# Environmental Criteria for Third Party Logistics (3PL) Transportation Service Selection towards Green Supply Chain: A Case of Fast Moving Consumer Goods Company

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**Abstract**

The increasing in green consideration of customers causes several companies to incorporate environmental practices into their supply chain aiming to increase competitiveness in the market. The company attention has been extended to environmental performance of outsourcing services from third party logistics (3PL) provider. However, there is a lack of environmental criteria in 3PL transportation service selection. Therefore, this research aims to fulfill this gap by developing environmental criteria in 3PL transportation service selection for a fast-moving consumer goods (FMCG) company in Thailand to promote sustainable performance. The research intends to conduct the analytic hierarchy process (AHP) to identify and prioritize criteria regarding the research aim. Three experts performed pair-wise comparison to weight the importance of criteria. The result indicated that "vehicle use" with 26.9% of importance criteria is the highest importance over the others, whereas "environmental control" (9.2%) is the least important criteria for the case study. The outcomes can support decision making process of FMCG company in 3PL selection and service improvement process of 3PL providers. The importance of criteria can enhance sustainable performance of company's supply chain.

***Keywords*****:** *Environmental criteria, Third party logistics (3PL) provider selection, Transportation service*

## 1. Introduction

Sustainable efforts have been increasing over the past decades, particularly in private corporate sector. The efforts are mainly due to impacts of global warming and an increasing of customer awareness of environmental issues. In addition, companies recognized sustainability as one of the key components to advance their performance and gain competitive advantage; ultimately to increase a superior performance over their competitors (El-Garaihy, Mobarak, & Albahussain, 2014). Several companies cooperate with their business partners, e.g. raw material suppliers, consumers and third-party logistics (3PL) providers, through sustainable supply chain management (SSCM), aiming to achieve a sustainable supply chain. SSCM improves the effectiveness of planning and operating from purchasing raw material to distribution of finished goods to be more cost effective, socially responsible and eco-friendly. Therefore, SSCM can be accomplished not only by selecting appropriate partners (So et al., 2006), but also by balancing the three pillars of sustainability, which are economic, social and environmental aspects.

An increasing number of companies concern on environmental issues can be seen from the popularity of green supply chain management (GSCM). GSCM is an integration of environmental consideration into supply chain management to lessen environmental impacts throughout its supply chain. The strategy can be applied throughout a product's lifecycle, from raw material acquisition to sourcing logistics services providers. For example, Unilever concentrates in sourcing 100% of raw materials sustainability, developing innovations to lessen greenhouse gas (GHG) emissions and to eco-efficiently operate their manufacturing processes along with their suppliers and distribution channels. Karsak and Dursun (2015) stated that selecting supplier is one of the key strategies to enhance company's competitiveness. Bedey et al. (2008) found that the traditional factors, such as price, quality and delivery processes, are mostly used in supplier selection. Companies that start to focus on environmental initiatives will consider environmental performance of their raw material suppliers, as well as services of 3PLs (Centobelli, Cerchione, & Esposito, 2017).

3PLs are the business that provides several logistics services, e.g. transportation, warehousing, global services, and information technology. Transportation service directly causes $CO_2$ emission and climate change, which has to be considered. Most companies that sell or produce goods tend to rely more

on 3PLs outsourcing in order to reduce cost and generate expertise to develop company supply chain. When 3PLs become partner of the companies, they must perform in the same direction as the company buyers for efficient outcomes. Therefore, when the company buyers outsource 3PLs, the company does not only focus on traditional dimensions, but also on environmental aspect, which is a key to drive supply chain towards sustainability.

3PL selection is an important strategy to increase the organizational opportunities in a highly competitive market. Besides 3PL selection based on traditional criteria, the increasing demand for green supply chain management causes the companies to raise their interest in environmental aspect. Thus, 3PLs need to transform their strategies into green practices in respect to customer demand. Consequently, 3PLs tend to increase and implement more environmental strategies (Huge-Brodin, Isaksson, & Sweeney, 2013). However, traditional and environmental criteria are important in different context. Therefore, stakeholders should combine traditional and environmental policies together to deal with the changing trends as well as to compete with the competitors.

In Thailand, the focus on the environment has been impacting on various sectors including fast moving consumer goods (FMCG) industry. FMCG industry, which is a core business in producing consumer products, e.g. food, beverages, personal care products and household products, attempts to create green business units for green consumers (Khanna, 2015). Moreover, an increase in environmental consciousness of customers has a direct influence on FMCG industry to employ more environmentally friendly practices, including 3PL selection for transportation service. FMCG companies attempt to shift transportation process out of their core business by outsourcing services from 3PLs for a professional and effective distribution of their products to customers. In order to reach a FMCG's competitive market, transportation service from an outsourcing 3PLs should be qualified and complied with environmental criteria. Thus, qualified 3PLs can help leading company's supply chain to become more competitive in the market and progress towards sustainability.

## 2. Objectives

The purpose of this research is to develop environmental criteria for a 3PL transportation service selection process to promote sustainable performance of a FMCG company in Thailand, in the context of GSCM. The objectives of this research are:

1. To identify environmental criteria for 3PL transportation service selection.
2. To provide a prioritized list of environmental criteria regarding 3PL transportation service selection for FMCG company in Thailand.

## 3. Materials and Methods

*3.1 Identification of environmental criteria in 3PL transportation service selection.*

Environmental criteria in 3PL transportation service selection were collected from literature, e.g. peer-reviewed journals, textbooks and online databases. The acquired criteria were from several studies in consideration of green initiatives from both company buyer and 3PL perspectives in different industries and countries. The primary list of main and sub criteria of environmental aspects was obtained in this section.

*3.2 Case study*

A case study in this research is one of companies in FMCG industry in Thailand. The company produces a wide range of frequency products e.g. food, beverage, personal care and household products. The company is internationally world-renowned for its sustainable business strategies. The products are incorporated in people's daily lifestyle. Customer demand also has direct influence on sustainability, particularly on environmental aspect of the products. The company takes ambitious driver to decrease environmental impacts in every process, e.g. sourcing of raw material and transportation service, to enhance positive impacts and long-term sustainability. The product distribution is outsourced from 3PLs to serve their customers for increasing the efficiency and expertise. Because the company does not have their own transportation service, 3PL selection is necessary to consider. The company generates sustainable sourcing

policy to be responsible to people and resources, which is essential to grow their business. In addition, the company looks for the options to explore environmental transportation to reduce environmental impacts to their customers.

Representatives of the selected FMCG company were specified by purposive sampling. The representatives participated in this research consisted of two 3PL compliance support managers and one assistant procurement manager in logistics. The representatives were classified as an expert since they have experience and authority to make decision related to 3PL transportation service selection in a company.

*3.3 Providing the prioritized list of environmental criteria regarding 3PL transportation service selection in FMCG company in Thailand.*

The application of an analytic hierarchy process (AHP) model was used to prioritize environmental criteria. AHP is one of the multiple-criteria decision making (MCDM) methods that derive complex decision into hierarchy. AHP can manipulate tangible and intangible judgment of individual and group (Bruno et al., 2012). Pair-wise comparison based on expert judgments was used to prioritize the selected criteria (Saaty, 2008). AHP consists of three main stages:

*3.3.1 Interview*

The interview process began after collecting main and sub criteria of environmental aspect towards 3PL transportation service from literature review and compiling them into a list. Expert's qualitative opinions on environmental criteria were collected by phone, individually. Then, experts were requested to add or delete environmental criteria related to company context in an interview form via e-mail to streamline the lists of environmental criteria for 3PL transportation service selection. Results of the interview process were the final main and sub criteria used to develop questionnaire survey, which gathering from three respondents.

*3.3.2 Questionnaire survey*

The close-ended questionnaire method was applied to collect quantitative data for the three respondents via e-mail. The experts were asked to perform pair-wise comparison for weighing the importance of each criterion to obtain its interrelation by 1-9 Saaty's scaling ratio, as presented in Table 1. Each criteria level was used to compare within the level by the experts. The data from questionnaire survey were concluded and evaluated for their consistency ratio (CR) in the next stage.

**Table 1** Saaty's scaling ratio

| Intensity of importance | Definition | Explanation |
|---|---|---|
| 1 | Equally important | Both elements have equal priority |
| 3 | Moderately important | One element is moderately favored over the other |
| 5 | Strongly important | Experience and judgment strongly recommend to prefer one element over the other |
| 7 | Very strong important | An element is given very strong preference over another and its dominance demonstrated in practice |
| 9 | Extremely strong important | The evidence favoring one activity over another is of the highest degree possible of affirmation |
| 2, 4, 6, 8 | Intermediate values | Used to represent compromise between the preferences listed above |

Source: (Shen, Muduli & Barve, 2015)

*3.3.3 Verification of consistency ratio (CR)*

After development of expert judgements, all criteria were weighted in normalized matrices. Then, the relative weight and maximum eigenvalue ($\lambda_{max}$) in each matrix were calculated. The $\lambda_{max}$ is an important value in AHP to calculate the consistency ratio as well as to validate the evaluation. Therefore,

the judgement is consistent if $\lambda_{max}$ is closed to the number of criteria. Consistency Index (CI) was applied to get the result used in CR verification. CR can validate the consistency of expert judgments. The consistent judgement is acceptable with CR value less than or equal to 0.10. Thus, CI and CR calculation can be performed by the following formulas:

Consistency Index (CI) = $\frac{\lambda_{max} - n}{n - 1}$

Where, n is the matrix size

Consistency Ratio (CR) = $\frac{CI}{RI}$

Where, RI is the random consistency index based on matrix size shown in Table 2.

**Table 2** The average random consistency index (RI)

| **n** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
|---|---|---|---|---|---|---|---|---|---|---|
| RI | 0.000 | 0.000 | 0.524 | 0.881 | 1.108 | 1.248 | 1.341 | 1.405 | 1.450 | 1.485 |

Source: (Alonso and Lamata, 2006)

## 4. Results and Discussion

*4.1 Identification of environmental criteria in 3PL transportation service selection.*

According to a comprehensive literature review as listed in Table 3, the lists of environmental criteria towards transportation service indicated that environmental criteria have received the attention by a few of researchers. However, the environmental concerns in various logistics services are becoming of increasing importance. The criteria selection in transportation service have been focused more on traditional criteria, e.g. price, quality, delivery, empathy and experience, which are the core consideration for company buyers to select the qualified 3PLs (Rapee, Peng, &Lee, 2014).

Seven main criteria and twenty-two sub criteria are categorized in the list of environmental criteria in 3PL transportation service selection. The acquired criteria were direct and indirect environmental aspects related to 3PL selection. In term of direct environmental renewable criteria, the effort on environmental practices in energy efficiency is contributed to the use of renewable energy. Evidently, the use of "energy" was the most popular criteria investigated by researchers to reduce emissions from transportation. Lam and Dai (2015) clarified that company buyers expect 3PLs to create the attempt to increase the use of renewable energy in order to decrease emission in transportation process. Bajec and Tuljak-Suban (2016) explained that the renewable energy, such as solar power and wind power, and fuels (fossil) are one of the selection criteria required by buyer perspective. On the contrary, environmental training for supplier of 3PLs is rarely used as selection criteria (Evangelista, 2014). In term of indirect environmental criteria, "greater use of intermodal" is the most investigated criterion which combines both economic and environmental effectiveness. Large, Kramer and Hartmann (2013) studied sustainable logistics services buying from buyer perspective in developed counties. They focused on the usage of rail and ship in cargo consolidation which does not only reduce cost but also carbon and energy. Thus, the providing of intermodal solutions is essential in adopting green initiatives.

Consequently, those acquired criteria were applied to the case company to select the qualified 3PLs which match company requirements. However, level of environmental concern is varied depends on different company context. Therefore, company buyers should define the important policies to collaborate with their 3PLs in the same direction.

**Table 3** Summary of environmental criteria in 3PL transportation service selection

| Main criteria | Sub criteria | Author(s) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1. Vehicle use | 1.1 Changing vehicle specification | | ● | | | ● | | | | |
| | 1.2 Reducing empty running | | ● | | | ● | | | | |
| | 1.3 Environmentally friendly vehicle | | ● | ● | ● | | | | | |
| 2. Transportation mode | 2.1 Improving vehicle loading modes | | | ● | ● | ● | | | | |
| | 2.2 Greater use of intermodal | | ● | ● | ● | ● | | | | |
| | 2.3 Choice of carrier | | ● | ● | ● | | | | | |
| 3. Energy efficiency | 3.1 Renewable energy | | | ● | ● | ● | ● | ● | ● | ● |
| | 3.2 Energy consumption | | | ● | ● | | ● | ● | ● | ● |
| | 3.3 Energy saving instrument | | | | ● | | ● | | ● | ● |
| 4. Environmental training | 4.1 Employee training | | ● | | ● | ● | | | | |
| | 4.2 Customer training | | | | ● | ● | | | | |
| | 4.3 Supplier training | | | | | ● | | | | |
| 5. Supply chain re-organization | 5.1 Transportation management system | | | ● | ● | | | | | |
| | 5.2 Logistic carbon management system | | | ● | ● | | | | ● | |
| | 5.3 Computerized routing and scheduling system | | | ● | ● | | | | | |
| 6. Supply chain collaboration | 6.1 Partnership with customers | ● | ● | | ● | ● | | | ● | |
| | 6.2 Partnership with other 3PLs | ● | ● | | ● | ● | | | ● | |
| | 6.3 Framework determination within company | ● | | | ● | ● | | | ● | |
| 7. Environmental control | 7.1 Environmental management system | | | ● | ● | ● | | | ● | |
| | 7.2 Setting lower GHG targets | ● | ● | ● | | ● | ● | | | |
| | 7.3 Pollution minimization | | ● | ● | | ● | ● | | | |
| | 7.4 $CO_2$ declaration | ● | ● | ● | ● | ● | | | | |

Author(s)
1 (Wolf & Seuring, 2010)
2 (Large, Kramer, & Hartmann, 2013)
3 (Sweeney, Huge-Brodin, & Isaksson, 2013)
4 (Huge-Brodin, Isaksson, & Sweeney, 2013)
5 (Evangelista, 2014)
6 (Lam & Dai, 2015)
7 (Bajec & Tuljak-Suban, 2016)
8 (Celik, Erdogan, & Gumus, 2016)
9 (Bask et al., 2018)

*4.2 Providing the prioritized lists of environmental criteria regarding 3PL transportation service selection in FMCG company in Thailand.*

The hierarchy model of final criteria is obtained from expert opinions, as illustrated in Figure 1. The experts deleted some sub criteria collected from literature review (Table 3), which are not relevant to company context. Thus, a total of seventeen sub criteria are divided into seven categories of main criteria as final criteria used to develop questionnaire survey.

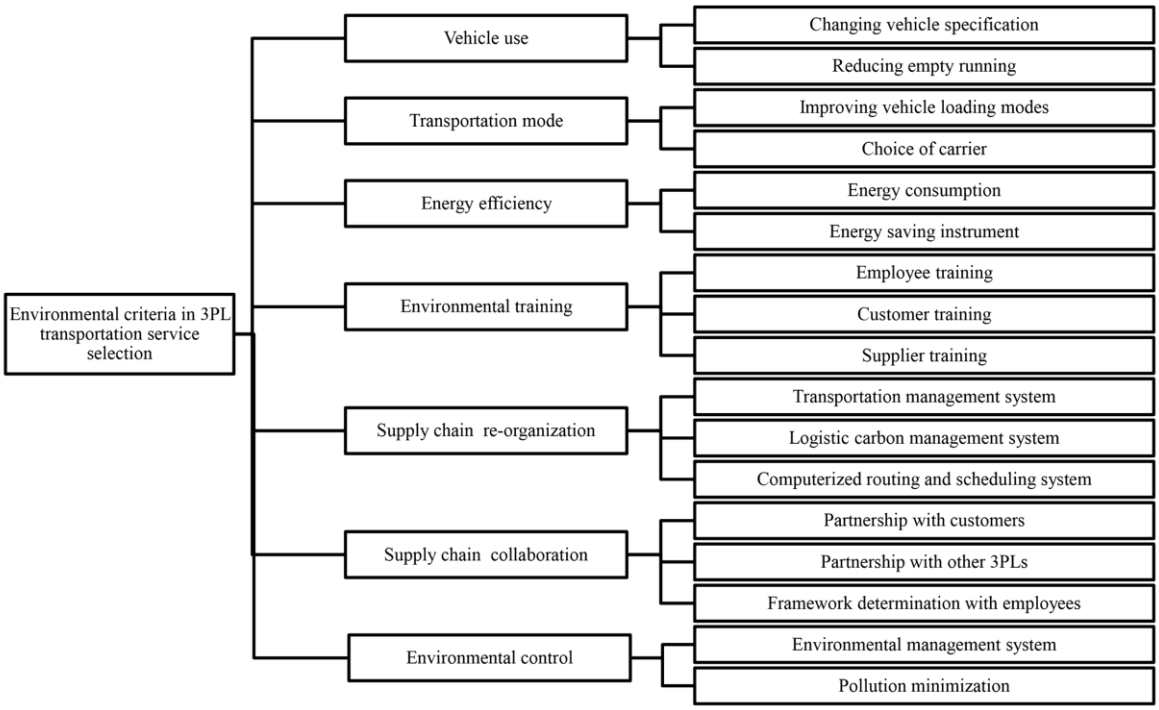


**Figure 1** Hierarchy model of environmental criteria in 3PL transportation service selection

The analysis results were obtained from experts in the case company by pair-wise comparison. Aggregation of expert judgments was generated by geometric mean using Microsoft Excel software. The relative weight of main and sub criteria was also determined by normalization from the judgments of all experts. According to the expert judgments, the consistency ratio (CR) was acceptable with CR $\leq$ 0.1; thus, the judgements were consistent. The results, which are presented as a rank of the main and sub criteria, are beneficial to the case company in selection of qualified 3PLs. The top three ranking main criteria are vehicle use, transportation mode, and supply chain collaboration, respectively, while environmental control was the least important main criteria.

Based on Table 4, the experts suggested that a main criterion "vehicle use" (with 26.9% of importance) ranked first. "Reducing empty running" was the most important sub criteria in this main criterion. This result was in line with the finding of Evangelista (2014) that twelve of thirteen Italian logistics companies as their case studies provided environmental initiatives on reducing empty running to improve their environmental performance. This meant 3PLs and company buyers intend to cooperate in the same direction to lower cost of services, while improving fuel efficiency. Moreover, an inefficient use of truck causes a higher price of services with greenhouse gas emission. "Transportation mode" (with 20.5%) ranked second among the main criteria where "improving vehicle loading modes" attained the most important sub criteria in this main criterion. Based on the expert opinions in this study, the experts preferred 3PLs to provide better services delivery and reduce cost. Therefore, this study recommended that 3PLs and company buyers should collaborate to share truck load. Mckinnon (2000) studied the chances for improving vehicle loading in sustainable distribution. He suggested that space utilization can cut traffic level and emission with more efficient product optimization. The third rank, "supply chain collaboration" (with 12%) showed the experts interest in "partnership with customers" rather than other parties. The collaboration between 3PLs and company buyers needs to align perception on environmental issues regards their company standards. The relationship between both parties is an important component for a long-term partnership. Environmental efforts can be achieved by clear demands, information sharing, and practice

cooperation between the two parties (Wolf & Seuring, 2010). The least important main criterion is "environmental control" with 9.2% of importance. Experts equally rated both environmental control's sub criteria, "environmental management system" and "pollution minimization". This equally rated result indicates an equal level of importance of two sub criteria for the case company. Although this main criterion is not directly related to the transportation performance, the lack of environmental control could post a negative image on the company. In addition, some expenses might occur to the company in term of fine from breaking environmental laws and regulations. Trademark of the FMCG company might not be presented on the 3PL vehicle; however, the company could help improve an environmental performance of the supply chain by setting a standard on environmental and emission control for their 3PLs. Celik, Erdogan and Gumus (2016) analyzed that the emission management system was one of the attributes in green logistics services provider selection in Turkey. They mentioned environmental certificate should be verified in policies and working processes by 3PLs. Moreover, pollution control is also an environmental practice that must be complied with regulations to achieve a sustainable supply chain (Lam & Dai, 2015).

**Table 4** The final ranking of environmental criteria in 3PL transportation service selection

| | Main criteria | Relative weight (%) | Ranking | | Sub criteria | Relative weight (%) | Ranking | |
|---|---|---|---|---|---|---|---|---|
| 1 | Vehicle use | 26.9 | 1 | 1.1 | Changing vehicle specification | 43.0 | 2 | CR=0.00 |
| | | | | 1.2 | Reducing empty running | 57.0 | 1 | |
| 2 | Transportation mode | 20.5 | 2 | 2.1 | Improving vehicle loading modes | 75.6 | 1 | CR=0.00 |
| | | | | 2.2 | Choice of carrier | 24.4 | 2 | |
| 3 | Energy efficiency | 11.1 | 4 | 3.1 | Energy consumption | 42.4 | 2 | CR=0.00 |
| | | | | 3.2 | Energy saving instrument | 57.6 | 1 | |
| 4 | Environmental training | 9.6 | 6 | 4.1 | Employee training | 31.7 | 2 | CR=0.03 |
| | | | | 4.2 | Customer training | 19.7 | 3 | |
| | | | | 4.3 | Supplier training | 48.6 | 1 | |
| 5 | Supply chain re-organization | 10.7 | 5 | 5.1 | Transportation management system | 46.0 | 1 | CR=0.01 |
| | | | | 5.2 | Logistic carbon management system | 16.0 | 3 | |
| | | | | 5.3 | Computerized routing and scheduling system | 38.0 | 2 | |
| 6 | Supply chain collaboration | 12.0 | 3 | 6.1 | Partnership with customers | 43.1 | 1 | CR=0.00 |
| | | | | 6.2 | Partnership with other 3PLs | 25.2 | 3 | |
| | | | | 6.3 | Framework determination with employees | 31.7 | 2 | |
| 7 | Environmental control | 9.2 | 7 | 7.1 | Environmental management system | 50.0 | 1 | CR=0.00 |
| | | | | 7.2 | Pollution minimization | 50.0 | 1 | |
| | CR = 0.03 | | | | | | | |

## 5. Conclusion

Environmental criteria for 3PL selection are one of the important strategies to implement in company supply chain. The implementation aids in environmental impact reduction as well as cost

reduction in economic aspect. In addition, the combination of environmental innovation as green supply chain management (GSCM) and traditional supply chain can enhance competitive advantage in the market. In this research, AHP was used in development of environmental criteria in 3PL transportation service selection of a FMCG company in Thailand. AHP identifies and prioritizes main and sub criteria by using a pair-wise comparison. After examining AHP model, criteria are ranked by the group of experts from the case company. The top three main criteria preferred are vehicle use, transportation mode and supply chain collaboration, respectively, while environmental control ranked last.

The findings of this research will be useful for a case company to reconsider 3PL selection criteria when outsourcing the qualified 3PLs based on environmental aspect. In addition, the criteria can be adopted by the case company to improve the environmental sustainability performance. The recommendation practices on 3PL selection towards environmental issue will be further developed in research contribution for company buyers and 3PLs. Therefore, two parties can perform in the same direction regarding environmental sustainability. However, the application in this research is a single case study. The direction of future research can be expanded by conducting the research on multi case studies in different industries and countries. Moreover, practical implication of company buyers and 3PLs is challenged for rethinking their strategies towards environmental performance.

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## 7. References

Alonso, J. A., & Lamata, M. (2006). Consistency in the Analytic Hierarchy Process: a New Approach. *International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems, 14*, 445-459. doi:10.1142/S0218488506004114

Bajec, P. & Tuljak-Suban, D. (2016). Identification of Environmental Criteria for Selecting a Logistics Service Provider: A Step Forward towards Green Supply Chain Management. *Sustainable Supply Chain Management*, Krmac, E. (ed.) Rijeka: InTech.

Bask, A., Rajahonka, M., Laari, S., Solakivi, T., Töyli, J., & Ojala, L. (2018). Environmental sustainability in shipper-LSP relationships. *Journal of Cleaner Production, 172*, 2986-2998. doi:https://doi.org/10.1016/j.jclepro.2017.11.112

Bedey, L., klund, S. E., Najafi, N., Wahren, W., & Westerlund, K. (2008). *Purchasing Management* Retrieved from http://publications.lib.chalmers.se/records/fulltext/90488.pdf

Bruno, G., Esposito, E., Genovese, A., & Passaro, R. (2012). AHP-based approaches for supplier evaluation: Problems and perspectives. *Journal of Purchasing and Supply Management, 18*(3), 159-172. doi:https://doi.org/10.1016/j.pursup.2012.05.001

Celik, E., Erdogan, M., & Gumus, A. T. (2016). An extended fuzzy TOPSIS-GRA method based on different separation measures for green logistics service provider selection. *International Journal of Environmental Science and Technology, 13*(5), 1377-1392. doi:10.1007/s13762-016-0977-4

Centobelli, P., Cerchione, R., & Esposito, E. (2017). Environmental sustainability in the service industry of transportation and logistics service providers: Systematic literature review and research directions. *Transportation Research Part D: Transport and Environment, 53*, 454-470. doi:10.1016/j.trd.2017.04.032

El-Garaihy, W., Mobarak, A. K., & Albahussain, S. (2014). Measuring the Impact of Corporate Social Responsibility Practices on Competitive Advantage: A Mediation Role of Reputation and Customer Satisfaction. *International Journal of Business and Management, 9*. doi:10.5539/ijbm.v9n5p109

Evangelista, P. (2014). Environmental sustainability practices in the transport and logistics service industry:

An exploratory case study investigation. *Research in Transportation Business & Management, 12*, 63-72. doi:https://doi.org/10.1016/j.rtbm.2014.10.002

Huge-Brodin, M., Isaksson, K., & Sweeney, E. (2013). Purchasing green transport and logistics services: Implications from the environmental sustainability attitude of 3PLs. *Outsourcing Management for Supply Chain Operations and Logistics Services, 1*, 449-465. doi:10.4018/978-1-4666-4852-4.ch005

Karsak, E., & Dursun, M. (2015). An integrated fuzzy MCDM approach for supplier evaluation and selection. *Computers & Industrial Engineering, 82*. doi:10.1016/j.cie.2015.01.019

Khanna, V. (2015). 8 mega trends impacting the global FMCG / CPG industry (updated Aug 2016). Retrieved from https://www.linkedin.com/pulse/8-mega-trends-affecting-global-fmcg-cpg-industry-vikram-khanna

Lam, J. S. L., & Dai, J. (2015). Environmental sustainability of logistics service provider: An ANP-QFD approach. *The International Journal of Logistics Management, 26*. doi:10.1108/IJLM-08-2013-0088

Large, R. O., Kramer, N., & Hartmann, R. K. (2013). Procurement of logistics services and sustainable development in Europe: Fields of activity and empirical results. *Journal of Purchasing and Supply Management, 19*(3), 122-133. doi:https://doi.org/10.1016/j.pursup.2013.05.002

McKinnon, A. (2000). Sustainable distribution: Opportunities to improve vehicle loading. *Industry and Environment, 23*(4), 26-30.

Rapee, P., Peng, K. C., & Lee, T. R. (2014). The key factors for selecting C2C Logistics Companies by using Fuzzy AHP in Thailand. *IOSR Journal of Business and Management, 16*, 75-85. doi:10.9790/487X-161127585

Saaty, T. (2008). Decision making with the Analytic Hierarchy Process. *Int. J. Services Sciences Int. J. Services Sciences, 1*, 83-98. doi:10.1504/IJSSCI.2008.017590

Shen, L., Muduli, K., & Barve, A. (2015). Developing a sustainable development framework in the context of mining industries: AHP approach. *Resources Policy, 46*, 15-26. doi:https://doi.org/10.1016/ j. resourpol.2013.10.006

So, S. H., Kim, J., Cheong, K., & Cho, G. (2006). Evaluating the service quality of third party logitics service providers using the analytical hirarchy process. *Journel of Information Systems and Technology Managemrnt, 3*, 261-270. doi:10.1590/S1807-17752006000300001

Sweeney, E., Evangelista, P., Huge-Brodin, M., & Isaksson, K. (2013). The role of third party logistics providers (3PLs) in the adoption of green supply chain initiatives. *European Financial Review*, 84, 32-34.

Wolf, C., & Seuring, S. (2010). Environmental impacts as buying criteria for third party logistical services.*International Journal of Physical Distribution & Logistics Management, 40*, 84-102. doi:10.1108/09600031011020377