the most common methods for vendor selection. Some other researchers have addressed the vendor selection issues in green management by applying AHP model (Noci, 1997; Lu et al., 2007; Chiou et al., 2008). Moreover, Aguezzoul (2014) concluded that the main MCDM methods used in the case of 3PL provider selection are: Analytic Hierarchy Process (AHP) (Ho et al., 2012; Lehmusvaara et al., 1999; Falsini, et al., 2012), Analytic Network Process (ANP) (Meade & Sarkis, 2012; Jharkharia & Shankar, 2007; Hsu et al., 2013; Thakkar et al., 2005; Liou & Chuang, 2010), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) (Bottani & Rizzi, 2006; Kannan et al., 2009; Büyüközkan & Feyziog ̇lu, 2008) and Data Envelopment Analysis (DEA), (Zhou et al., 2008; Hamdan & Rogers, 2008; Falsini et al.,2012).

Additionally, Chai et al. (2013) reviewed 123 journals from 2008 to 2012 on decision making process in supplier selection and concluded that the most widely used approach is AHP (24.39%), followed by LP (15.44%), TOPSIS (14.63%), ANP (12.20%), DEA (10.57%), and multi-objective optimization (10.57%). Jato-Espino et al. (2014) studied the application of multi-criteria decision analysis in the construction industry by analyzing 88 relevant papers over the last two decades. Based on the approach type, they divided these methods into single approaches (i.e. AHP, DEA, ELECTRE, TOPSIS, ANP) and Hybrid approaches (AHP, ANP, TOPSIS, MIVES). They concluded that among the other methods, AHP and TOPSIS seem to be the most preferable especially when they are implemented in combination with other techniques.

Another attempt was implemented by Zimmer et al. (2016) which reviewed 143 publications regarding SSM with focus on formal models used by decision-makers for supplier selection/evaluation. Considering the big variety of methods that were implemented in these papers they decided to accumulate all of them into one model (*see figure 2*). In this model, they divided the methods in two main categories based on the model type (i.e., Single and Combined models) and in four sub-categories (i.e., Qualitative, Mathematical Programming, Mathematical Analytical

and Artificial Intelligence) based on the modelling approach. They concluded that despite the fact that PROMETHEE method was widely used in the past, AI single or MA in combination with AI seems to be the new trend in SSM literature especially from 2010 (Zimmer et al., 2016).

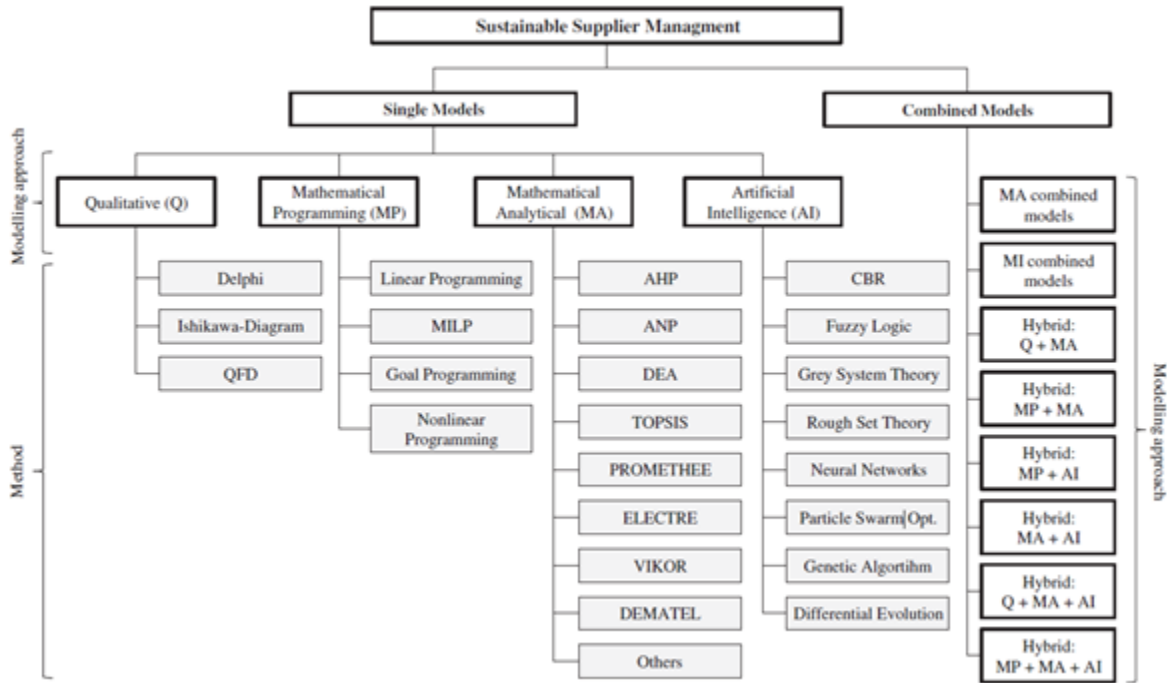


Figure 2. Modeling approach. Source: Zimmer et al., 2016

By taking all the above-mentioned literature into account, next section consists of the analysis of the four most preferable methods (i.e. ANP, AHP, DEA, TOPSIS) for sustainable supplier selection/evaluation.

2.4 Data Envelopment Analysis for sustainable supplier selection

2.4.1 Data Envelopment Analysis definition

Sustainability is a relatively new concept and some of the models/methods that are being used today for sustainable supplier evaluation/selection are quite old. Charnes, Cooper and Rhodes (1978) implemented a new method for adjusting data to prescribed theoretical requirements such as optimal production surfaces, etc., prior to undertaking various statistical tests for purposes of public policy analysis. This method was named Data Envelopment Analysis (DEA).

Bousofiane et al. (1991, pp. 15) defined this method as “a linear programming-based method for measuring the relative efficiency of organizational units”. Furthermore, they also stated that “DEA

models can be suitable modified to yield targets compatible with desired changes to the input/output levels of the units being assessed” (Boussofiane et al. 1991, pp. 10). Moreover, they claimed that DEA can identify the most and the least efficient units at the same time, measure the conservation of resources of the possible outputs. The term units refer to the selected inputs/outputs each time that this method is used, however this selected sample of units needs to be smaller than the total units (Boussofiane et al., 1991).

DEA can also be used for: identifying efficient operating practices, identifying efficient strategies, resource allocation, using peer groups, target setting and for monitoring efficiency changes over time (Boussofiane et al., 1991). As a result, different scholars have implemented this method in their researches in order to evaluate/select sustainable suppliers.

2.4.2 Data Envelopment Analysis application in sustainable supplier selection

In order to point out the importance and the wide usage of the DEA method, different scholars have examined relative articles over the years. Gattoufi et al. (2004) made an attempt to collect all relevant literature from 1951-2001 regarding DEA in a file. They took as base Seiford's (1997) list and updated it with more than 100 new articles. Ho et al. (2010) reviewed the literature from 2000-2008 and concluded that DEA is the most prevalent individual approach regarding efficiency evaluation in terms of DMUs. van Weele (2010) defined as DMU all individuals and groups of people that are involved in purchasing decision making process. These people share some goals and the risks that can arise from these decisions.

Emrouznejad and Yang (2018) conducted research regarding DEA articles that had been published in different journals and books from 1978-2016. They studied and collected data from 10,300 DEA-related articles in total. Furthermore, Zhou et al. (2018) narrowed their research by studying 320 relevant articles from 1996 to March 2016. They concluded that the current key route of DEA in sustainability focuses more on eco-efficiency measurement which is related to maximizing the economic outputs and minimizing the negative environmental impacts. Moreover, DEA models have been applied from different scholars not only for issues related to the supply chain but also regarding regional and national sustainability issues (ibid).

It was Callens and Tyteca (1999) that first proposed the evaluation of corporate sustainability through DEA by considering the three dimensions of sustainability. Azadi et al. (2015) have used

DEA method in resin production company in order to evaluate supplier's performance from the sustainability perspective. DEA was also proposed by Dobos and Vörösmarty (2018) for green supplier selection in order to solve inventory related problems. Later on, Rashidi and Saen (2018) claimed that DEA allows investigators to consider the three dimensions of sustainability (i.e. economic, environmental and social criteria) in the evaluation process of sustainable suppliers. They applied this method in a company from machinery industry. Shabanpour et al. (2017) applied GP and DEA for ranking sustainable supplier in an engineering company in Iran. Same approach was implemented by Torres-Ruiz and Ravindran (2019) for sustainable supplier selection in an auto parts manufacturer company. Romero (2004) stated that through goal programming (GP) decision-makers can have a clearer view regarding expected and realized goals, and through its combination with D-DEA suppliers can be evaluated regarding their past, present and future performance (Shabanpour et al., 2017). DEA can be successfully applied for sustainable supplier selection in the mining industry (Gupta et al., 2018). Moreover, Hatami-Marbini et al. (2017) developed a methodology based on DEA for identifying supplier performance. They present a case study from the semiconductor industry to demonstrate the applicability of this model and the efficacy of the procedures and algorithms. Quite recently Moheb-Alizadeh & Handfield (2019) have applied DEA approach to evaluate potential suppliers in a manufacturing and engineering company in automotive industry.

Wu and Blackhurst (2009) used data envelopment analysis (DEA) in their research and proposed a methodology that incorporates standards which embellish the ability for organizations to evaluate and rank suppliers. Furthermore, more recently Zhou et al. (2018) identified that traditional DEA models are the most periodically used in sustainability study topics since they use the radial to scope and calculate efficiency based on the input overabundance and output imperfection. Yousefi et al. (2016) applied the data envelopment analysis (DEA) approach for determining benchmarks regarding ineffective decision-making units. However, the traditional model of this method failed to rank efficient decision-making units (DMU) therefore, they proposed a new approach through dynamic data envelopment analysis (D-DEA) and dynamic ideal decision-making units (DIDMU). On the other hand, Slack-based models (SBM) introduced by Tone (2011) are the most commonly used for evaluating the sustainability of DMUs from both macro and micro aspects by counting unwanted outputs in the model. Some scholars stated that DEA is a valuable tool for sustainability performance evaluation since it could provide benchmark systems to companies in

order to find the most cost-effective manner (Gómez-Limón et al., 2012; Kuosmanen & Kortelainen, 2005). In this way the environmental depravity reduction can be achieved, and policymakers can reach improvements instead of impending economic activities.

Çelebi and Bayraktar (2008) applied the integration of DEA approach and neural networks for the assessment of suppliers under incomplete information. Toloo and Nalchigar (2011) proposed an integrated DEA model for determining the most efficient suppliers with imprecise data.

Even though many scholars have approved DEA methods as suitable for sustainability evaluation, there are some others that believe that efficiency in DEA models is a relative concept. Hence, defining DEA models as non-suitable for sustainability performance evaluation (Callens & Tyteca, 1998; Huppel & Ishikawa, 2005). Despite that a big variety of researches regarding DEA methods and their implementation in different aspects exist, there is still a gap in the literature as for the evaluation of interactive impacts between the three elements: social-environmental, environmental-economic and social-economic (Zhou et al., 2018).

2.5 Technique for Order of Preference by similarity to Ideal solution for sustainable supplier selection

2.5.1 Technique for Order of Preference by similarity to Ideal solution definition

TOPSIS was developed on 1981 by Hwang and Yoon. They defined TOPSIS as a practical and useful technique that allows to rank and select alternatives based on their distances from the ideal and the negative ideal solutions. The uniqueness of this method is that two artificial alternatives are being defined as an ideal or positive solution and a non-ideal solution or negative solution (Rouyendegh & Saputro, 2014). In the first alternative, the benefit criteria are maximized while the cost criteria are minimized. In the second alternative (i.e. non-ideal/negative solution), the cost criteria are maximized while the benefit criteria are minimized (Wang & Elhag, 2006). In order to make it easier for the reader to understand how this method is used, Prakash and Dev (2014) created a matrix where the steps of the method are provided (see figure 3).

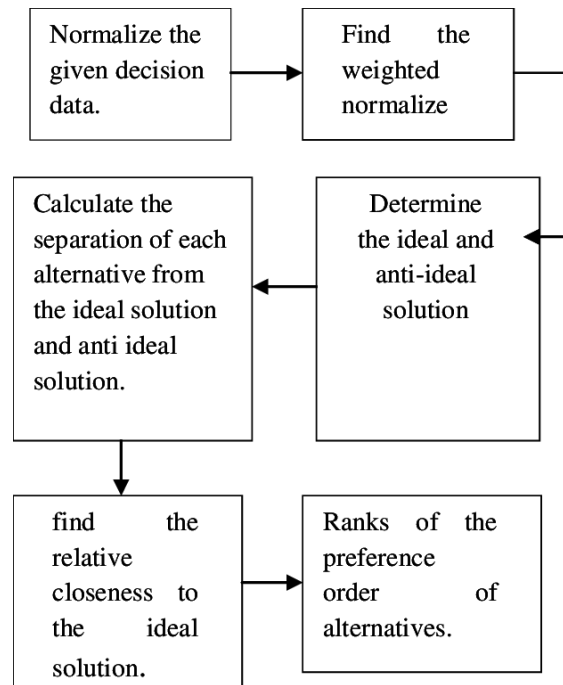


Figure 3. Steps used in TOPSIS method. Source: Prakash and Dev, 2014

2.5.2 Technique for Order of Preference by similarity to Ideal solution application in sustainable supplier selection

As mentioned before, during the last years an increase in published articles regarding TOPSIS is noticed. Almost 50% of them were published since 2010 (Behzadian et al., 2012). Yang et al. (2011) implemented the TOPSIS method in the railway industry for vessel selection under uncertain circumstances. Behzadian et al. (2012) reviewed 266 papers regarding TOPSIS published since 2000 and classified them into nine categories based on their application area (i.e. 1. Supply Chain Management and Logistic, 2. Design, Engineering and Manufacturing Systems, 3. Business and Marketing Management, 4. Health, Safety and Environment Management, 5. Human Resources Management, 6. Energy Management, 7. Chemical Engineering, 8. Water Resources Management, and 9. Other topics). Among them, TOPSIS is widely applied in the first two categories since more than half of the published literature relates to them.

Behzadian et al. (2012) stated that TOPSIS can be easily combined with other methods. In their research they presented a table with all the combinations that exist so far. Among these articles around 53% consist of fuzzy set approach, followed by group decision-making approach (28,6%) and AHP (23,3%) (ibid). According to Yang et al. (2011) TOPSIS is used to answer various types

of problems of selecting a finite number of alternatives by multiple conflicting criteria. Still, there are some factors that cannot be defined thus leading in inaccurate results. Therefore, a fuzzy set needs to be combined with TOPSIS for bringing into light more accurate results. Krohling and Pacheco (2015) applied a novel method based on TOPSIS for solving the problem of ranking and comparing algorithms. Moreover, Chu (2002) used TOPSIS for solving location problem.

Yu et al. (2019) proposed TOPSIS as the most suitable method for sustainable supplier selection. They proved the validity of this method by examining the case study of a home appliances manufacturer in China. In order to solve issues related to sustainable supply chain evaluation and risk management in Oil industry Rostamzadeh et al. (2018) applied TOPSIS in a real case-study in Iran. Moreover, Nourmohamadi Shalke et al. (2018) applied also TOPSIS for sustainable supplier selection in a company that is operating in the manufacturing and packaging protein-based food industry in the north of Iran. Jia et al. (2015) proved that TOPSIS method is suitable for ranking potential suppliers by implementing a research in the fashion industry in India. Quite lately, Li et al (2019) proposed a rough cloud TOPSIS approach for sustainable supplier selection based on SSCM practices. This method was used in a real-case study and the collected data were obtained from a Chinese state-owned energy company. Gupta and Barua (2017) used TOPSIS as suitable for supplier selection focusing on the green initiatives by examining a real case in the automobile industry. Sen et al. (2018) used TOPSIS and GRA in their empirical case-study for sustainable supplier selection in fuzzy environment. Furthermore, Ahmadian et al. (2017) have proposed a framework using a case study involving selection of material and supply structure for curtain wall of a building in Australia. The framework is supplemented by a MCDM module based on the technique for order preference by similarity to ideal solution (TOPSIS) to account for the trade-offs between different economic and environmental impacts associated with the supply decisions.

In their research Awasthi et al. (2011) took a logistics company and implemented TOPSIS for selecting the right location for distribution center under uncertainty. According to Boran et al. (2009) the combination of TOPSIS with intuitionistic fuzzy set has tremendous chance of success for MCDM problems regarding the vague perception of decision makers opinion. Fuzzy TOPSIS is applied to make an intuition regarding the intangible criteria of suppliers, hence treated as eligibility parameter for each supplier. Moreover, Chen et al. (2006) implemented TOPSIS for

solving supplier selection problems in fuzzy environment and for resolving issues regarding supplier profitability, technological capability, conformance quality, relationship closeness and conflict settlement factors.

In their research regarding supplier selection and order allocation, Rouyendegh and Saputro (2014) aimed to adopt the hybrid method by using TOPSIS combined with triangular fuzzy number and MCGP. Multi-Choice Goal Programming is an analytical method proposed for the first time by Chang (2007). This method is suitable for multiple decision variables coefficient problems. Consequently, the combination of TOPSIS with MCGP can avoid the thoughtlessness in DM (Rouyendegh & Saputro, 2014). TOPSIS was also preferred by Wen et al. (2013) regarding sustainable supplier selection for calculating the relative closeness coefficient of alternatives. Besides, Kahraman et al. (2009) implemented TOPSIS to knob outsourcing decision-making obstacles. Techniques for Order Preference by Similarity to Ideal Solution (TOPSIS) has also been demonstrated by Saen (2010) for supplier selection and evaluation. The fact that TOPSIS method is quite easy to calculate and close to ideal and non-ideal solutions to a decision-making problem has made its applicability wide. Hence, it is being rated in the second place after the AHP regarding the most employed options (Jato-Espino et al., 2014).

2.6 Analytic Hierarchy Process for sustainable supplier selection

2.6.1 Analytic Hierarchy Process definition

In green supply chain literature, different approaches have been adopted to evaluate and select the best suppliers. One of these approaches is Analytical Hierarchy Process (AHP) which was applied by various investigators in their researches (Noci, 1997; Handfield et al., 2002; Lu et al., 2007; Chiou et al., 2008; Lee et al., 2009; Grisi et al., 2010).

AHP is a multi-criteria decision approach which was developed initially by Saaty (1980). He defined AHP as “*a general theory of measurement. It is used to derive ratio scales from both discrete and continuous paired comparisons. These comparisons may be taken from actual measurements or from a fundamental scale which reflects the relative strength of preferences and feelings*” (Saaty, 1980, pp. 161). AHP is a well-known method used in MCDM process to identify and analyze the hierarchy of the decision factors of a decision problem (Saaty 1980; 1986).

According to Luthra et al. (2017) AHP is a decision analysis model that helps to prioritize the evaluation criteria of sustainable supplier selection. This method is based on three basic principles: *“Building a hierarchical structure by decomposing a decision-making problem into a hierarchical form leading to sub-problems that can be easily realized and evaluated, determining priorities of the elements at each level of the decision hierarchy, and synthesizing priorities to determine overall priority of the decision alternatives”* (Gupta et al., 2018, pp.4). The applicability of AHP method has been used and implemented in many decision-making situations in several fields such as SCM, engineering, design, education, management and energy (Ordoobadi, 2010; Bao et al., 2013; Luthra et al., 2015).

2.6.2 Analytic Hierarchy Process application in sustainable supplier selection

The use of AHP has increased exponentially during 2005 to 2009. It functions as a dominant factor in manufacturing (Sipahi & Timor, 2010) and it makes a complex decision-making process more rational (Handfield et al., 2002). Ho et al. (2010) declared that the analytic hierarchy process is the most popular method for supplier selection. The AHP-based models for supplier selection are very useful in decision making. It has been reported that AHP is one of the most well-known and common techniques used in this area (Ho et al., 2010). This method can be used to establish measures with both tangible and intangible factors. This method has been adopted widely in multi-factor analysis, planning and resource allocation as well as in conflict resolution (Saaty, 1987). Gupta et al. (2018) also stated that the AHP model has been applied in a wide variety of decision-making situations including group-decision making. They also found that this method is the most applied method either in solo or in integration with other methods (Chai et al., 2013). To follow up (Kang & Park, 2014; Mangla et al., 2016) concluded that although decision-making process may be made by AHP itself, but the MCDM process usually obtains superior results by incorporating AHP with other decision support frameworks.

According to Ho et al. (2010) findings, the popularity of this method is due to its simplicity, ease of use, check of consistency and great flexibility. This model resolves the problems by considering the problem in a hierarchical form where the lower-level variables are the subsets of the higher-level variables. Prioritization of the criteria and sub-criteria is done at each level of hierarchy by using the experts' knowledge and judgment. However, due to the existence of interdependencies

between criteria and sub-criteria several MCDM problems cannot be structured in a strict hierarchical manner (Saaty, 2001).

Gupta et al. (2018) mentioned several cases of applying AHP in different industries in order to facilitate and improve the decision-making process with focus on supplier selection process. Gupta et al. (2018) applied AHP in order to prioritize different parameters regarding the selection of the most sustainable vehicles for transportation. In their research they referred to previous researches in this topic and concluded that despite the fact that AHP is one of the most preferable methods for MCDM problems in several industries, its applicability in transport issues scores quite low. There are many real-case examples where AHP has been used. Mohanty and Deshmukh (1993) adopted AHP for assessment of the supply sources. Liu et al. (2005) integrated AHP and DEA in order to exploit benefits of both models, where AHP can bring out the weights of indicators and the DEA model can rank the suppliers and identify the weaker suppliers. Ho (2008) and Sipahi & Timor (2010) chose an AHP model as their main evaluation framework due to its ease of use and well-known applicability in different life cases. Mani et al. (2014) adopted AHP method as a decision-making framework for the sustainable supplier selection with focus on social aspects.

Singh and Nachtnebel (2016) used AHP model in order to rank hydropower schemes taking into account social, economic and environmental dimensions. Awasthi et al. (2018) used AHP-VIKOR for sustainable global supplier selection that takes sustainability risks from sub-suppliers into account. Sarkis et al. (2012) applied AHP & ANP in order to incorporate sustainability into contractor evaluation and team formation in the built environment in general with no real case applicability. Ware et al. (2014) applied AHP for flexible supplier selection by taking into account both qualitative and quantitative factors. Kumar et al. (2017) have applied integrated fuzzy AHP and fuzzy multi-objective linear programming approach for order allocation among suppliers. The case study has been conducted in an Indian automobile company. Gupta et al. (2016) have developed an optimization model which integrates multi-objective integer linear programming and AHP model for sustainable vendor selection. A weighted possibilistic programming approach was also considered as a solution approach to solve the optimization model (solution approach + integrated model). The case study of this research is a multinational company located in India specialized in designing and manufacturing various kinds of automobile parts. Mani et al. (2014) applied AHP for sustainable supplier selection with focus on the social aspects of sustainability in

the emerging economies. Firms engaged in electrical, automotive and cement manufacturing were examined for the case study.

Luthra et al. (2017) applied AHP and VIKOR for sustainable supplier evaluation in the automotive industry in India. Neumüller et al. (2016) applied AHP and GP for the implementation of a sustainable supplier portfolio in the automotive industry. Gupta et al. (2018) used AHP & DEA for selecting a sustainable transportation way the mining industry in India. Torres-Ruiz & Ravindran (2018) developed a MCDM model and applied AHP that aligns sustainability goals regarding the risk assessment in the supplier portfolio. They implemented this model by collecting real data from a global manufacturer of consumer products with operations in Mexico. Kaur et al. (2016) have proposed a sustainable flexible framework using integer linear programming integrated with various MCDM techniques such as AHP, ANP, TOPSIS, etc. for sustainable supplier selection process.

Awashti et al. (2018) have integrated AHP and VIKOR techniques to evaluate the global suppliers and sub-suppliers based on the sustainability criteria. Dey et al. (2015) in their research have investigated on strategic supplier performance evaluation of a UK-based carpet manufacturing organization through using an integrated analytical framework. They have utilized an integrated analytical model that combines quality function deployment and the analytic hierarchy process method for suppliers' performance evaluation. Azadnia et al. (2014) have integrated various MCDM methods including AHP approach in order to select sustainable supplier selection. The case study of packaging film in a food industry has been carried out in this research. Pishchulov et al. (2019) proposed a VAHP tool in order to help purchasing managers in the sustainable supplier selection process since this method takes three dimensions of sustainability into consideration. They applied this method in a company from the wood construction industry, based in Switzerland.

Guarnieri and Trojan (2019) used AHP and ELECTRE-TRI for selecting sustainable suppliers with a focus on social, ethical and environmental aspects in a textile industry. Liu et al. (2019) proposed AHP-TOPSIS model which considers quantitative and qualitative criteria as well as objective and subjective data. The applicability of the tool has been demonstrated through a case study in an agrifood value chain in France. Zhou et al. (2019) have applied an AHPSort II method

for sustainable supplier selection (SSS) to IT2FSs. Xu et al. (2019) have applied an AHPSort II method for sustainable supplier selection (SSS) to IT2FSs.

In supplier selection, AHP has been used for both determination of criteria weight and performance evaluation (Luthra et al., 2017). However, the findings showed that the conventional AHP is not very useful in case of uncertainty. There are some drawbacks and limitations associated with this method. The method only considers one-way hierarchical relationships among variables and it does not take into consideration the interactions among the different criteria, besides this model may produce rank reversal (Dou & Sarkis, 2010). It also does not take into account the dependency and feedback between the elements of hierarchical model (Kuo et al., 2010).

Jharkharia and Shankar (2007) also emphasized that the major limitation of AHP is the assumption of independency among the different decision criteria. In addition, a large number of criteria and alternatives cannot be handled effectively in AHP because of fatigue that exists due to the repetitive assessments that must be made by the decision maker (Briand, 1998). Therefore, using this model might result in a decision that is less than optimal (Kadoic' et al., 2017).

In order to solve/overcome the above-mentioned limitations Saaty (2001) proposed the Analytic Network Process (ANP).

2.7 Analytic Network Process for sustainable supplier selection

2.7.1 Analytic Network Process definition

The ANP is the second generation of the Analytic Hierarchy Process, which has been widely used for multiple-criteria decision making problems (Deng et al., 2014; Saaty & Sodenkamp, 2008). Same definition has been stated by Tavana et al. (2017, pp. 256) as “ANP is a generalised/an extension form of AHP enabling decision makers (DMs) to define and study the functional interdependency existing among the decision factors belonging both to different levels of a hierarchy and to the same level”.

2.7.2 Analytic Network Process application in sustainable supplier selection

ANP has been utilized to support decision-makers on the initiation of TBL-driven supplier evaluation/assessment (Lin et al., 2015). Recently, ANP has also been accepted in the supplier selection due to its advantage of considering interdependencies of higher-level elements from

lower level elements. According to Kannan (2018) ANP assumes the influence of some elements over others by using the network. The four major steps of ANP has been defined by Kannan (2018) (see figure 4).

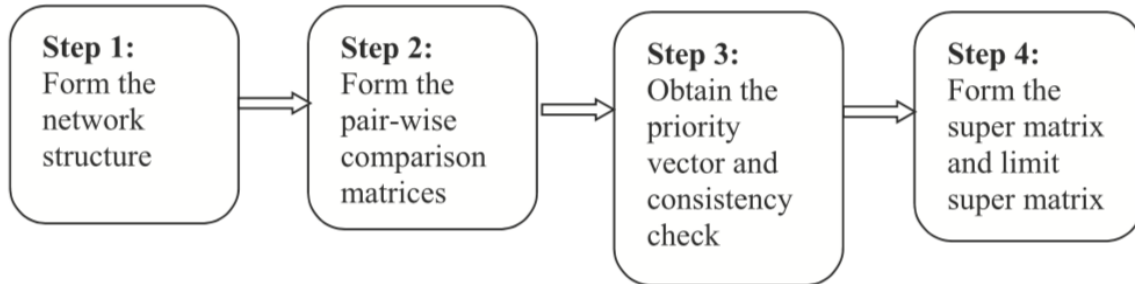


Figure 4. Four major steps of ANP (Kannan, 2018, pp. 397)

Govindan et al. (2016) stated that the ability to consider interdependencies and feedback among criteria is the main advantage of ANP over other MCDM tools such as AHP and TOPSIS. Because all real-life problems are interlinked, it is important to utilize a methodology that addresses interdependencies (Wu, 2008). However, this model considers interdependencies, but it represents those interlinks in a reciprocal manner (two-way relationship) (Ho et al., 2010). Kadoić et al. (2018) also concluded that one of the most advanced and complex multi-criteria decision-making models is ANP. Similarly, among multi-criteria decision models, ANP has been recognized as one of the most popular techniques according to Ho et al. (2010) after the examination of 78 articles. Additionally, in situations where the hierarchy between variables are not very clear and can goes both ways and finally where the interdependence among variables cannot be excluded, ANP is the best option available to the decision makers.

Saaty (1996) also stated that this model takes into consideration interdependencies among the decision criteria and brings out a more systematic analysis. It also allows inclusion of all the relevant criteria (tangible or intangible, objective or subjective) that can affect the decision-making process.

Similarly, some scholars stated that this model can be adopted by decision makers to present a non-linear network structure of a multi-criteria decision-making problem with possible

interdependencies and feedback (Nguyen et al., 2014; Saaty & Sodenkamp, 2008). Therefore, ANP is applied when dealing with more complex decision-making problems (Dou et al., 2014).

The major advantage associated with ANP in comparison to AHP is that complex relationships among variables that represent the real-life issues can be easily represented and evaluated (Faisal et al., 2007). Using the network structure of the ANP, decision makers can avoid the issues related to what criteria comes first and what comes next as in a hierarchy. Additionally, Girubha, et al. (2016) claimed that ANP is more advanced in compared with AHP because it considers the group interrelationship. Therefore, this method has found wide applications in a variety of MCDM problems including supply chain management (Faisal et al., 2007). However, the usage of ANP or AHP for computation of weights has been appreciated (Girubha et al., 2016).

Verdecho et al. (2010) proposed a performance management model based on ANP for supplier selection in automotive industry in Spain. Zhu et al. (2010) applied this model for a portfolio-based analysis in supplier selection. They declared that this approach is not complicated, and both quantitative and qualitative criteria are mixed into the decision-making process, therefore, it helps to gain a common solution for multiple parties. Neumüller et al. (2016) proposed a method based on a combination of ANP and GP which meets all the requirements for integration of three-dimensional sustainability into strategic supplier selection. Abdel-Baset et al. (2019) have employed ANP and VIKOR method for evaluation and selection of suppliers. The aim of this study to solve the problem of supplier selection in sustainable supplier chain management. This study has been conducted in a large importing company in Egypt. Faisal et al. (2007) have developed a multi-criteria decision model which considers simultaneously the impact of three dimensions of 3BL approach and their sub-dimensions on the supplier selection decision. The proposed approach was applied to the supplier selection problem for a large white goods manufacturer in India using the ANP approach. Kuo et al. (2010) have combined ANN and ANP models into DEA model to build a green supplier selection system. Girubha et al. (2016) have applied ANP, VIKOR and ELECTRE in order to evaluate and select the most suitable suppliers from the sustainability perspective. The case study was carried out in electronic switches manufacturing company in India. Büyüközkan and Çifçi (2011) have proposed ANP method in order to analyze the sustainability of a number of suppliers in a main producer of a Turkish white goods industry.

Tavana et al. (2017) applied an integrated ANP–QFD framework for sustainable supplier selection in a dairy company. Lin et al. (2015) applied ANP based on the Triple Bottom Line (TBL) for sustainable supplier selection at a Taiwanese Electronics Company. Lin et al. (2015) used this framework to identify key factors for a sustainable supplier selection at a Taiwanese electronic company, based on the triple bottom line. They concluded that product design for sustainability and GSCM scores higher among other factors in supplier selection. Sarkis (1998) has observed that ANP has been effectively applied in decisions related to energy policy planning, product design, and equipment replacement. Jharkharia and Shankar (2007) has adopted ANP-based model in order to select the logistics service providers. Due to the fact that there are a huge number of criteria when selecting providers (objective and subjective) which are also interrelated, therefore, they suggested ANP model due to its consideration of interdependencies/interrelations among different decision attributes which has rarely been applied in the context of outsourcing decisions. Jharkharia and Shankar (2007) concluded that the development of such model demands significant time and efforts from the decision-makers in the formation of pairwise comparison matrices, therefore, this model should be applied for long-term objectives. Despite the fact that this technique is computationally intensive, the benefits of risk reduction will overcome the cost and time. However, they came up with some drawbacks with this model such as the outcome of the model is dependent on the inputs provided by the logistics manager of the company. It is not possible to roll out the bias of the decision-maker towards any particular provider while using this model. Therefore, group decisions should be preferred in the pairwise comparison. The formation of pairwise comparison matrices is a time-consuming and complex task. Inconsistency may also arise in the pairwise comparison of matrices, which may lead to wrong results.

Another disadvantage with ANP is the increase of effort by analysts and decision-makers when the number of factors and respective interrelationships increase (Sarkis & Talluri 2002; Jharkharia & Shankar 2007). Nguyen et al. (2014) also after applying this method for decision making process within a green supply chain, stated that the major disadvantage with this method is the substantial amount of decision-maker input that is needed. According to Kadoić et al (2018) since ANP is characterised by complex and time-consuming processes, the implementation of the ANP can be difficult and decision makers usually misinterpret some of ANP steps.

Based on the reviewed articles (i.e. more than 200 articles) the methods which have been used in order to select and evaluate sustainable suppliers are mainly quantitative approaches and the selected criteria are mainly quantified criteria. Despite the fact that many authors have applied these models, they didn't always take the three aspects of sustainability into consideration. After studying the relevant articles within logistics industry, the findings showed that sustainability aspects in this industry have not been considered and the majority of the company focus more on the economic aspects when selecting logistics suppliers. Even though sustainability and sustainable supplier selection process have gained a lot of attention, still there is room for improvement especially regarding the qualitative approaches which seem to not be preferred from researchers and in this case, there are very few studies that have been conducted related to sustainable logistic provider selection.

3 Methodology

Literature review is an important part for any research since gives access to authors to examine previous research in the topic, to find out possible gaps in the sector, detect the association between different concepts, to answer the current research question/s and to provide solutions in present issues as well as to propose further recommendation in potential issues. By taking this into account, this paper aims to answer the research question by examining a considerable number of companies in Sweden and more specifically in the city of Gothenburg. These companies must be active in the Swedish market and comply with sustainability regulations. Among the four types regarding data collection that will be analyzed in the particular section below, individual interviews is selected for the fulfilment of this research. For achieving a valid and reliable result, the interviewees are chosen from purchasing or from any department that is connected to supplier selection for goods and services. For example, someone that works in the logistics department or transport department can participate in this research since these two departments are related with the main topic of this paper.

The sample of this research consists of ten companies and their analysis has to be under a short period of time. Seeing that the sample is not very big, the quantity of data scores low, whereas the quality scores high since the outcome of this research will be rich in details and nuance (Collis & Hussey, 2014). In this research the interviewees are asked to give more details regarding the

answers and elaborate on each question. Additional questions will be addressed if needed. For a more complete view regarding interviewees, demographic data will be collected. Demographics data can provide information as for the gender, age, ethnicity, employment status of the participants. These data are useful part of a research because they can be used in the future by other researchers that want to study the same age groups, gender or employment status and their behavior (French 2014).

3.1 Research approach

3.1.1 Inductive and Deductive approach

Three types as for the research approach exist, inductive approach and deductive approach and abductive approach. Goddard and Melville (2004) claimed that inductive approach, is also known as inductive reasoning, since it begins with the observations and theories are proposed close to the end of the research process as a result of observations. Also, in an inductive research the pattern from observations is being examined as well as the explanation development of those pattern theories based on hypotheses (Bernard, 2011). However, in an inductive approach these hypotheses are not applied from the beginning. Hence, providing the researcher with freedom as for the study direction after the research initiation (John Dudovskiy, 2018).

On the other hand, the deductive approach has to do with the development of a hypothesis/ses based on the existing theory followed by designing a research strategy in order to test these hypotheses (Wilson, 2010). The deductive approach is also known as deductive reasoning which mean reasoning from the particular to the general, whilst inductive reasoning is the opposite (Pelissier, 2008).

According to Babbie (2010, pp.52) a deductive approach begins with an “expected pattern that is tested against observations, whereas induction begins with observations and seeks to find a pattern within them”. In this research no expected pattern exist, therefore this method is not suitable for the implementation of the purpose of this paper.

Finally, as for the third approach, Peirce (1998) relates abductive reasoning with the adoption of a hypothesis which is suggested based on the facts. Even though different facts exist, no hypothesis has been tested in this paper. However, considering that we started with some observations

regarding the methods that companies are using in order to select and evaluate their logistics service providers, it can be concluded that this research follows the inductive approach. When the interviews were completed, we identified the pattern based on our observations. Common key words or actions taken by companies were studied deeper for finding the connection.

3.2 Research paradigm

This research follows the interpretivism paradigm. It is focused on exploring the complexity of social phenomena with an intention of gaining interpretive understanding. Therefore, findings are derived from qualitative methods of analysis and are based on the clarification of qualitative research data (Collis & Hussey, 2014). This is the most suitable method for this research since the researchers are involved with what is being researched through the interviews. Considering that we have an academic background relative with logistics and sustainability, the interviewees are asked to explain more and go deeper into details for a better response to the questions.

When implementing the interpretivism paradigm, people that are involved are treated as an important partner in the research. On contrary, in the positivist paradigm people are treated as objects (Tuli, 2010). The main reason of this difference is that positivist researchers are trying to be as objective as possible and emphasize more on measuring variables and testing hypotheses. Considering that qualitative researchers examine how people learn about and make sense of topics based on their daily life, Hox and Boeije (2015) proposed a flexible and sensitive to the social context method for data collection. Hence, we have followed their example by excluding question that can bring an unpleasant experience to the interviewees.

According to Holloway (2005) interviews that are implemented in the qualitative researches can be called conversations with a purpose that aim to explore the “insiders’ perspective”. On the other hand, quantitative researches focus mostly on the large volume of numerical data analysis and is detailed (Al-Qurtas & Zairi, 2003). Forasmuch as that the research questions of this paper cannot be answered with numerical data, the quantitative approach is not suitable for this research. Moreover, since these research questions are addressing a topic that needs details as well as the “insiders’ perspective”, the qualitative approach is more suitable.

In our case interviews take place in the subjects' office or on-site in the company under consideration each time. The place is chosen from the interviewee in order to make him/her feel more comfortable during the interview. As for the type of interview, the semi-structured method is applied since is more suitable due to the limited number of the companies in this research as well as the broad and semi-structured type of questionnaire. However, since the interviews are conducted with semi-structured questions, during the interview some other questions might be asked too. According to Mason (2002) no research interview can be entirely devoid of structure. Therefore, the majority of interviews used in qualitative researches has to be semi/lightly structured, loosely structured or in-depth in format and aim (Leicester & Lovell, 1997).

In our case the interview is more like a conversation between the examiner and the firm's employee. Based on the interviewee's responses, more questions regarding the topic are addressed. There are some specific questions that each interviewee is required to answer and are they are the same for all participants known as "interview guide" (Bryman & Bell, 2011). This "interview guide" has been formulated based on the literature review in order to answer in the most proper way the research questions of this paper. Questions may not be addressed according to the schedule but they all will be asked, and a similar wording will be used from interviewee to interviewee (ibid). However, all interviews are unique since each interviewee is unique. This uniqueness is important for the researchers who acknowledge the individuality, and humanity of each interviewee (Holloway, 2005).

All interviews will be confidential therefore, the name of the interviewee and the company that is representing will not be mentioned. On contrary, companies will be referred with coding such as: C1, C2...C10. Considering that almost all the examined companies are big "players" in their sector, we are not going to disclose the name of the interviewed companies in this study due to confidentiality reason. Furthermore, findings will be presented in tables and coding will be applied for each question.

3.3 Research design

According to Yin (2003) a research design connects the collected data in a logical way. There are some types of designs that usually researchers implement in their papers such as: concurrent design, embedded design, explanatory and exploratory design. Among them the last two types are

the most widely used where exploratory design is the most preferable in the qualitative studies (Creswell & Clark, 2017). Moreover, Harrison and Reilly (2011) defined this design as the most suitable when exploring relationships and developing a new theory. As is mentioned above this research is following the interpretivist paradigm, therefore a more detailed explanation as for the used methods needs to be done (Collins & Hussey, 2014). Furthermore, case studies are a methodology used mostly by interpretivists. Hence, in order to answer the research questions, we are applying the case studies methodology and more specifically the method of a comparative case studies.

Stuart et al. (2002) stated that there are five stages of a research process model (i.e. define the research question, instrument development, data gathering, data analysis, disseminate), and all these five stages are being implemented in this paper. The first stage is based on the theory building and development. The research question helps us for the better understanding of the situation and theory enhancement.

In the second stage a case study or multi-case studies needs to be selected. Furthermore, the sample size has to be determined. In our case, the sample consist of ten companies, hence, is a multi-case approach. In the third stage, semi-structured interviews were used as a tool in order to collect the data. As for the fourth stage, the collected data will be compared with each other and the conclusions will be formulated based on these results. And finally, in the fifth stage reliability and validity of these results both internal and external will be consider.

3.4 Data collection process

Four types as for data collection exist: individual interviews, focus groups, observations, and action research (Polikinghorne, 2005). As is already mentioned, individual interviews have been chosen as most suitable for this research. Different companies from different industries have been searched online for finding out ten companies that meet our requirement as for the examined topic. These companies were studied for finding out if they have purchasing department and more specifically if they buy logistics services from another company. After that, the initial approach for the accomplishment of this paper was implemented via email. Through that email the person was informed about the aim and the research question of this paper and if his/her response was positive then an appointment was followed. Every time that an interview is conducted, the data are

collected in excel sheets and presented in tables or/and charts in order to depict in the easiest way what interviewees believe.

One of the most important advantages of primary data collection is that the operationalization of the theoretical constructs, the implemented strategy for data collection as well as research design can be made-to-order to the research question. Hence, ensuring that the study is comprehensible and that the collected data helped in solving the up-to-date problem (Hox & Boeije, 2015). The primary data that were collected in this research helped in answering the research questions. These collected primary data can be added to the present store of social knowledge and can be used as secondary data for further investigation by other researchers. For supporting the primaries data value, researchers tend to use secondary data. In our case the annual reports of the investigated companies can be used as secondary data, however considering that citing these reports can reveal the companies' identity, no secondary data are going to be presented/used.

3.5 Quality of data

Construct validity, internal validity, external validity and reliability are four main aspects that need to be taken into account for ensuring the quality of a case study (Yin, 2003). Moreover, Johnson (1997) claimed that there are three types of validity that are used in the qualitative research; the examiners' self-were based on his/her background of knowledge; participants' point of view such as work experience and working position and finally, the connection between the applied theory and the data. On the other hand, Whittemore et al. (2001) claimed that this does not indicate an exaggeration on the research operation and research product and that researchers must be creative and act freely as well as to avoid the overanalysis of things. In this paper we are applying the third type (i.e. the connection between the theory and the data) since we want to point out where the theory is in line with the data that we have collected from companies.

According to Yin (2003) internal validity is applied only for explanatory or causal studies since it refers to the relationship between results and variables. Whilst, external validity focuses on how the results of the research can be generalized.

Furthermore, the case study database can be used as an evidence in order to prove the reliability of the case (Yin, 2008). Therefore, all the interviews have been recorded and kept as an evidence

and all the sources are included in the list of references. Also, the emails with the setting date of the interviews will be kept as well for proving that the interviews are real.

3.6 Analysis

According to Yin (2002) five different analytical techniques exist (i.e., pattern matching, explanation building, time-series analysis, logic models and cross-case analysis). Among them the first four are suitable for both single-case and multiple-case whilst the fifth one is suitable only for multi-case analysis. The first technique requires pattern identification from the empirical data as well as their comparison with the pre-developed propositions based on the existing theory. In the second technique, a repetitive search take place regarding the causal links in the empirical data which are later on presented in a chronological form. The third technique is with focus in details since is suitable for tracing an event over the years. As for the fourth technique, the focus is in more complex events where repetition as for the cause and effect take place. Later on, this pattern is compared with the theoretically predicted occasions. Finally, in the fifth technique all case studies are being treated as a single one, thus combining finding within several studies (Yin, 2002).

Among them, the first technique seems to be most suitable for our case. The open-type questions that have been applied during the interviews will be examined for the pattern identification. After its identification we will compare it with the existing theory from the literature review. For the analysis of data as for the meaning and conclusions, we have applied content analysis since is the most suitable way for studying qualitative data (Bryman & Bell, 2007). The recordings have been used in order to identify and select the most convenient aspects from the context in order to answer the questions, prove the theoretical framework, understand the content and solve the problem. Moreover, by classifying some of the answers under a specific segmentation/label the provided results will be more understandable, hence unnecessary details will be avoided.

3.7 Ethical considerations

According to Bell et al. (2018) there are four main principles regarding ethics: harm to participants; lack of informed consent; invasion of privacy; deception involvement. A research that could harm the participants can be characterized as unacceptable, therefore we are addressing question to interviewees that are not going to harm them or their company. Very sensitive topics are being avoided in order to protect the participants in this research. Also, when the research findings will

be published, we are going to ensure that organizations and individuals are not identifiable. This is acceptable in qualitative researches since the use of pseudonyms and anonymity are implemented quite often (Bell et al., 2018).

When it comes to second principle it is stated that interviewees need to be informed in case that the interview is going to be recorded as well as for the recording equipment that it will be used (ibid). As we mentioned above, we have asked all the interviewees to consent to be recorded before we start with the questions. Regarding the recording equipment we have used our personal mobile phones. In relation to the third principle, researches need to respect the interviewees privacy regarding the answer or non-answer to a particular question that is asked during the interview (Bryman & Bell, 2007). Therefore, we have respected interviewees willing for not answering a question and we haven't pushed them to give us an answer anyway. The interviewees have been treated sensitively and individually as is suggested by Bryman and Bell (2007).

Regarding the fourth principles, many times researchers tend to disrespect this principle since they represent their research not as it really is but as something different. As Bryman and Bell (2007, pp. 141) claimed "deception should be minimized, and when necessary, the degree and effects must be mitigated as much as possible." Therefore, we have fully informed the interviewees as for the type and concept of our research.

4 Findings and discussion

In this section the finding of this paper will be discussed. The questions that had been addressed during the interviews will be analyzed. Furthermore, the research questions of this paper will be discussed and answered below.

4.1 Empirical finding

Focal companies are operating in industries such as: Automotive, Energy, Healthcare, Manufacturing and Logistics Solutions. These companies have big market share in Sweden, globally and have facilities all around the world (table 1). However, due to the non-disclosure agreement, it is not possible to provide a precise number of their percentage of the market share that these companies own. Among these companies, the majority are competing, and, in some cases, they are collaborating in order to achieve the best result for their customers and stakeholders

in total. It worth mentioning that some of the interviewees have considerable working experience in purchasing related positions which increases the validity of the results.

The questionnaire consists of 18 questions in total (*see appendix 1*). Among them five (5) are addressing demographic information regarding the interviewee, whilst thirteen (13) are addressing the main questions of the questionnaire. Among these thirteen questions one is created based on Likert chart and the other twelve are open-ended type questions. The first part of this section consists of the demographic data whilst the main questions are analyzed in detail in the second part.

The demographic related questions have been asked as standard set up questions which a part of any interview is usually although this information was not used directly in this thesis. Another reason why these demographic questions have been addressed is for creating a friendly atmosphere by knowing more information's about the interviewees. Authors have also presented themselves in order to build a trust and prepare the ground for the main question of the questionnaire. Moreover, these demographic data can also be used in the future by other researchers that will examine a similar topic but in bigger scale and samples.

The first question regarding demographic data addresses the question about the age of the interviewee. In order to provide a faster result, ages have been classified in five different groups as follow:

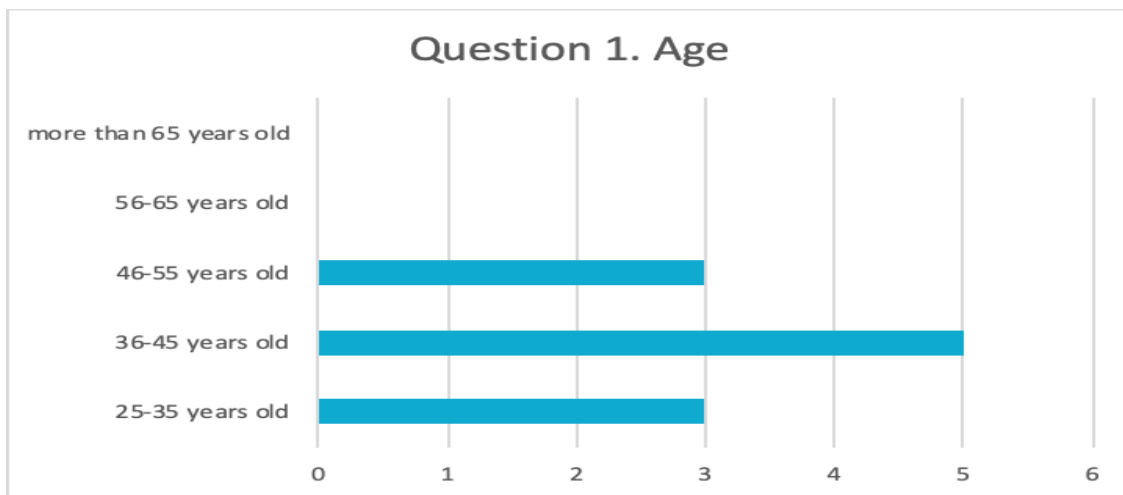


Figure 5. What is your age; Own

As we can see for the figure 5 the majority of the interviewees belong to the group age 36-45.

The second question addresses the interviewees gender. As we can see in the *figure 6* most of the interviewees defined themselves as male. The reason why the total number is eleven instead of ten is because for the C5 we had two participants.

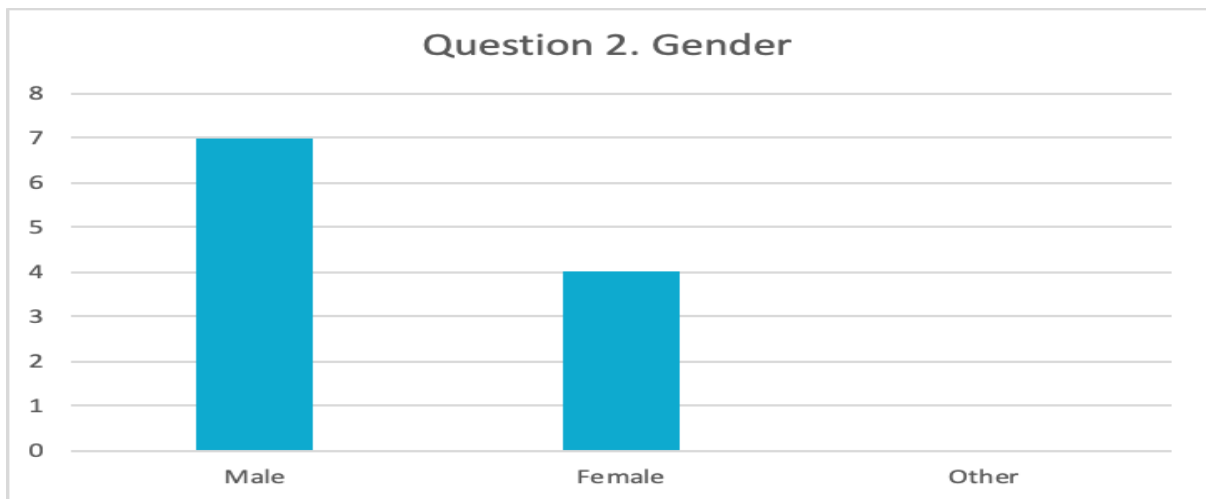


Figure 6. What is your gender; Own

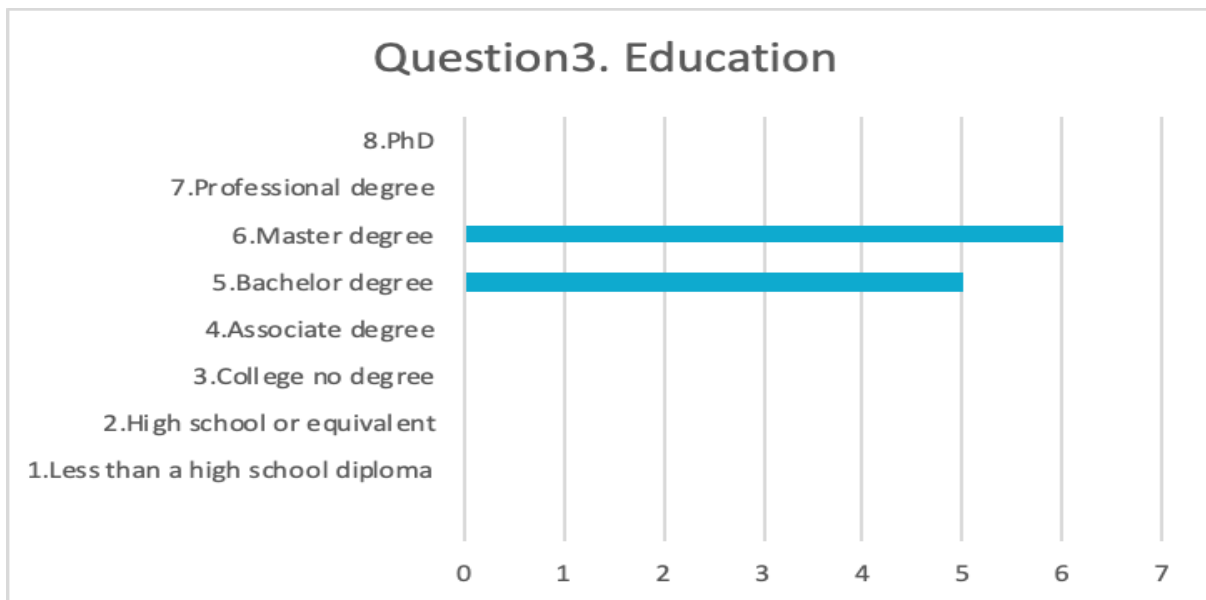


Figure 7. What is your education; Own

The figure 6 shows that all 45% of the interviewees are holding a bachelor's degree and 55% a master's degree. The reason for this question was to find out how familiar the participants with

the academic terminology regarding the suppliers and sustainability are. Having a higher level of education could increase the possibilities of familiarity with the examined topic of this research, however this is not always the case.

COMPANY 1	SUSTAINABILITY MANAGER
COMPANY 2	LEAD BUYER
COMPANY 3	REGIONAL PROCUREMENT
COMPANY 4	SENIOR BUYER
COMPANY 5	PURCHASING ANALYST/ MANAGER IN DEVELOPING PURCHASING
COMPANY 6	DIRECTOR OF SUPPLY CHAIN
COMPANY 7	SOLUTION DESIGNER & TRANSPORT MANAGER
COMPANY 8	SENIOR GLOBAL CATEGORY BUYER
COMPANY 9	MANAGEMENT CONSULTANT
COMPANY 10	BUSINESS EXCELLENCE

Figure 8. Job title; Own

Figure 8 contains interviewees' job title. They were also asked to describe some of their responsibilities. Among them, the most common responsibility was supplier and customer communication. The interviewees stated that it is their responsibility to find the right supplier for each service each time. They communicate the problem to suppliers and based on what they offer they find the best solution as for the way and the transportation mode.

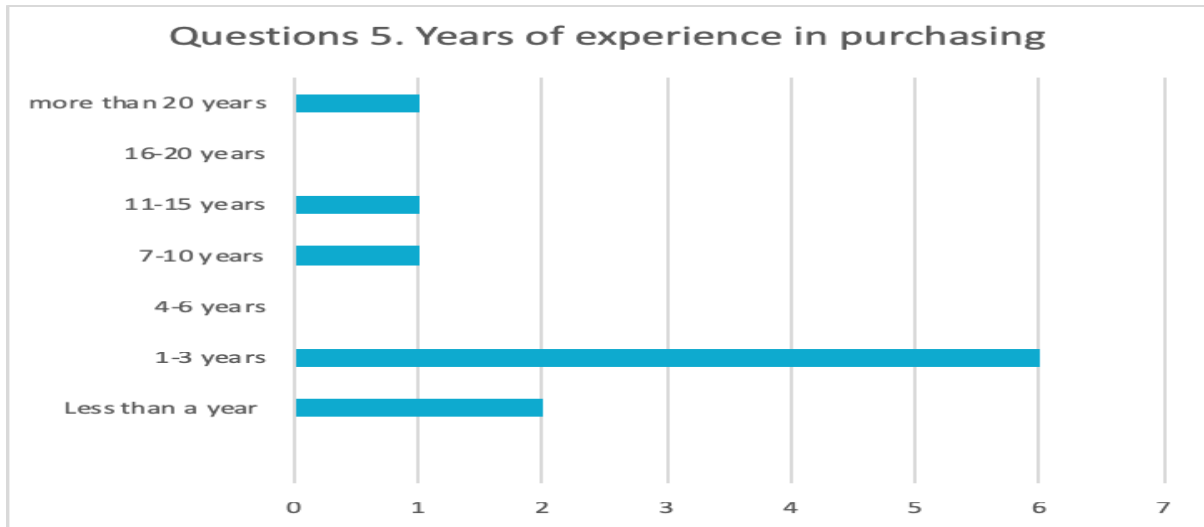


Figure 9. Years of experience; Own

When it comes to working experience within purchasing department, the results vary. Most of the interviewees have 1-3 years working experience and only two of them had less than a year. However, as we can see in the figure 8 some interviewees have 7-20 years of working experience, which increase the validity of the following findings.

The table 1 below consists of some general information about the companies. For confidentiality reasons the companies have been classified in different categories. In order to protect the companies' anonymity, the exact numbers of employees, revenues and the number of operating countries have not been revealed.

Company	Revenue			Number of employees			Number of operating countries		
	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
C1			✓			✓	✓		
C2		✓		✓			✓		
C3	✓				✓			✓	
C4		✓		✓			✓		
C5			✓			✓		✓	
C6		✓			✓				✓
C7			✓			✓			✓
C8	✓					✓			✓
C9			✓			✓			✓
C10				✓				✓	

Table 1. General data regarding companies; Own

*Based on the nr of employees: Large > 30,000; Medium 10,000-30,000; Small < 10,000

*Based on the amount of revenues: Large > 100 billion SEK; Medium 10-100 billion SEK; Small < 10 billion SEK

*Based on the nr of countries that are operating: Large >50 countries; Medium 10-50 countries; Small <10 countries

When it comes to three dimensions of sustainability almost all the interviewees believed that their company takes them into account. However, by digging deeper in the question it became obvious that the social criteria were not defined and clear enough. Therefore, the authors had to mention some factors that are included in the social dimension of sustainability (i.e. fair wage, safety regulation, child labour). This helped the interviewees to identify some of them in their selection process, whereas economic aspects were clear enough and easy to identify and measure. More details regarding this topic will be provided in the following section.

4.2 Findings from questionnaires

Starting with our main question we will analyze the finding and discuss the connection if any with the literature. Sustainability seems to gain a lot of attention since all the interviewees are familiar with this term. Almost all the selected companies had integrated sustainability in their core values. By training and informing their employees regarding the importance of the sustainability, companies are trying to increase awareness about this topic. The interviewees were asked for their point of view toward sustainability as well as company's point of view (see appendix 1, question 6). It was interesting finding that these two points of views in most of the cases were in line. Although in one case (**C6**) where the company did not prioritize the sustainability concept the interviewees' point of view was not in line with the company's policy. The interviewee was aware regarding sustainability and its benefits not only for the company but also for the future generations as well. However, as the interviewee stated, few changes as for a more sustainable operational way have been applied lately but there is still room for improvements.

When it comes to the four widely applied methods in the literature, based on the results from interviews, the majority of the companies in this study either were totally unfamiliar with the methods or except couple of cases (**C9; C10**) where the interviewees had some basic knowledge about them (*figure 10*). None of the selected companies have ever used any of the methods (i.e. AHP, ANP, DEA, TOPSIS) and none of them knew how the methods worked generally. This shows that there is a big gap between academia and industry regarding the usage of these methods.

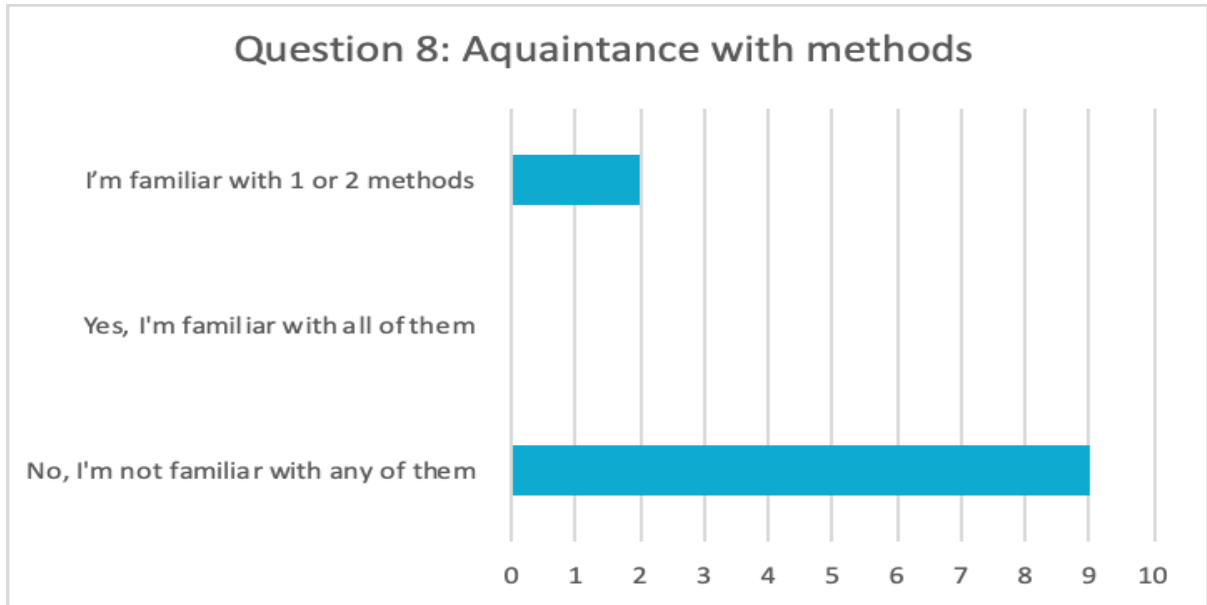


Figure 10. Are you familiar with methods? Own

Even though there are plenty of methods which have been mentioned from different scholars, our findings show that still none of them have been applied in the industry in our selected samples (figure 11). Some of them have their own internal model for supplier's evaluation in order to rank and weigh the criteria for the supplier selection process, usually done in Excel. They all stated that they have some criteria which are the same for all suppliers that want to collaborate with them. New suppliers are called to answer in some questions regarding these criteria and based on their answer they give them some points. The majority stated that the suppliers have to meet the basic requirement level (**C1; C2; C7**) (it is an audit to make sure about their capabilities). They also stated that the suppliers have to fulfil the basic service agreement. According to them if the suppliers meet the requirement at the basic level the only criterion which is taken into consideration after that is usually price. For example, if suppliers need to meet five basic criteria, and they meet them, then the total score does not really matter. This means that the higher score does not ensure that the company will select that supplier for a specific delivery. One of the interviewees (**C5**) claimed that questionnaires are also used for the supplier evaluation process but is not preferred

from the majority. Based on these questionnaires results, companies take the “go” or “not go” decision.

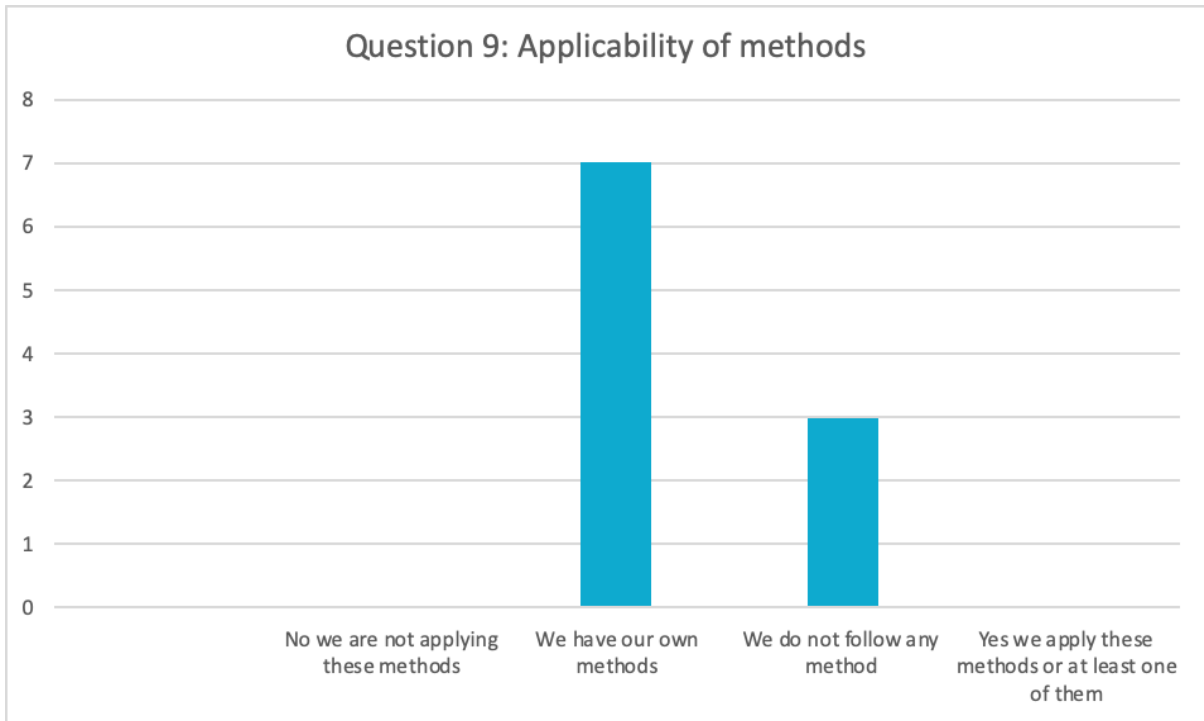


Figure 11. Methods applicability; Own

The interviewees who replied that they have their own evaluation method (C1; C2; C3; C4; C7; C8; C9), defined that the company is having a database created for internal use where all the suppliers are collected there. Then based on the results from previous collaborations the suppliers are graded and classified as suitable (green color) and non-suitable (red color). However, some companies do not follow a specific method for supplier evaluation (C5;C6;C10) considering the three aspects of sustainability, they prefer selecting their suppliers based on economic criteria where price scores higher among all the other criteria which also has been confirmed by Fallahpour et al. (2017) which stated that economic criteria are mostly taken into account when selecting suppliers (All the other companies except C3 and C4).

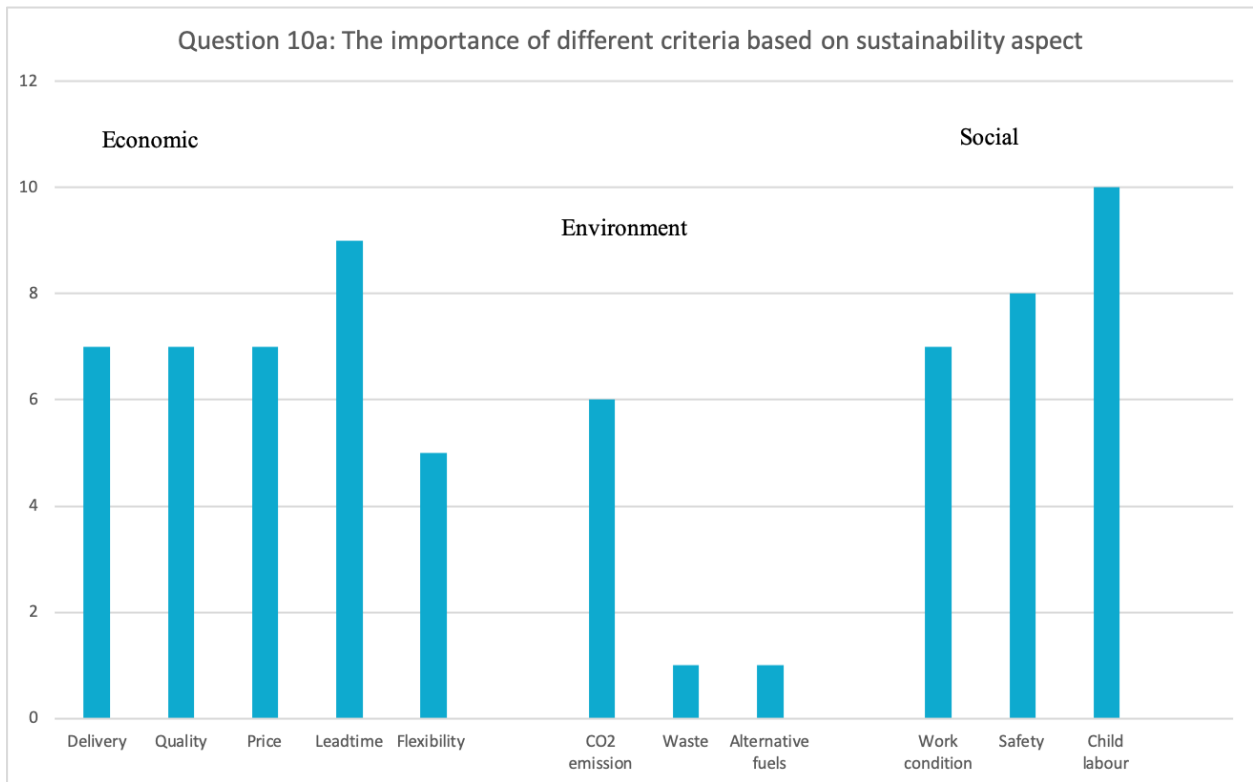


Figure 12. Criteria for supplier selection; Own

In this question, interviewees were asked to list the specific criteria from the three aspects of sustainability (i.e., economic, environmental, social) which they consider when selecting their logistics service providers. The economic aspects seem to be clearer and more structured among the others. All the interviewees could identify at least two or more criteria used in their selection process which are easy to trace and measure. They have proactive approach toward economic aspects while other factors are usually taken into granted that for instance their suppliers are complying with the legislations. This is in line with Fawcett and Smith (1995) statement which argued that quality, delivery, flexibility, cost, and innovation in services are the most important criteria when selecting suppliers. The results prove that economic aspects are taken into account more when selecting logistics service providers. Companies are still using the traditional economic-based model in order to select their suppliers, hence proving right Abbasi and Nilsson (2016) statement regarding logistics service providers' sustainability issues which have a tendency toward economic/profit.

The majority of interviewees emphasized on the price (C1; C2; C6; C7; C8; C9; C10) as the main criterion and cost minimization.

The figure 12 shows that the economic aspects are of primary importance whereas environmental aspects are not taken into account as much as economic aspects from all focal companies. Some companies are demanding a proof from their suppliers regarding the CO₂ emissions (C5; C2) but the majority take it as granted that their suppliers comply with Swedish regulations regarding the environmental aspects (C1; C3; C4; C6; C7; C8; C9; C10). Hence, they don't find it necessary to check and control the type of trucks that they are operating with (i.e., Euro5, Euro 6). In the second priority they mentioned environmental aspects, but it was mainly focused on CO₂ emission and other aspects of environment haven't been included.

As for the social dimension, only a few criteria were listed. Although they were ranked relatively high, but the factors were vague and unclear on how to measure and apply them when selecting logistics service providers. It is worth mentioning that most of the interviewees were struggling to identify the social aspects which is in line with what Carter and Easton (2011) and Ashby et al. (2012) pointed out that due to the difficulties to reach tangible outcomes the social aspects of sustainability have not been studied enough. However, most of the interviewees emphasized that taking environmental and social aspects into consideration help them to gain competitive advantage which is in line with Kannan (2018) which stated that due to the globalization companies have taken into consideration not only economic aspects but also environmental and social parameters. Moreover, all interviewees emphasized that child labor or human trafficking is totally unacceptable. Last but not least, there were nothing mentioned regarding equality or diversity.

Question 10b: *How do you identify and prioritize the criteria?*

Regarding criteria identification the answers vary since the companies are operating in different industries; hence the criteria identification and prioritization is not similar. Some of them are very dependent on the market and some of them are customer driven. For example, if the product needs to be delivered in the short time, then the logistics service provider that can offer the faster delivery is being selected. The nature of the product is the reason why companies that are operating in the Healthcare industry are mostly using Air mode for delivering their products to their customers. Another criterion is the customers location. In some cases, customers cannot be reached through road transportation and as a results train or ship transportation is chosen instead. Additionally, for some companies (C1; C2; C4; C5; C6; C8) lead time plays an important role since is closely

connected to the production line, therefore they are willing to pay a higher price in order to have the right product on the right time. This explains why some of the interviewees stated that they prioritize the selected criteria based on their customers' demands and the companies' business model and products. Moreover, in some of the cases there are some specific criteria they need to be met which are included in the companies' code of conduct which is in line with (Mamic, 2005) findings regarding the establishment of code of conducts, in order to establish the business relationship between buying firms and their suppliers.



Figure 13. Number of suppliers. Own

Figure 13 indicates that most of the focal companies (**C1; C3; C5; C8**) are working with relatively big number of suppliers (i.e. more than 20). This could show that the companies are trying to have as many suppliers as possible in order to mitigate the risk of too much dependency on suppliers and have enough alternatives to switch if necessary. Moreover, they want to make sure that they are able to cover the markets demands especially in the global context. Considering that adaptation process takes quite long time they prefer to have longer contracts with their suppliers.



Figure 14. Number of top suppliers; Own

The figure 14 indicates that the majority of the companies have a list of top suppliers, however two of them didn't give a specific number (C2; C5). The term of top suppliers refers to suppliers that the company prefers to work each time with a specific service. Both companies stated that it is dependent on the market segmentation each time which is based on customers characteristics. Considering that these companies are operating globally, sometimes they have to cooperate with some local logistics companies which can provide better service in that particular area. However, the majority prefer to work with the same logistics service providers most of the time since they have proved that they can meet their expectation. Besides, in this way they build a long-term relationship which increase the trust between the involved parties.

Question 13: *Do you believe that operating in a sustainable way could bring benefits to your company? If yes, what kind of benefits did your company had so far?*

Most of the companies stated that sustainable business practices could improve the image of the company and bring reputation which ultimately leads to competitive advantage. Some of them also mentioned profitability as a result of operating in sustainable manner (e.g. using solar systems, eliminate waste, recycling). It can be concluded that all the companies agreed that sustainability can bring direct and indirect benefits to organizations. It can help them maintain competitive position in the market and be more agile in the future and ready to meet the new environmental compliances and legislations. Furthermore, this was stated as well by companies that have not integrated sustainable practices so far.

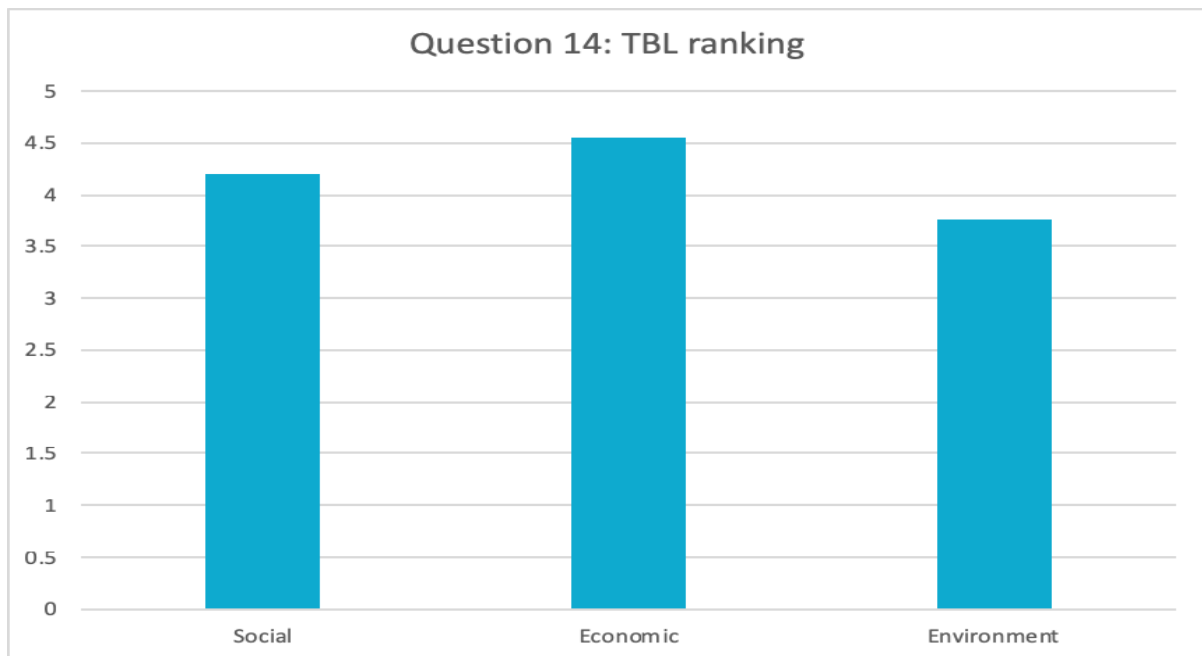


Figure 15. Ranking Sustainability pillars based on their importance; Own

Question 14

All the interviewees stated that sustainability is one of the critical tasks in their operations. They were totally aware of the high significance of sustainability in their companies. In the subjective evaluation of sustainability all the pillars of sustainability scored high but in practice as it is shown in figure 12 only the aspects of economic dimension were clear enough and measurable. The majority of the companies ranked the economic dimension as the most important one followed by the social dimension whilst environmental have been placed in the third place. The reason why companies have started putting much effort regarding social aspects could be linked with Azadnia et al. (2012) which stated that companies have to integrate sustainability into their supply chain in order to be sustainable. However, based on the findings environmental and social dimension have started to draw attention but still there is room for improvement.

Question 15: *How do you make sure that your logistics suppliers comply with sustainability regulations?*

Finding the right supplier based on the sustainability aspects is quite complicated procedure. In the beginning all the suppliers will try to show their best side in order to win a contract that will

bring them benefits. However, ensuring that your suppliers comply with the regulations demand some actions. Focal companies replied that through audits which are done usually every second year, they can control if their suppliers are complying with the rules and doing what they are supposed to do. But in all of the cases, they have to inform the inspected company about the date and the time of the audit in advance. As a consequence, this method cannot ensure the reliability of the results. This was also emphasized by some of the interviewees (C4) that stated that they cannot be sure about their supplier's compliance especially about the social aspects of sustainability (fair salary/treatment, appropriate working condition). Supplier assessment is another technique implemented at least at one of the focal companies (C9), where a group of engineers (SQE: Supplier Quality Engineers) are asking and controlling if suppliers are holding ISO certifications. However, according to the interviewees it is extremely hard to assess sub-suppliers (tier1, tier 2...,) in order to find out whether they follow the rules and compliances.

Question 16a/b: *Have you had any incident related to any of your logistics suppliers regarding social aspects of sustainability such as child labor or safety issues? If yes, how did your company react to that?*

Asking about previous incidents regarding social and environmental aspects related to their logistics service suppliers seem to be quite sensitive topic since some companies weren't willing to reveal the information and one of them refused to answer (C5). According to our findings none of the focal companies have had any incident that they can recall. However, in case that something like that occurs then the discussion/negotiation seems to be the first action taken by all the companies. When it comes to environmental aspects, companies seem to be more tolerate since the majority stated that they are going to discuss with their suppliers and will try to help them solve the problem if it's not a severe one. The tolerance level for incidents that can bring a negative publicity is very limited for most of the companies.

The termination phase is being put in action when it is violating the companies' policy of when the incident is so severe that gets published on media or there is a big risk of damaging the image of the company. But concerning social aspects, the findings show that the companies are more careful and stricter especially on sensitive issues such as child labour or human trafficking. On the other hand, for minor problems, discussion is implemented where the suppliers are called to give

explanations regarding the incidents as well as for the resolvent plan. If the problem can be solved, then they will continue their relationship if not then they have to terminate the contract.

Before proceeding with the discussion part, it is worth mentioning that all interviewees were well-prepared and well-informed regarding the supplier selection process for goods and services which includes logistics service providers as well.

4.3 Discussion

The real sustainability is not achieved unless the entire supply chain performs in a sustainable way. Suppliers play vital role in helping companies move toward sustainability goals and are an important and indispensable part of the entire chain. Without sustainable suppliers a company can never reach true sustainability which makes the supplier selection process even more crucial. However, the importance of supplier selection process especially in logistics industry seems not to have got enough attention in practice. The insufficient focus on supplier selection could result in negative impacts on the entire supply chain and the consequences are bigger than companies may believe. There are some consequences associated with wrong supplier selection such as: drop in profit margin, loss of competitive advantage, reputations loss and possible replacement of an existing supplier which comes at a very high cost.

From the very beginning of their establishment, companies are trying to improve their public image, which can be easily damaged by selecting wrong suppliers. The company's reputation is also affecting its value and market share. Well-known brands tend to sell more, and any kind of reputation loss and scandal devalues the company and its stock price. Therefore, any action that can bring a negative publicity to a company needs to be avoided. The findings of this paper show that companies have started to act in different ways to adopt sustainability in their core values. However, the social and environmental dimensions are not clear enough. Asking for CO₂ emission report doesn't ensure that a specific supplier with a low emission truck, meets the requirements as for the other factors which are included in the environmental aspects. The same applies in the case of social dimension. Social and environmental factors should be clearly defined and made as a standard. Therefore, a more holistic view as for the three dimensions of sustainability is needed.

The first research question was created with the purpose of finding out the connection between the literature and real-life cases. Obviously, there is a gap between theory and practice as for the

applicability of methods in real life cases. Even though, many scholars stated that decision makers are applying specific methods in order to evaluate their sustainable suppliers, our results show that there is no structured way or method for sustainable logistics supplier selection in these companies. Some companies do this based on checklists and some others based on questionnaire or just by asking the new and old suppliers to comply with their supplier code of conducts.

The second research question was formulated for finding out which criteria companies mostly consider when selecting their logistics service providers. Our results confirm the literature, which stands that in most of the cases, the evaluation of logistics service providers is implemented based on the economic criteria. Price has always been and continue to be the first and the most important criterion for building and creating a partnership within the business world. However, quite lately companies have started to take also into consideration environmental criteria, but still it is not the main criterion. The final decision for the logistics service provider is taken based on the best offered price.

The third research question aims to find the existing gaps within academia and industry regarding these methods applicability. Our results show that there is a lack of comprehensive knowledge as for the sustainable methods regarding logistics service providers. Decision makers tend to apply easier and more familiar ways without any complexity or specific mathematical, linear or non-linear model.

To summarize, companies are changing the way they operate in order to be more sustainable, hence ensuring that they can compete with the market's high demands. However, there is quite a long journey ahead for achieving the real sustainability within the logistics sector. The working culture needs to change, people and firms need to change, and these changes could probably take long.

5 Conclusions

The concept of sustainability in supplier selection process is definitely an upcoming and trending topic which will get more and more attention by time. The findings show that most of the companies are very aware about the importance of sustainability in their business and the benefits that are being brought to the company in long term by integrating a more sustainable way of working in all aspects of the business. Looking specifically into the businesses that buy logistics services the findings from this study show that usually the logistics providers are not treated the same way as the classic suppliers of goods and material are. This requires more education and awareness in companies and the fact that there is no difference between goods and service providers and how they are being treated.

Most of the companies and purchasing managers in this study are aware about the concept of the sustainability and its different dimensions; economic, environment and society. In fact, looking at the way they are prioritized at a high level, social and environmental factors get almost the same weight as economic factors which has traditionally been the main factor in the supplier selection. Although this is a very good news, but it stays at the perception level and the results show that it has not really penetrated to the heart of the business. In practice it is still the economic factors and criteria such as price, quality, delivery and capacity that have the final say in selection a logistic service provider.

This becomes more obvious looking at the criteria that is being used for the different dimensions of sustainability. The criteria for economic aspects are very clear and quantifiable where one can easily evaluate and compare different service providers. When it comes to the environmental factors although there are some criteria named by the companies, but they are not being followed and evaluated accurately and stays at a very high level such as CO₂ footprint etc. this becomes even vaguer and almost nonexistent.

The few criteria that we identified were child labor, safety and work condition which are very hard to trace and monitor and measure. Unlike the economic factors where the companies are proactively negotiating with their suppliers to improve, the environmental and social factors are not getting much attention and they usually becomes an issue if a supplier get involved in an

environmental or social scandal. In another word, the companies have a reactive approach to these factors although from an awareness perspective the social and environmental aspect are ranked very high. Defining and identifying some basic list of social and environmental criteria related to logistics service provider selection could be a very good first step to increase the awareness and motivate the companies to start looking into other factors too.

There are many underlying reasons behind this. Traditionally the companies have always focused on economic factors trying to get a better service/product with lower cost in shorter time. Although environmental and social factors are getting a lot of attentions, but it is mostly focused on internal activities and less on the third parties and their businesses. “We trust in our suppliers that they care about their workers and working conditions and environment”, was a statement that came up many times in more or less same formulation which is an evidence that many of the big companies are still struggling to understand and implement sustainability for their extended supply chain. As mentioned before this is even more evident for service suppliers, in this case logistics service providers. Companies need to understand that a truly sustainable business expands and reaches outside of the company and a company cannot claim to be sustainable unless the entire supply chain is sustainable with all the services and goods provided by its suppliers.

Another contributing reason is the relatively low level of knowledge and skills regarding MCDM methods. Supplier selection combined with different dimensions of sustainability where there are both quantitative and qualitative factors (tangible and intangible factors) to consider, makes the selection process very complex which in reality leads to not considering those factors all together. The findings show that none of the companies in this study use any of the MCDM methods reviewed in this thesis and in most of cases they use their own oversimplified matrix and methods. As a result, the focus will only be on the traditional and measurable factors connected to economic factors. Looking at the low level of maturity in today’s businesses in using such methods, a useful suggestion would be to work on a simplified Multi Criteria Decision Making method that can help the companies to step up and start using a more systematic and structured approach in their supplier selection process. It could be concluded that today the existing methods such as AHP, ANP, DEA and TOPSIS are still too complicated for the companies. It requires some level of maturity which today is not in place.

Companies need to look into the sustainability in the context of supplier selection not only from short-term benefit perspective and acquire a more long-term perspective. This is more than just methods and tools but rather a big change of mindset which requires also a great commitment and involvement from the top management. Although most of the companies in this study are aware about the importance of sustainability in their business, their public image and their responsibility regarding the society and environment, very few, if any, had a clear view on the long-term benefits brought up by these activities. In fact, in most of the cases the sustainability work in supplier selection was regarded as something “good to do” rather than “must be done”.

5.1 Limitations

This research does not impose any restrictions on the kind of industries that the examined companies belong to. Focal companies are from different industries for having a more complete view of the topic. The focus area of this study is Swedish market and more specifically the city of Gothenburg. Moreover, companies that have their own internal logistics services have been excluded from this research. However, due to time restrictions, the number of companies is low. This could affect the reliability and validity of the research results. The collected data were only confirmed with annual reports from the companies as secondary data when needed, hence other sources were not taken into consideration.

Also, considering the high significance of supplier selection process in all industries this paper narrows the research by focusing more on logistics industry. Therefore, focal companies should buy logistics services from one or more logistics service providers.

Taking into account that the literature on the supplier evaluation methods is extensive and too broad to be fully covered, we focus only on four frequently used MCDM methods: AHP, ANP, DEA and TOPSIS.

5.2 Future Research

In this study we have laid down a foundation with focus on the as-is situation regarding the sustainable supplier selection where the suppliers are the logistic service providers. Based on the identified gaps in the industry there are some area that need more investigations and further study:

1. There is a need to study to identify the possible environmental and social criteria in the logistics service providers. Looking at the situation today most of the companies have no or very few and

vague ideas about the type of criteria they need to consider while choosing their logistics providers. These criteria need to be identified and used as reference. “What these criteria are and how they could be measured and evaluated” are two main research questions.

2. As mentioned before, there is a lack of knowledge and skills within the companies regarding the existing MCDM methods. A problem with the existing methods is the level of complexity of these methods. A further research suggestion could be look into the existing methods and find a way to simplify these methods in a pragmatic way, where companies can easily learn how to use and benefits from them. This study together with the previous one can provide a good framework and support for the companies on how to start integrating sustainability in their supplier selection process.

3. Another future research idea could be developing a business case on how being sustainable can actually help the organizations to become more profitable and successful in long run. It is still very hard for companies to see the real long-term benefits of such endeavor. Lack of such long-term perspective will delay the pace of such integration. The main research question in this case would be “what is the long-term benefits of implementing sustainability in Logistics service provider selection process for companies?”

Appendix 1

1. Demographic information

Q1. Age: What is your age?

Q2. Gender: What is your gender?

Q3. Education: What is the highest degree or level of school you have completed? If currently enrolled, highest degree received.

- Less than a high school diploma
 - High school degree or equivalent (e.g. GED)
 - Some college, no degree
 - Associate degree (e.g. AA, AS)
 - Bachelor's degree (e.g. BA, BS)
 - Master's degree (e.g. MA, MS, MEd)
 - Professional degree (e.g. MD, DDS, DVM)
 - Doctorate (e.g. PhD, EdD)
-

Q4. Employment Status: What is your job? What are your main responsibilities?

Q5. For how long have you been working in purchasing department in this position totally?

2. Main Questions

Q6. What does sustainability mean for your company?

Q7. Is your supplier selection process sustainable in your point of view?

Q8. Are you familiar with these models?

- 1- Analytic Hierarchy Process
 - 2- Analytical Network Process
 - 3- Data Envelopment Analysis
 - 4- Techniques For Order Preference by Similarity to Ideal Solution? If yes, for what purpose do you use this method?
-

Q9. Do you use any specific model such as (AHP, ANP, DEA, TOPSIS) in order to prioritize/rank your logistics suppliers concerning sustainability? If not, do you use any kind of assessment tools in order to evaluate sustainability of logistics suppliers?

Q10a. Which criteria and why do you consider when selecting sustainable logistics suppliers? Which criteria are more important than the others?

Economic:

Environmental:

Social:

Q10b. How do you identify and prioritize the criteria?

Q11. How many logistics service providers you are working with?

Q12. How many logistics service providers are in the first list when selecting a logistics service provider and how do you rank them?

Q13. Do you believe that operating in a sustainable way could bring benefits to your company? If yes, what kind of benefits did your company had so far?

Q14. Could you please rank the three pillars of sustainability based on their importance for your company?

1-Not at all 2-A little 3-Rather 4-Much 5-very strong

	1	2	3	4	5
<i>Economic</i>					
<i>Environment</i>					
<i>Social</i>					

Q15. How do you make sure that your logistics suppliers comply with sustainability regulations?

Q16a. Have you had any incident related to any of your logistics suppliers regarding social aspects of sustainability such as child labor or safety issues? If yes, how did your company react to that?

Q16b. Have you had any incident related to any of your logistics suppliers regarding environmental aspects of sustainability such as waste disposal, pollution? If yes, how did your company react to that?

6 References

- Abbasi, M., Nilsson, F., (2016). Developing environmentally sustainable logistics: Exploring themes and challenges from a logistics service providers' perspective: Exploring themes and challenges from a logistics service providers' perspective. *Transportation Research Part D*, 46, pp.273–283.
- Abdel-Baset, M., Chang, V., Gamal, A. & Smarandache, F. (2019). “An integrated neutrosophic ANP and VIKOR method for achieving sustainable supplier selection: A case study in importing field”. *Computers in Industry* 106, pp. 94–110.
- Ahmadian, A.F.F. et al., (2017). BIM-enabled sustainability assessment of material supply decisions. *Engineering, Construction and Architectural Management*, 24(4), pp.668–695
- Aguezoul, A., (2014). Third-party logistics selection problem: A literature review on criteria and methods. *Omega (United Kingdom)*, 49, pp.69–78.
- Al-Qurtas, M., & Zairi, M. (2003). Enhancement of the effectiveness of case studies as a research method through the selection of polar cases. *Journal of Advances in Management Research*, 1(1), 41-47.
- Amindoust, A. & Saghafinia, A., (2017). Textile supplier selection in sustainable supply chain using a modular fuzzy inference system model. *The Journal of The Textile Institute*, 108(7), pp.1250–1258.
- Amindoust, A., Ahmed, S., Saghafinia, A., Bahreininejad, A., (2012). Sustainable supplier selection: a ranking model based on fuzzy inference system. *Journal of Applied Soft Computing*, 12, (6), 1668-1677.
- Ashby, A., Leat, M. and Hudson-Smith, M. (2012). Making connections: a review of supply chain management and sustainability literature. *Supply Chain Management: An International Journal*, 17, (5), pp. 497-516.
- Awasthi, Chauhan & Goyal, (2011). A multi-criteria decision making approach for location planning for urban distribution centers under uncertainty. *Mathematical and Computer Modelling*, 53(1), pp.98–109.
- Azadnia, A. H., M. Z. M. Saman, K. Y. Wong, P. Ghadimi, and N. Zakuan. (2012). Sustainable Supplier Selection based on Self-organizing Map Neural Network and Multi Criteria Decision Making Approaches. *Procedia – Social and Behavioral Sciences*, 65, 879–884.
- Babbie, E. R. (2010). *The Practice of Social Research*. Cengage Learning, p.52.
- Bai, C. and Sarkis, J. (2010), “Integrating sustainability into supplier selection with grey system and rough set methodologies”, *International Journal of Production Economics*, 124. (1), pp. 252-264.
- Banaeian, N.E. et al., (2018). Green supplier selection using fuzzy group decision making methods: A case study from the agri-food industry. *Computers and Operations Research*, 89, pp.337–347.
- Bao, P.N., Aramaki, T., Hanaki, K., (2013). Assessment of stakeholders' preferences towards sustainable sanitation scenarios. *Water Environ. Journal*. 27 (1), 58-70.

- Behzadian et al., (2012). A state-of the-art survey of TOPSIS applications. *Expert Systems with Applications*, 39(17), pp.13051–13069.
- Bell, E., Bryman, A. (2007). Business research methods, 2nd edition. Oxford University Press.
- Bell, E., Bryman, A., Harley, B., (2018). Business research methods, 5th edition.
- Benn, S., Dunphy, D., Griffiths, A., (2014). Organizational Change for Corporate Sustainability. Routledge Publication.
- Bernard, H.R. (2011). Research Methods in Anthropology. 5th edition, AltaMira Press, p.7.
- Beskovnik, B., & Jakomin, L. (2010). Challenges of green logistics in southeast Europe. *Promet-Traffic & Transportation*, 22(2), pp.147–155.
- Bhatnagar, R.; Sohal, A.S.; Millen, R. (1999) Third Party Logistics Services: A Singapore Perspective. *Int. J. Phys. Distrib. Logist. Manag*, 29, pp.569–587.
- Boone, C., Modarres, A.,(2009). City and environment. Temple University Press.
- Boran et al., (2009). A multi-criteria intuitionistic fuzzy group decision making for supplier selection with TOPSIS method. *Expert Systems With Applications*, 36(8), pp.11363–11368.
- Bottani, E.; Rizzi, A. (2006). A Fuzzy TOPSIS Methodology to Support Outsourcing of Logistics Services. *Supply Chain Manag.* 11, pp.294–308.
- Boussofiene, Dyson & Thanassoulis, E. (1991). Applied data envelopment analysis. *European Journal of Operational Research*, 52(1), pp.1–15.
- Bowen, F.E., Cousins, P.D., Lamming, R.C., Faruk, A.C., (2001). Horses for courses. Explaining the gap between the theory and practice of green supply. *Greener Management International: The Journal of Corporate Environmental Strategy and Practice*, 35, pp.41–60.
- Büyüközkan, G.; Feyzioglu, O.; Nebol, E. (2008). Selection of the Strategic Alliance Partner in Logistics Value Chain. *Int. Journal of Production Economics*, 113, pp.148–158.
- Callens, I. , & Tyteca, D. (1999). Towards indicators of sustainable development for firms: A productive efficiency perspective. *Ecological Economics*, 28 (1), pp.41–53.
- Carter CR. (2006). Purchasing social responsibility and firm performance: the key mediating roles of organizational learning and supplier performance. *International Journal of Physical Distribution and Logistics Management* 35(3), pp.177–194.
- Carter, C.R. and Liane Easton, P. (2011). Sustainable supply chain management: evolution and future directions , *International Journal of Physical Distribution and Logistics Management*, 41(1), pp. 46-62.
- Carter, C.R., (2004). Purchasing and Social Responsibility: *A Replication and Extension*. *Journal of Supply Chain Management*, 40(3), pp.4–16.
- Çelebi, D., and D. Bayraktar. (2008). An Integrated Neural Network and Data Envelopment Analysis for Supplier Evaluation Under Incomplete Information. *Expert Systems with Applications* 35 (4), pp. 1698–1710.

- Chai, J., J. N. K. Liu, and E. W. T. Ngai. (2013). "Application of Decision-making Techniques in Supplier Selection: A Systematic Review of Literature." *Expert Systems with Applications*, 40 (10), pp. 3872–3885.
- Chan, F.T.S., Kumar, N., (2007). Global supplier development considering risk factors using fuzzy extended AHP-based approach. *Omega* 35 (4), pp. 417-431.
- Chang & Yeh, (2001). Evaluating airline competitiveness using multi-attribute decision making. *Omega*, 29(5), pp.405–415.
- Chang, C.T. (2007). Multi-choice goal programming. *Omega, The International Journal of Management Science*, 35, pp.389-396.
- Charnes, A. , Cooper, W. W. , & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operational Research*, 2 (6), pp. 429–444.
- Chen, C. T., Lin, C. T., & Huang, S. F. (2006). A fuzzy approach for supplier evaluation and selection in supply chain management. *International Journal of Production Economics*, 102, pp. 289–301.
- Chen, Paulraj & Lado, (2004). Strategic purchasing, supply management, and firm performance. *Journal of Operations Management*, 22(5), pp.505–523.
- Chiou, C.Y., Hsu, C.W., Hwang, W.Y., (2008). Comparative investigation on green supplier selection of the American, Japanese and Taiwanese electronics industry in China. In: International Conference on IE&EM, IEEE 8-11 Dec, pp. 1909-1914.
- Chung, S.H., Lee, A.H.I., Pearn, W.L., (2005). Analytic network process (ANP) approach for product mix planning in semiconductor fabricator. *Int. J. Prod. Econ.* 96 (1), pp. 15–36.
- Claudia Neumüller, Rainer Lasch, Florian Kellner, (2016) "Integrating sustainability into strategic supplier portfolio selection", *Management Decision*, 54, (1), pp.194-221, <https://doi.org/10.1108/MD-05-2015-0191>
- Colicchia, C., and Marchet, G., and Melacini, M., and Perotti, S., (2013). Building environmental sustainability: Empirical evidence from Logistics Service Providers. *Journal of Cleaner Production*, 59, pp.197–209.
- Collis, J. & Hussey, R., (2014). *Business research a practical guide for undergraduate & postgraduate students* Fourth., edition.
- Connie I. Reimers-Hild (2010). *Sustainability through Profitability: The Triple Bottom Line* University of Nebraska-Lincoln. Kimmel Education and Research Center. Available at <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1008&context=kimmelpapers>
- Creswell, J.W., & Clark, V.L.P. (2017). *Designing and conducting mixed methods research*. Sage publications.
- Dao V, Langella I, Carbo J. (2011). From green to sustainability: information technology and an integrated sustainability framework. *J. Strat. Inf. Syst.* 20(1), pp. 63–79.
- Dapiran, P.; Lieb, R.; Millen, R.; Sohal, (1996). A. Third Party Logistics Services Usage by Large Australian Firms. *nt. J. Phys. Distrib. Logist. Manag.* 26, pp. 36–45.

- de Boer, L., Wegen, L. and Telgen, J. (1998), Outranking methods in support of supplier selection, *European Journal of Purchasing & Supply Management*, 4 (2-3), pp. 109-118.
- de Boer, Labro & Morlacchi, (2001). A review of methods supporting supplier selection. *European Journal of Purchasing and Supply Management*, 7(2), pp.75–89.
- Dey et al., (2015). Strategic supplier performance evaluation: A case-based action research of a UK manufacturing organisation. *International Journal of Production Economics*, 166(C), pp.192–214.
- Deng, X., Hu, Y., Deng, Y., & Mahadevan, S. (2014). Supplier selection using AHP methodology extended by D numbers. *Expert Systems with Applications*, 41, pp.156–167.
- Desanctis, G. & Gallupe, R.B., (1987). A Foundation for the Study of Group Decision Support Systems. *Management Science*, 33(5), pp.589–609.
- Dey et al., (2015). Strategic supplier performance evaluation: A case-based action research of a UK manufacturing organization. *International Journal of Production Economics*, 166(C), pp.192–214.
- Dou, Y. & Sarkis, J., (2010). A joint location and outsourcing sustainability analysis for a strategic offshoring decision. *International Journal of Production Research*, 48(2), pp.567–592.
- Dou, Y., Zhu, Q., & Sarkis, J. (2014). Evaluating green supplier development programs with a grey-analytical network process-based methodology. *European Journal of Operational Research*, 233, pp.420–431.
- Elkington, J. (1998). Partnerships from cannibals with forks: the triple bottom line of 21st-century business, *Environmental Quality Management*, 8 (1), pp. 37-51.
- Elkington, J. (1998). *Cannibals with forks: The triple bottom line of 21st century business*. Gabriola Island, BC; Stony Creek, CT: New Society Publishers.
- Elkington, J., (1994). Towards the sustainable corporation: win–win–win business strategies for sustainable development. *California Management Review* 36 (2), pp. 90–100.
- Emrouznejad & Yang, (2018). A survey and analysis of the first 40 years of scholarly literature in DEA: 1978–2016. *Socio-Economic Planning Sciences*, 61(C), pp.4–8.
- Faisal, M.N., Al-Esmael, B. & Sharif, K.J., (2017). Supplier selection for a sustainable supply chain. Benchmarking: *An International Journal*, 24(7), pp.1956–1976.
- Faisal, M.N., Banwet, D.K. and Shankar, R. (2007), Supply chain risk management: SCOR approach and analytic network process, *Supply Chain Forum: An International Journal*, 8 (2), pp. 66-79.
- Fallahpour et al., (2017). A decision support model for sustainable supplier selection in sustainable supply chain management. *Computers & Industrial Engineering*, 105, pp.391–410.
- Falsini, D., Fondi, F., Schiraldi, MM. (2012). A logistics provider evaluation and selection methodology based on AHP, DEA and linear programming integration. *International Journal of Production Research*, 50 (17), pp. 4822-482.
- Fawcett, S.E.; Smith, S.R. (1995). Logistics Measurement and Performance for United States-Mexican Operations under NAFTA. *Transp. J.*, 34, pp.25–34.

- Ferri & Pedrini, (2018). Socially and environmentally responsible purchasing: Comparing the impacts on buying firm's financial performance, competitiveness and risk. *Journal of Cleaner Production*, 174, pp.880–888.
- Fombrun, C.J., (2005). The leadership challenge: building resilient corporate reputations. In: Doh, J.P., Stumpf, S.A. (Eds.), *Handbook on Responsible Leadership and Governance in Global Business*. Edward Elgar, Cheltenham, pp. 54–68.
- García-Cascales & Lamata, (2012). On rank reversal and TOPSIS method. *Mathematical and Computer Modelling*, 56(5-6), pp.123–132.
- Gattoufi, S., Oral, M., Reisman, A. (2004). Data envelopment analysis literature: a bibliography update (1951–2001). *Socio-Economic Planning Sciences*, 38(2), pp.159–229.
- Gimenez, Sierra & Rodon, (2012). Sustainable operations: Their impact on the triple bottom line. *International Journal of Production Economics*, 140(1), pp.149–159.
- Girit, S. (2017). *Turkey: Zara shoppers find labour complaints inside clothes*. [Online] Available at: <http://www.bbc.com/news/world-europe-41981509> [Accessed 12 April 2019].
- Girubha, J., Vinodh, S. & Kek, V., (2016). Application of interpretive structural modelling integrated multi criteria decision making methods for sustainable supplier selection. *Journal of Modelling in Management*, 11(2), pp.358–388.
- Goddard, W. & Melville, S. (2004). *Research Methodology: An Introduction*. 2nd edition, Blackwell Publishing.
- Godschalk, DR., (2004). Land use planning challenges: Coping with conflicts in visions of sustainable development and livable communities. *Journal of the American Planning Association*. 70(1), pp.5-13.
- Gómez-Limón, J. A., Picazo-Tadeo, A. J., & Reig-Martínez, E. (2012). Eco-efficiency assessment of olive farms in Andalusia. *Land Use Policy*, 29 (2), pp.395–406.
- Govindan, K., Khodaverdi, R., Jafarian, A., (2013). A fuzzy multi criteria approach for measuring sustainability performance of a supplier based on triple bottom line approach. *Journal of Cleaner Production*, 47, pp.345–354.
- Govindan, K., Rajendran, S., Sarkis, J., Murugesan, P., (2015). Multi criteria decision making approaches for green supplier evaluation and selection: a literature review. *Journal of Cleaner Production*, 98, pp.66–83.
- Govindan, Shankar & Kannan, (2016). Supplier selection based on corporate social responsibility practices. *International Journal of Production Economics*, 200, pp.353–379.
- Govindan, K., Kadzinski, M., Ehling, R., Miebs, G. (2018) Selection of a sustainable third-party reverse logistics provider based on the robustness analysis of an outranking graph kernel conducted with ELECTRE I and SMAA. *Omega*, 85 pp.1-15
- Grimm, J.H., Hofstetter, J.S., Sarkis, J., (2016). Exploring sub-suppliers' compliance with corporate sustainability standards. *Journal of Cleaner Production*. 112, pp.1971-1984.

- Grimm, J.H., Hofstetter, J.S., Sarkis, J., (2014). Critical factors for sub-supplier management: a sustainable food supply chains perspective. *International Journal of Production Economics*. 152, pp.159-173.
- Grisi, R.M., Guerra, L., Naviglio, G., (2010). Supplier performance evaluation for green supply chain management. *Bus. Perform. Meas. Manag.*, pp.149-163. Part 4.
- Gupta, P. et al., (2018). An integrated AHP-DEA multi-objective optimization model for sustainable transportation in mining industry. *Resources Policy*.
- Gupta & Barua, (2017). Supplier selection among SMEs on the basis of their green innovation ability using BWM and fuzzy TOPSIS. *Journal of Cleaner Production*, 152, pp.242–258.
- Guarnieri, P., Trojan, F. (2019). Decision making on supplier selection based on social, ethical, and environmental criteria: A study in the textile industry. *Resources, Conservation and Recycling*, 141, pp. 347–361.
- Gören, H.G., (2018). A decision framework for sustainable supplier selection and order allocation with lost sales. *Journal of Cleaner Production*, 183, pp.1156–1169.
- Hamdan, A., Rogers, KJ. (2008). Evaluating the efficiency of 3PL logistics operations. *International Journal of Production Economics*, 113 (1), pp. 235-244.
- Handfield, R., Walton, S.V., Sroufe, R., Melnyk, S.A., (2002). Applying environmental criteria to supplier assessment: a study in the application of the analytical hierarchy process. *European Journal of Operational Resources*, pp.141, 70-87.
- Handfield, R.B., Sroufe, R., Walton, S., (2005). Integrating environmental management and supply chain strategies. *Business Strategy and the Environment*, 14(1), pp.1–19.
- Harrison, R.L., & Reilly, T.M. (2011). Mixed methods designs in marketing research. *Qualitative Market Research: An International Journal*, 14(1), pp.7-26.
- Hatami-Marbini et al., (2017). A flexible cross-efficiency fuzzy data envelopment analysis model for sustainable sourcing. *Journal of Cleaner Production*, 142, pp.2761–2779.
- Ho, W. (2008). Integrated Analytic Hierarchy Process and its applications- A Literature Review. *Eur. J. Oper. Res.*, 186, pp.211–228.
- Ho, W.; He, T.; Lee, C.K.M.; Emrouznejad, (2012) A. Strategic Logistics Outsourcing: An Integrated QFD and Fuzzy AHP Approach. *Expert Syst. Appl*, 39, pp.10841–10850.
- Ho, Xu & Dey, (2010). Multi-criteria decision-making approaches for supplier evaluation and selection: A literature review. *European Journal of Operational Research*, 202(1), pp.16–24.
- Holloway, I., (2005) Qualitative research in health care.
- Hox., J., Boeije., R., H. (2005). Data collection, Primary vs Secondary. *Encyclopedia of Social Measurement*, 1, pp.593-599.
- Hsu, C.; Liou, J.J.; Chuang, Y. (2013). Integrating DANP and Modified Grey Relation Theory for the Selection of an Outsourcing Provider. *Expert Syst. Appl*. 40, pp.2297–2304.

- Huppel, G., & Ishikawa, M. (2005). A framework for quantified eco-efficiency analysis. *Journal of Industrial Ecology*, 9 (4), pp.25–41.
- Hwang, C.L. and Yoon, K. (1981) Multiple Attribute Decision Making: Methods and Applications. Springer-Verlag, New York.
- ITF - OECD/International Transport Forum (2013). ITF Transport Outlook 2013: Funding Transport. OECD Publishing/ITF, <http://dx.doi.org/10.1787/9789282103937-en>
- Jato-Espino et al., (2014). A review of application of multi-criteria decision-making methods in construction. *Automation in Construction*, 45(C), pp.151–162.
- Jia, P. et al., (2015). Supplier Selection Problems in Fashion Business Operations with Sustainability Considerations. *Sustainability*, 7(2), pp.1603–1619.
- Jharkharia & Shankar, (2007). Selection of logistics service provider: An analytic network process (ANP) approach. *Omega*, 35(3), pp.274–289.
- John Dudovskiy, (2018). The Ultimate Guide to Writing a Dissertation in Business Studies: A Step-by-Step Assistance.
- Johnson, B. R. (1997). Examining the validity structure of qualitative research. *Education*, 118(3), 282-292.
- Jumadi, H., & Zailani, S. (2010). Integrating green innovation in logistics service towards logistics services sustainability: A conceptual paper. *Environmental Research Journal*, 4(4), pp. 261–271.
- Jung, H., (2017). Evaluation of Third Party Logistics Providers Considering Social Sustainability. *Sustainability*, 9(5), pp.777.
- Kadoić N, Begićević Red-ep N, Divjak B (2017) Decision making with the analytic network process. In: Kljajić Borštnar M, Zadnik Stirn L, Žerovnik J, Drobne S (eds) SOR 17 proceedings. Slovenia Society Informatika—Section for Operational Research, Bled, Ljubljana, pp 180–186.
- Kadoić, N., Divjak, B. & Ređep, N., (2018). Integrating the DEMATEL with the analytic network process for effective decision-making. *Central European Journal of Operations Research*, pp.1–26.
- Kahraman, C., Engin, O., Kabak, O., & Kaya, I. (2009). Information systems outsourcing decisions using a group decision-making approach. *Engineering Applications of Artificial Intelligence*, 22, pp. 832–841.
- Kang, D., Park, Y., (2014). Review-based measurement of customer satisfaction in mobile service: sentiment analysis and VIKOR approach. *Expert Syst. Appl.* 41 (4), pp.1041-1050.
- Kannan, D., (2018). Role of multiple stakeholders and the critical success factor theory for the sustainable supplier selection process. *International Journal of Production Economics*, 195, pp.391–418.
- Kannan, G.; Pokharel, S.; Sasi Kumar, P. (2009). A Hybrid Approach using ISM and Fuzzy TOPSIS for the Selection of Reverse Logistics Provider. *Resour. Conserv. Recycle*, 54, pp.28–36.
- Kaur, H., Singh, S. & Ghardon, P., (2016). An Integer Linear Program for Integrated Supplier Selection: A Sustainable Flexible Framework. *Global Journal of Flexible Systems Management*, 17(2), pp.113–134.

- Keskin, G.A., İlhan, S. and Özkan, C. (2010), The fuzzy ART algorithm: a categorization method for supplier evaluation and selection, *Expert Systems with Applications*, 37(2), pp. 1235-1240.
- Khan, S. A., Dweiri, F., & Jain, V. (2016). Integrating analytical hierarchy process and quality function deployment in automotive supplier selection. *International Journal of Business Excellence*, 9(2), pp.156-177.
- Kirytopoulos, K., Leopoulos, V. and Voulgaridou, D. (2008). Supplier selection in pharmaceutical industry; an analytic network process approach. *Benchmarking*, 15(4), pp. 494-516.
- Kleindorfer, P.R., Singhal, K., and Wassenhove, L.N.V., (2005). Sustainable operations management. *Production and Operations Management*, 14 (4), pp.482–492.
- Knoppen, D., Sáenz, M.J., (2015). Purchasing: Can we bridge the gap between strategy and daily reality? *Business Horizons*, 58 (1), pp.123-133.
- Kudla & Klaas-Wissing, (2012). Sustainability in shipper-logistics service provider relationships: A tentative taxonomy based on agency theory and stimulus-response analysis. *Journal of Purchasing and Supply Management*, 18(4), pp.218–231.
- Kumar, Padhi & Sarkar, (2019). Supplier selection of an Indian heavy locomotive manufacturer: An integrated approach using Taguchi loss function, TOPSIS, and AHP. *IIMB Management Review*, 31(1), pp.78–90.
- Kuo, R.J., Wang, Y.C. and Tien, F.C. (2010), Integration of artificial neural network and MADA methods for green supplier selection. *Journal of Cleaner Production*, 18, (12), pp. 1161-1170.
- Kuosmanen, T., & Kortelainen, M. (2005). Measuring eco-efficiency of production with data envelopment analysis. *Journal of Industrial Ecology*, 9 (4), pp.59–72.
- Lai, K.; Ngai, E.; Cheng, T. (2002). Measures for Evaluating Supply Chain Performance in Transport Logistics. *Transport Resources. Part E Logist. Transp. Rev.*38, pp.439–456.
- Lee H. (2010). Don't tweak your supply chain - rethink it end to end. *Harvard Business Review* 88(10), pp.63–66.
- Lee K, Kim J. (2009). Current status of CSR in the realm of supply management: the case of the Korean electronics industry. *Supply Chain Management: An International Journal* 14(2), pp.138–148.
- Lehmusvaara, A.; Tuominen, M.; Korpela, J. (1999). An Integrated Approach for Truck Carrier Selection. *Int. J. Logist. Res. Appl.* 2, 5–20.
- Leicester, M. & Lovell, T., (1997). Disability Voice: Educational experience and disability. *Disability & Society*, 12(1), pp.111–118.
- Lewis, H., Irwin, R.D., (1943). *Industrial Purchasing Principles and Practises*, p. 249. Illinois, Homewood.
- Li, F., Li, L., Jin, C., Wang, R., Wang, H., & Yang, L. (2012). A 3PL supplier selection model based on fuzzy sets. *Computers & Operations Research*, 39(8), pp.1879-1884.
- Li, J., Fang, H., Song, W. (2019). Sustainable supplier selection based on SSCM practices: A rough cloud TOPSIS approach. *Journal of Cleaner Production*, 222, pp. 606-621.

- Lieb, Robert C. & Lieb, Kristin J., (2011). The North American Third-Party Logistics Industry in 2010: the Provider Ceo Perspective. *Supply Chain Forum: An International Journal*, 12(3), pp.44–52.
- Lin, C.Y., & Ho, Y.H. (2011). Determinants of green practice adoption for logistics companies in China. *Journal of Business Ethics*, 98(1), pp.67–83.
- Linton, J.D., Klassen, R., and Jayaraman, V., (2007). Sustainable supply chains: an introduction. *Journal of Operations Management*, 25 (6), pp.1075–1082.
- Liou, J.J.H.; Chuang, Y. (2010). Developing a Hybrid Multi-Criteria Model for Selection of Outsourcing Providers. *Expert System with Applications*, 37, pp.3755–3761.
- Liu, C.M., Hsu, H.S., Wang, S.T., Lee, H.K., (2005). A performance evaluation model based on AHP and DEA. *Journal of the Chinese Institute of Industrial Engineers*, 22 (3), pp.243-251.
- Lu, L.Y.Y., Wu, C.H., Kuo, T.C., (2007). Environmental principles applicable to green supplier evaluation by using multi-objective decision analysis. *Int. J. Prod. Res.* 45 (18-19), pp.4317-4331.
- Luthra et al., (2017). An integrated framework for sustainable supplier selection and evaluation in supply chains. *Journal of Cleaner Production*, 140(P3), pp.1686–1698.
- Luthra, S., Mangla, S.K., Kharb, R.K., (2015). Sustainable assessment in energy planning and management in Indian perspective. *Renew. Sustain. Energy Rev.* 47, pp.58-73.
- Maloni, M.J., & Carter, C.R. (2006). Opportunities for research in third-party logistics. *Transportation Journal*, 45(2), pp.23–38.
- Mamic, I., (2005). Managing global supply chain: the sports footwear, apparel and retail sectors. *Journal of Business Ethics* 59(1/2), pp.81–100.
- Mangla, S.K., Govindan, K., Luthra, S., (2016). Critical success factors for reverse logistics in Indian industries: a structural model. *J. Clean. Prod.* 129, pp.608-621.
- Mangla, S.K., Kumar, P., Barua, M.K., (2014). Flexible decision approach for analyzing performance of sustainable supply chains under risks/uncertainty. *Global. Journey*.
- Mani, Agrawal & Sharma, (2014). Supplier selection using social sustainability: AHP based approach in India. *International Strategic Management Review*, 2(2), pp.98–112.
- Marasco, A. (2008). Third-party logistics: A literature review. *International Journal of Production Economics*, 113(1), pp.127–147.
- Mardani, A., Jusoh, A., Zavadskas, E. K., (2015). Fuzzy multiple criteria decision-making techniques and applications – Two decades review from 1994 to 2014. *Expert Systems with Applications*, 42(8), pp.4126–4148.
- Mason, J. (2002) *Qualitative researching*, 2nd edition. London, sage.
- McKinnon, A.C. (2008). The potential of economic incentives to reduce CO2 emissions from goods transport. Proceedings of the 1st International Transport Forum on ‘Transport and Energy: The Challenge of Climate Change, 28-30 May, Leipzig (Germany).
- Millen, R.; Sohal, A.; Dapiran, P.; Lieb, R.; Van Wassenhove, L.N. (1997). Benchmarking Australian Firms’ Usage of Contract Logistics Services: A Comparison with American and Western European Practice. *Benchmark. Qual. Manag. Technol.* 4, pp.34–46.

- Mohanty, R.P., Deshmukh, S.G., (1993). Using of analytic hierarchical process for evaluating sources of supply. *International Journal of Physical Distribution and Logistics Management*, 23 (3), pp.22-28.
- Moheb-Alizadeh, H & Handfield, R. (2019). Sustainable supplier selection and order allocation: A novel multi-objective programming model with a hybrid solution approach. *Computers & Industrial Engineering*, 129, pp. 192-209
- Mousavi-Nasab & Sotoudeh-Anvari, (2018). A new multi-criteria decision-making approach for sustainable material selection problem: A critical study on rank reversal problem. *Journal of Cleaner Production*, 182, pp.466–484.
- Murphy, P.R.; Daley, J.M. (1997). Investigating Selection Criteria for International Freight Forwarders. *Transport Journal*. 37, pp.29–36.
- Nguyen, H., Dawal, S. Z. M., Nukman, Y., & Aoyama, H. (2014). A hybrid approach for fuzzy multi-attribute decision making in machine tool selection with consideration of the interactions of attributes. *Expert Systems with Applications*, 41, pp.3078–3090.
- Oelze, N. et al., (2016). Sustainable Development in Supply Chain Management: The Role of Organizational Learning for Policy Implementation. *Business Strategy and the Environment*, 25(4), pp.241–260.
- Ordoobadi, S.M., (2010). Application of AHP and Taguchi loss functions in supply chain. *Industrial Management and Data System*. 110 (8), pp.1251-1269.
- Orji, I. J., Wei, S., (2015). An innovative integration of fuzzy-logic and systems dynamics in sustainable supplier selection: A case on manufacturing industry. *Computers & Industrial Engineering*. 88, pp.1-12. <https://doi.org/10.1016/j.cie.2015.06.019>
- O'Shea, T., Golden, J. S., & Olander, L. (2013). Sustainability and earth resources: Lifecycle assessment modeling. *Business Strategy and the Environment*, 22(7), pp.429–441.
- Padhi, Pati & Rajeev, (2018). Framework for selecting sustainable supply chain processes and industries using an integrated approach. *Journal of Cleaner Production*, 184(C), pp.969–984.
- Pagell, M., Wu, Z. and Wasserman, M.E. (2010), “Thinking differently about purchasing portfolios: an assessment of sustainable sourcing”, *Journal of Supply Chain Management*, 46 (1), pp. 57-73.
- Park, Okudan Kremer & Ma, (2018). A regional information-based multi-attribute and multi-objective decision-making approach for sustainable supplier selection and order allocation. *Journal of Cleaner Production*, 187, pp.590–604.
- Pelissier, R. (2008) “Business Research Made Easy” Juta & Co., p.3
- Pishchulov, G., Trautrimas, A., Chesney, T., Gold, S., Schwab, L. (2019).The Voting Analytic Hierarchy Process revisited: A revised method with application to sustainable supplier selection. *International Journal of Production Economics*, 211, pp. 166–179.

- Peirce, C. (1998). On the logic of drawing history from ancient documents. In Peirce Edition Project (Ed.), *The essential Peirce: Selected philosophical writings, 1893-1913* (p. 95). Bloomington, IN: Indiana University Press.
- Porter, M. E., & Kramer, M. R. (2011). The big idea: creating shared value. Retrieved February 2, 2014, from Harvard Business Review website: <http://hbr.org/2011/01/the-big-idea-creating-shared-value>.
- Polkinghorne, D. E. (2005). Language and meaning: Data collection in qualitative research. *Journal of Counseling Psychology*, 52(2), 137-145. <http://dx.doi.org/10.1037/0022-0167.52.2.137>
- Prakash & Barua, (2016). An analysis of integrated robust hybrid model for third-party reverse logistics partner selection under fuzzy environment. *Resources, Conservation & Recycling*, 108, pp.63–81.
- Prakash, Surya & Dev, Saty. (2014). Application of Techniques for Order Preference by Similarity to an Ideal Solution (TOPSIS) for Assessing Risk Factors in Collaborative Supply Chain. 10.13140/2.1.2379.6000.
- Pullman, M.E., Maloni, M.J., Carter, C.G., (2009). Food for thought: social versus environmental sustainability programs and performance outcomes. *Journal of Supply Chain Management*, 45 (4), pp.38–54.
- Rao, C., Goh, M., Zheng, J., (2017). Decision mechanism for supplier selection under sustainability. *International Journal of Information Technology & Decision Making*. 16, pp.87-115. <https://doi.org/10.1142/S0219622016500450>
- Rao, P. & Holt, D., (2005). Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management*, 25(9), pp.898–916.
- Rashidi, K., & Cullinane, K., (2019). A comparison of fuzzy DEA and fuzzy TOPSIS in sustainable supplier selection: Implications for sourcing strategy. *Expert Systems with Applications*, 121, pp. 266-.28.
- Rashidi, K., Saen., R. F., (2018). Incorporating dynamic concept into gradual efficiency: Improving suppliers in sustainable supplier development. *Journal of Cleaner Production*. 202, pp.226-243.
- Redclift, M., (2005) Sustainable development: an oxymoron comes of age. *Sustainable development*. 134, pp. 212-227.
- Rostamzadeh, R., Govindan, K., Esmaeili, A., Sabaghi, M., (2015). Application of fuzzy VIKOR for evaluation of green supply chain management practices. *Ecol. Indic.* 49, pp.188-203.
- Rostamzadeh, R. et al., (2018). Evaluation of sustainable supply chain risk management using an integrated fuzzy TOPSIS- CRITIC approach. *Journal of Cleaner Production*, 175, pp.651–669.
- Rouyendegh & Saputro, (2014). Supplier Selection Using Integrated Fuzzy TOPSIS and MCGP: A Case Study. *Procedia - Social and Behavioral Sciences*, 116, pp.3957–3970.

- Saaty T.L.(1996). Decision making with dependence and feedback: the analytic network process. Pittsburgh, PA: RWS Publications;
- Saaty, T. L. (1980). *The Analytic Hierarchy Process*. New York: McGraw-Hill.
- Saaty, T. L. (1986). Axiomatic Foundation of the Analytic Hierarchy Process. *Management Science*, 32 (7), pp. 841–855.
- Saaty, T. L., & Sodenkamp, M. (2008). Making decisions in hierarchic and network systems. *International Journal of Applied Decision Sciences*, 1, pp.24–79.
- Saaty, T.L., (2001). *Decision Making with Dependence and Feedback: The Analytic Network Process*, second ed. RWS Publications, Pittsburgh, PA.
- Sachs, I., (1999). Social sustainability and whole development: exploring the dimensions of sustainable development. *Sustainability and the social sciences: a cross-disciplinary approach to integrating environmental considerations into theoretical reorientation*. Pp.25-36
- Saen, R.F., (2010). Developing a new data envelopment analysis methodology for supplier selection in the presence of both undesirable outputs and imprecise data. *Int. J. Adv. Manuf. Technol.* 51 (9–12), pp.1243–1250.
- Sarkis J. (1998) Evaluating environmentally conscious business practices. *European Journal of Operational Research*, 107, pp.159–74.
- Sarkis, Meade & Presley, (2012). Incorporating sustainability into contractor evaluation and team formation in the built environment. *Journal of Cleaner Production*, 31, pp.40–53.
- Sarkis, J., & Dhavale, D. G. (2015). Supplier selection for sustainable operations: A triple-bottom-line approach using a Bayesian framework. *International Journal of Production Economics*, 166, pp.177–191.
- Sarkis, J., (2001). Manufacturing’s role in corporate environmental sustainability: concerns for the new millennium. *International Journal of Operations and Production Management*, 21 (5–6), pp.666–686.
- Sarkis, J., (2003). A strategic decision framework for green supply chain management. *Journal of Cleaner Production*, 11 (4), pp.397-409.
- Sarkis, J., Dhavale, D.G., (2015). Supplier selection for sustainable operations: a triple bottom-line approach using a Bayesian framework. *International Journal of Production Economics*, 166, pp.177-191
- Sarkis, J., Gonzalez-Torre, P., Adenso-Diaz, B., (2010). Stakeholder pressure and the adoption of environmental practices: the mediating effect of training. *Journal of Operational Management*, 28 (2), pp.163-176
- Seiford, L., (1997). A bibliography for Data Envelopment Analysis (1978-1996). *Annals of Operations Research*, 73, pp.393–438.
- Selviaridis, K., & Spring, M. (2007). Third party logistics: A literature review and research agenda. *The International Journal of Logistics Management*, 18(1), pp.125–150.

- Sen, D. K., Datta, S., Mahapatra, S. S., (2018). Sustainable supplier selection in intuitionistic fuzzy environment: a decision-making perspective. *Benchmarking: An International Journal*, 25, pp.545-574. <https://doi.org/10.1108/BIJ-11-2016-0172>
- Seuring, S. (2012), A review of modeling approaches for sustainable supply chain management. *Decision Support System*, 54 (4), pp.1513-1520.
- Seuring, S., et al., (2008). Sustainability and supply chain management – an introduction to the special issue. *Journal of Cleaner Production*, 16 (15), pp.1535–1551.
- Seuring, S., Müller, M., (2008) From a literature review to a conceptual framework for sustainable supply chain management. *Journal of cleaner production*. 1615, pp. 1699-1710.
- Shabanpour, H., Yousefi, S., Saen, R. F., (2017). Future planning for benchmarking and ranking sustainable suppliers using goal programming and robust double frontiers DEA. *Transportation Research Part D: Transport and Environment*. 50, pp.129-143. <https://doi.org/10.1016/j.trd.2016.10.022>
- Shahryari, Nia, A., Olfat, L., Ahmad Esmaeili, A., Rostamzadeh, R., Antucheviciene, J. (2016) Using fuzzy Choquet integral operator for supplier selection with environmental considerations. *Journal of Business Economics and Management*, 17(4), pp.503–526 [doi:10.3846/16111699.2016.1194315](https://doi.org/10.3846/16111699.2016.1194315)
- Sharma, S., Henriques, I., (2005). Stakeholder influences on sustainability practices in the canadian forest products industry. *Strategic Management Journal* 26, pp.159–180.
- Simpson, D., Power, D., Samson, D., (2007). Greening the automotive supply chain: a relationship perspective. *International Journal of Operations & Production Management* 27 (1), pp.28–48.
- Singh, R.P., Nachtnebel, H.P., (2016). Analytical hierarchy process (AHP) application for reinforcement of hydropower strategy in Nepal. *Renew. Sustain. Energy Rev.* 55.
- Sipahi, S.; Timor, M. (2010) The Analytic Hierarchy Process and Analytic Network Process: An Overview of Applications. *Manag. Decis.*, 48, pp.775–808.
- Song, Xu & Liu, (2017). Developing sustainable supplier selection criteria for solar air-conditioner manufacturer: An integrated approach. *Renewable and Sustainable Energy Reviews*, 79, pp.1461–1471.
- Stoddard, J.E., Pollard, C.E. & Evans, M.R., (2012). The Triple Bottom Line: A Framework for Sustainable Tourism Development. *International Journal of Hospitality & Tourism Administration*, 13(3), pp.233–258.
- Stuart, I., McCutcheon, D., Handfield, R., McLachlin, R., & Samson, D. (2002). Effective case research in operations management: a process perspective. *Journal of Operations Management*, 20(5), 419-433.
- Sucky, E. (2007). A Model for Dynamic Strategic Vendor Selection. *Computers & Operations Research* 34 (12), pp.3638–3651.
- Svensson, G., Baath, H.,(2008).Supply chain management ethics: conceptual framework and illustration .*Supply Chain Management: An International Journal* 13(6), pp.398–405.

- Tate, W.L., Ellram, L.M., Kirchoff, J.F., (2010). Corporate social responsibility reports: a thematic analysis related to supply chain management. *Journal of Supply Chain Management* 46(1), pp.19–44.
- Tate, W. L., Ellram, L. M., & Gölgeci, I. (2013). Diffusion of environmental business practices: A network approach. *Journal of Purchasing and Supply Management*, 19(4), pp.264-275.
- Tavana, M., Yazdani, M. & Di Caprio, D., (2017). An application of an integrated ANP–QFD framework for sustainable supplier selection. *International Journal of Logistics Research and Applications*, 20(3), pp.254–275.
- Thakkar, J.; Deshmukh, S.; Gupta, A.; Shankar, R. (2005). Selection of Third-Party Logistics (3PL): A Hybrid Approach using Interpretive Structural Modeling (ISM) and Analytic Network Process (ANP). *Supply Chain Forum* , 6, pp.32–46.
- Toloo, M., and S. Nalchigar. (2011). A New DEA Method for Supplier Selection in Presence of Both Cardinal and Ordinal Data. *Expert Systems with Applications* 38 (12), pp.14726–14731.
- Tone, K. (2001). A slacks-based measure of efficiency in data envelopment analysis. *European Journal of Operational Research*, 130 (3), pp.498–509.
- Torres-Ruiz, A., Ravi Ravindran, R., A. (2019). Use of interval data envelopment analysis, goal programming and dynamic eco-efficiency assessment for sustainable supplier management. *Computers and Industrial Engineering*, 131, pp. 211–226.
- Trapp, A.C., Sarkis, J., (2016). Identifying robust portfolios of suppliers: a sustainability selection and development perspective. *Journal of Cleaner Production*, 112, pp.2088-2100.
- Tseng, M.-L., Chiang, J. H., & Lan, L. W. (2009). Selection of optimal supplier in supply chain management strategy with analytic network process and choquet integral. *Computers & Industrial Engineering*, 57(1), pp.330–340.
- Tuli, F. (2010). The basis of distinction between qualitative and quantitative research in social science: Reflection on ontological, epistemological and methodological perspectives. *Ethiopian Journal of Education and Sciences*, 6(1), pp.97-108.
- Vahidi, Torabi & Ramezankhani, (2018). Sustainable supplier selection and order allocation under operational and disruption risks. *Journal of Cleaner Production*, 174, pp.1351–1365.
- Verdecho, M. J., Alfaro-Siaz, J. J., & Rodríguez-Rodríguez, R. (2010). An approach to select suppliers for sustainable collaborative networks. In IFIP international federation for information processing, pp. 304–311.
- Wang, Y. M., & Elhag, T. M. S. (2006). Fuzzy TOPSIS method based on alpha level sets with an application to bridge risk assessment. *Expert Systems with Applications*, 31, pp.309–319.
- Wang, Z. & Sarkis, J., (2013). Investigating the relationship of sustainable supply chain management with corporate financial performance. *International Journal of Productivity and Performance Management*, 62(8), pp.871–888.
- Wanke, P., Arkader, R. & Fernanda Hijjar, M., (2007). Logistics sophistication, manufacturing segments and the choice of logistics providers. *International Journal of Operations & Production Management*, 27(5), pp.542–559.

- Ware, N., Singh, R. & Banwet, S., (2014). Modeling Flexible Supplier Selection Framework. *Global Journal of Flexible Systems Management*, 15(3), pp.261–274.
- Wazir, B., (2001). “Nike accused of tolerating sweatshops”. [Online] Available at: <https://www.theguardian.com/world/2001/may/20/burhanwazir.theobserver> [Accessed 12 April 2019].
- Weele, A.J, van. (2010). Purchasing & supply chain management: analysis, strategy, planning and practice 5th ed.,
- Weele, A.J, van, (2018). Purchasing & supply chain management: analysis, strategy, planning and practice 7 upplagan.,
- Whittemore, R., Chase, S.K., & Mandle, C.L. (2001). Validity in qualitative research. *Qualitative Health Research*, 11(4), pp.522-537.
- Wilson, J. (2010). Essentials of Business Research: A Guide to Doing Your Research Project. SAGE Publications, p.7
- Wilson, J.P., (2015). The triple bottom line. *International Journal of Retail & Distribution Management*, 43(4/5), pp.432–447.
- Winstanley, D., Clark, J., Leeson, H., (2002). Approaches to child labour in the supply chain. *Business Ethics: A European Review*, 11(3), pp.210–223.
- Wolf, C., & Seuring, S. (2010). Environmental impacts as buying criteria for third party logistical services. *International Journal of Physical Distribution & Logistics Management*, 40(1), pp.84–102.
- Wu, T., Blackhurst, J., (2009). Supplier evaluation and selection: an augmented DEA approach. *Int. J. Prod. Res.* 46 (16), pp.4593–4608.
- Wu, W.W., (2008). Choosing knowledge management strategies by using a combined ANP and DEMATEL approach. *Exp. Syst. Appl.* 35 (3), pp.828–835
- Wu, Z., and M. Pagell. (2011). Balancing Priorities: Decision- Making in Sustainable Supply Chain Management. *Journal of Operations Management*, 29 (6), pp.577–590. doi:10.1016/j.jom.2010.10.001.
- Wu et al., (2016). Supplier selection in nuclear power industry with extended VIKOR method under linguistic information. *Applied Soft Computing*, 48, pp.444–457.
- Xiu-Li Tang, (2009). Study on selection of logistics supplier based on support vector machine. Machine Learning and Cybernetics. *International Conference on*, 2, pp.1231–1235.
- Xu, Z. , Qin, J, Liu, J. & Martínez, L. (2019). Sustainable supplier selection based on AHPSort II in interval type-2 fuzzy environment. *Information Sciences* 483, pp. 273–293
- Yang, Z.L., Bonsall, S., Wang, J., (2011). Approximate TOPSIS for vessel selection under uncertain environment. *Expert Systems With Applications*. 38 (12), pp.14523–14534.
- Yazdani et al., (2017). Integrated QFD-MCDM framework for green supplier selection. *Journal of Cleaner Production*, 142(P4), pp.3728–3740.

- Yeung, A.C. (2006). The Impact of Third-Party Logistics Performance on the Logistics and Export Performance of Users: An Empirical Study. *Mar. Econ. Logist.* 8, pp.121–139.
- Yin, R. K., (2008). Case Study Research: Design and Methods, Fourth Edition. Newbury Park, CA: Sage Publications, Inc
- Yin, R. (2002) Case study Research. Thousand Oaks, CA: Sage
- Yin, R. K. (2003). Case study research design and methods third edition. Applied social research methods series, 5. Sage Publications Inc. Thousand Oaks, California.
- Yousefi et al., (2016). Evaluating and ranking sustainable suppliers by robust dynamic data envelopment analysis. *Measurement*, 83, pp. 72-85.
- Yu, C., Shao, Y., Wang, K., Zhang, L. (2019). A group decision making sustainable supplier selection approach using extended TOPSIS under interval-valued Pythagorean fuzzy environment. *Expert Systems With Applications* 121, pp. 1–17.
- Zadeh, L. A. (1965). Fuzzy sets. *Information and Control*.
- Zimmer., K., Fröhlinga., M., and Schultmanna., F. (2016). Sustainable supplier management – a review of models supporting sustainable supplier selection, monitoring and development. *International Journal of Production Research*, 54(5), pp.1412–1442, <http://dx.doi.org/10.1080/00207543.2015.1079340>
- Zhou et al., (2018). Data envelopment analysis application in sustainability: The origins, development and future directions. *European Journal of Operational Research*, 264(1), pp.1–16.
- Zhou, F., Lin, Y., Wang, X., Zhou, L., He, Y., (2016). ELV recycling service provider selection using the hybrid MCDM method: a case application in China. *Sustainability*. 8, pp.482. <https://doi.org/10.3390/su8050482>
- Zhou, G., Min, H., Xu, C., Cao, Z.(2008).Evaluating the comparative efficiency of Chinese third-party logistics providers using data envelopment analysis. *International Journal of Physical Distribution and Logistics Management*, 38 (4), pp. 262-279
- Zhou, P. , & Ang, B. W. (2008). Linear programming models for measuring economy-wide energy efficiency performance. *Energy Policy*, 36 (8), pp.2911–2916.
- Zhu, Q., Dou, Y., Sarkis, J., (2010). A portfolio-based analysis for green supplier management using the analytical network process. *International Journal of Supply Chain Management*. 15 (4), pp. 306-319
- Zhu, Q., J. Sarkis, and K.-H. Lai. (2008). Confirmation of a Measurement Model for Green Supply Chain Management Practices Implementation. *International Journal of Production Economics*, 111 (2): 261–273. doi:10.1016/j.ijpe.2006.11.029.
- Zhu, Q., Sarkis, J., (2007). The moderating effects of institutional pressures on emergent green supply chain practices and performance. *International Journal of production Research*, 45 (18/19), pp. 4333-4355.
- Zsidisin, G.A., Siferd,S.P., (2001). Environmental purchasing: a framework for theory development. *European Journal of Purchasing & Supply Management* 7(1), pp.61–73.

