VOL. 11, NO. 11, JUNE 2016 ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences

www.arpnjournals.com

# THE ANALYTIC APPROACH APPLICATIONS IN GREEN SUPPLIER SELECTION: A LITERATURE REVIEW

Tran Thi My Dung[1], Nguyen Minh Luan[2] and Le Hai Quoc[1]
[1]Department of Industrial Management, Can Tho University, Vietnam
[2]Department of Automation Technology, Can Tho University, Vietnam
E-Mail: ttmdung@ctu.edu.vn

**ABSTRACT**

In recent years, green factors which are concentrated on environment awareness and sustainable development of enterprises have been being become vital criteria of selecting a supplier. This paper reviews the literature of the Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP) applications in green supplier selection by analysing 36 related papers which were published in the high prestige journals from 2002 to 2014. Those papers are compiled and categorized according to business areas; namely, energies, materials, consumer discretionary, consumer staples, and so forth. The aims of this investigation are to focus on the facilitation of AHP/ANP in terms of green supplier selection process and its application in business fields as well as the successful factors of its implementation. In addition, the review is implemented to facilitate researchers and practitioners in embracing the analytic approach applications in green supplier selection.

**Keywords:** analytic hierarchy process, analytic network process, green supplier selection, overview.

## INTRODUCTION

The use of multiple factor decision making models has been extensively studied in recent years. As a matter of fact, the traditional single criterion approach based on lowest cost is not supportive and robust enough because the qualitative factors are not concerned. Green supplier selection, which is a vital step in green supply chain management, would be seen as multiple objective decision analysis to improve the competitiveness for sustainable growth and development of an enterprise. The purpose of this research is to review and assess the application of well-known multiple criteria decision making methodologies, called the analytic hierarchy process (AHP) and Analytic Network Process (ANP), to various important problems in green supplier selection.
The articles are gathered and analysed to answer the following research questions:

a) How AHP/ANP facilitate the decision making in the green supplier selection?
b) How does AHP/ANP integrate into other methods for the green supplier selection?
c) What are the successful factors of AHP/ANP implementation?
d) Which opportunities should researchers search for in the future?

The organization of the present study is as follows: the next section highlights the AHP/ANP background with the basic principle and several works related to overview. Section 3 consists of research methodology while section 4 provides the observations and discussions. Then, future works will be presented in section 5. Finally, section 6 provides a conclusion.

## BACKGROUND

### Analytic hierarchy process

The analytic hierarchy process, proposed by Saaty (1980), represents a powerful and flexible multi-criteria decision technique for complex problem that allows subjective as well as objective factors to be considered in decision making process. The AHP has been gradually increased in almost all the application in multiple criteria decision making. The wide applicability is due to usefulness, simplicity, and flexibility to integrate with other methods.

The AHP involves three basic principles: problem decomposition, comparative judgment, and synthesis of priorities. Firstly, the AHP decomposes a complex, multiple criteria problem into a decision hierarchy. The hierarchy structure starting with the goal, through the primary criteria and sub-criteria levels to the lowest level which usually contains the set of alternatives. After the hierarchy structure is constructed, all pair wise comparisons are carried out to determine the priorities of the attributes at the same level with respect to the next higher level of the hierarchy using a nine-point scale. The relative weights are computed as the component of the normalized eigenvector associated with the largest eigenvalue of their matrix. Then, the priorities are pulled together through the principle of hierarchy composition to determine the overall priorities of decision alternatives after checking the consistency. For detailed description of the AHP procedure, it is preferred to the references (Saaty, 1980; 1994; Saaty and Vargas, 1994).

### Analytic network process

ANP, which was developed by Saaty (1996), is a general form of AHP. The structure of AHP comprises the decision problem into a hierarchy with a goal, decision criteria and alternatives which are considered independent of each other. On the other hand, the ANP has a network

structure in which decision levels and attributes have complex interrelationships that usually occurred in many real-world cases. In fact, the ANP is combined of two parts; one is a network of criteria and sub-criteria that controls the interrelationships, and another is a network of influences among the elements and clusters. Moreover, ANP model has feedback loops among the elements that help system ability to adjust factors properly. In term of robust characteristic, the ANP is more consistent ranking than the AHP model in case changing the supplier selection criteria. Kuo *et al* (2012) examined via deleting one criterion, cooperation from the criteria list. As the result, the ranking of most criteria of ANP method does not change while AHP method does. As mentioned above, the ANP method is capable dealing with complex decisions that dependence and feedback analyzed in related areas of benefits, opportunities, costs and risks. In fact, there have been numerous applications of ANP in both practical and hypothetical research (Saaty 2006).

**Literature review**

Several literature review papers have discussed the application of the analytic methods as well as considered the green factors. Subramanian and Ramanathan (2012) presented a literature review about the applications of AHP in different areas of operations management which were classified by operations strategy, product and process design, planning and scheduling resources, project management, and managing the supply chain. As a result, the most addressed decision themes are product and process design and, managing the supply chain. Regarding to supplier selection, Wu and Barnes (2011) paid particular attention to decision-making models and approaches that are especially relevant for use in agile supply chains by categorizing in four phases including formulation of criteria, qualification, final selection, and application feedback. Furthermore, Chai *et al*. (2013) briefly review applications decision making techniques by analyzing 123 papers between 2008 and 2012. The authors indicated that AHP and ANP remain the most important and commonly used methods that constitute up-to-date decision approaches for supplier selection. Many different definitions for green and sustainable supply chain management have been proposed through different sets of key characteristics for business sustainability and supply chain management (Ahi and Searcy, 2013). On the other hand, Seuring (2013) summarized research on quantitative models for sustainable supply chains based on life-cycle assessment models, equilibrium models, multi-criteria decision making and analytical hierarchy process.

Genovese *et al*. (2013) observed international scientific journal papers related to greener supplier selection problem with concentrating on utilized methodologies and current issues. Moreover, they clearly verified the environmental and green criteria for the supplier selection in corporate practice by conducting survey questionnaire to the 100 manufacturing companies and two interviews in large multinational firms. Igarashi *et al*. (2013) offered literature review and conceptual model development for green supplier selection by dividing selected paper according to theory-building research into two groups: analytical and empirical research. The authors concluded in the three folds of research. First, analytical research is the most dominant using for final stage in green supplier selection and broadly employing techniques. Then, empirical research is less influent with lacking of background theory. Finally, conceptual research is used for linking green supplier selection to an organization's strategy in few cases. A recent review by Appolloni *et al.* (2014) contributes to the green procurement research by providing a list of motivations, barriers and performances, developing a conceptual framework and proposing a number of future research directions in this area.

This work is different from other literature studies that our review is more focused on applications of AHP in GSS, analyzed clearly based on business areas and methods were implemented.

## RESEARCH METHODOLOGY

The present study reviews the literature of applications of AHP/ANP in green supplier selection that has been available in international journals from 2002 to 2014. Major databases were used to search for related article provided by major publishers such as Elsevier (www.sciencedirect.com), ProQuest (www.proquest.com), Emerald (www.emeraldinsight.com), and Springer (www.springerlink.com). The research process was used the term "Analytic hierarchy process", "Analytic network process" as a topic combine with keywords related to "green supplier selection". The term "green" was replaced by either "environmental" or by "sustainable". For the concept "supplier", the alternatives were "vendor", "contractor" and "partner". Similarly, "choice", "evaluation" and "assessment" were interchangeably used with "selection". While selecting the articles, an adjustment has been conducted to examine: (1) if the AHP/ANP had been used, and (2) whether the AHP/ANP application fits within the green supplier selection. This overview aimed only at papers in peer-reviewed scientific journals in English. This excluded papers in other languages as well as master/doctoral thesis, conference proceeding, books. As the results, a total of 36 papers were identified.

## OBSERVATIONS AND DISCUSSIONS

**Classifications of the AHP or ANP applications by business areas**

The total of 36 articles was classified in 8 categories base on business areas (Morgan Stanley Capital International (MSCI) and Standard and Poor's, 1999) and shown in Table-1.

With regards to the data provided in Table-1 and Figure-1, it is clear that there are two main groups supported in GSS with high and low numbers of paper separately. The larger group includes the following fields, Consumer discretionary, Information technology, Materials and Industrials, with the same 25% for the first two categories and 19% and 14% for the rest respectively.

However, in the remaining group, Consumer staples, Energy, and Healthcare shared the same Figure and accounted for only 3% for each of those. The others category contributed 8% in total.

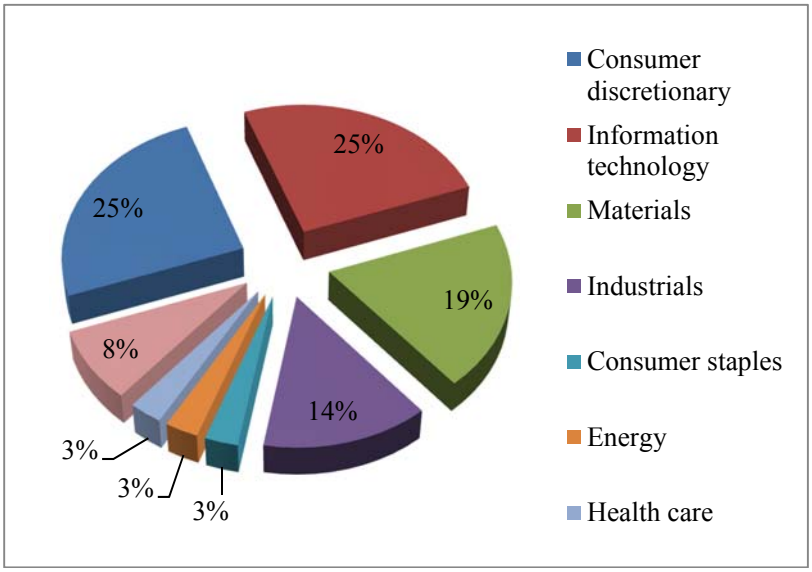


**Figure-1.** Related business areas articles.

**Table-1.** Classifications of the AHP or ANP applications by business areas.

| Business areas | No. of article | Percentage | Methods | Preference | Remark |
|---|---|---|---|---|---|
| Consumer discretionary | 9 | 25% | Fuzzy AHP, Fuzzy Delphi | Cheng and Tang (2009) | Bicycle Industry |
| | | | ANP | Zhu *et al* (2010) | Refrigerator Assembly |
| | | | Fuzzy AHP, Fuzzy MOLP | Shaw *et a*l (2012) | Garment manufacturing company |
| | | | Fuzzy AHP | Wang *et al* (2012) | Apparel or fashion industry |
| | | | Fuzzy ANP, Fuzzy DEMATEL, Fuzzy TOPSIS | Büyüközkan and Çifçi (2012) | Ford Otosan |
| | | | AHP, GRA | Peng (2012) | Produce refrigerators to exports to EU countries |
| | | | Fuzzy AHP, Fuzzy TOPSIS, Fuzzy MOLP | Kannan *et al* (2013) | Automobile manufacturing |
| | | | Fuzzy AHP, AD | Büyüközkan (2012) | Automotive industry |
| | | | Fuzzy AHP | Huang *et al* (2014) | Electronic industry |
| Information technology | 9 | 25% | Fuzzy AHP, Fuzzy Logic | Lu *et al* (2007) | Electronic equipment |
| | | | AHP | Tsai, Hung (2009) | A mobile-phone manufacturer |
| | | | Fuzzy AHP, Delphi | Lee *et al* (2009) | Assemble a TFT–LCD module |
| | | | ANP | Dou and Sarkis (2010) | IT industry |
| | | | ANP | Cheng and Lee (2010) | TFT-LCD sector |
| | | | ANP, DEA, ANN | Kuo *et al* (2010) | Designs and manufactures digital cameras |
| | | | AHP/ANP, DEA | Kuo and Lin (2012) | Camera manufacturer |
| | | | AHP/ANP | Chen *et al* (2012) | Production of electronics equipment |
| | | | AHP | Mani *et al* (2014) | Computer hardware manufacturing |
| Materials | 7 | 19% | Fuzzy AHP | Kahraman *et al* (2003) | White good manufacturing |
| | | | Fuzzy AHP | Haq and Kannan (2006) | Raw materials for tire-manufacturing product |
| | | | Fuzzy ANP, PROMETHEE | Tuzkaya *et al* (2009) | White goods manufacturer |
| | | | Fuzzy ANP | Büyüközkan and Çifçi (2011) | White goods industry |
| | | | ANP, DEMATEL, VIKOR | Hsu *et al* (2012) | Aluminum Composite Panels manufacturing |
| | | | ANP, RBF | Zhou *et al* (2012) | Chemical Industry |
| | | | AHP, Fuzzy TOPSIS | Senthil *et al* (2014) | Plastic recycling plant |
| Industrials | 5 | 14% | Fuzzy ANP | Hsu and Hu (2009) | Electronics industry |
| | | | Fuzzy AHP | Lee *et al* (2012) | |
| | | | Fuzzy AHP | Lee *et al* (2012) | Hand tools industry |
| | | | Fuzzy AHP | Ayhan (2013) | Gear motor company |
| | | | AHP | Govindan *et al* (2014) | |
| Consumer Staples | 1 | 3% | ANP | Theißen and Spinler (2014) | Fast Moving Consumer Goods sector |
| Energy | 1 | 3% | AHP, QFD | Scott *et al* (2013) | Bioenergy |
| Health care | 1 | 3% | Fuzzy ANP | Tseng (2009) | Integrated healthcare service provider and an original product manufacturer |
| Others | 3 | 8% | AHP | Handfield *et al* (2002) | |
| | | | AHP | Humphreys *et al* (2003) | |
| | | | AHP/ANP | Sarkis *et al* (2012) | |
| **Total** | 36 | 100% | | | |

**Classification of the applications by method**

In order to get more detail about the methods indicated in selected paper, the analysis of the applications by method was summarized in Table-2 and compared in Figure-2 with distribution of publications over the period shown. In Table-2, the column "Integrated models" provides the name of the tool that has been used, if any, together with the AHP or ANP in respective paper. The term "AHP+" or "ANP+" indicated that the method are combined with others model.

**Table-2.** Classification of the applications by method.

| Methods | Integrated models | Preference |
|---|---|---|
| AHP | | Handfield *et al* (2002), Humphreys *et al* (2003), Tsai and Hung (2009), Mani *et al* (2014), Govindan *et al* (2014) |
| ANP | | Dou & Sarkis (2010), Zhu *et al* (2010), Cheng and Lee (2010), Chen *et al* (2012), Sarkis *et al* (2012), KuoTheißen and Spinler (2014) |
| AHP+ | Fuzzy | Kahraman *et al* (2003), Haq and Kannan (2006), Lu *et al* (2007), Lee *et al* (2009), Cheng and Tang (2009), Lee *et al* (2012), Shaw *et al* (2012), Wang *et al* (2012), Büyüközkan (2012), Ayhan (2013), Huang *et al* (2014) |
| | GRA | Peng (2012) |
| | Fuzzy, F-TOPSIS, F-MOLP | Kannan *et al* (2013) |
| | QFD | Scott *et al* (2013) |
| | Fuzzy TOPSIS | Senthil *et al* (2014) |
| ANP+ | Fuzzy | Hsu and Hu (2009)<br>Tseng (2009)<br>Büyüközkan and Çifçi (2011) |
| | Fuzzy, PROMETHEE | Tuzkaya *et al* (2009) |
| | DEA, ANN | Kuo *et al* (2010) |
| | DEA | Kuo and Lin (2012) |
| | Fuzzy, DEMATEL, TOPSIS | Büyüközkan and Çifçi (2012) |
| | RBF | Zhou *et al* (2012) |
| | DEMATEL, VIKOR | Hsu *et al* (2012) |

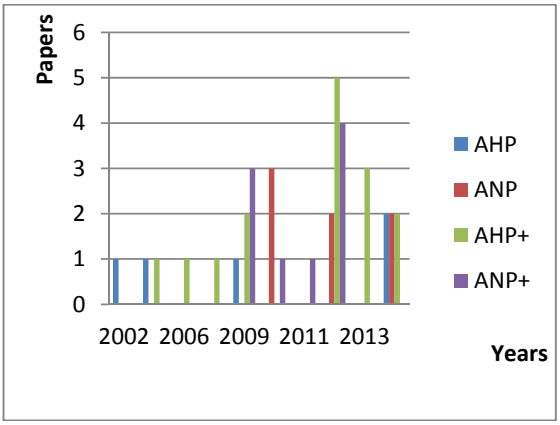


**Figure-2.** Articles in methods time series.

According to the classification of employed methodologies, it can be observed that there are only 11 out of 36 papers using ANP and AHP method separately while the remaining are focused on the such methods combination with others. Therefore, it can be stated that the wide applications are used due to usefulness, simplicity, and flexibility to integrate with other methods.

**Success factors of AHP implementation**

The third objective of this research is to find out the factors for successful AHP/ANP implementation. Cross function team is often preferred rather than single evaluator. In a group decision making, the selection of decision makers and the aggregation of their information will affect the elicitation of preference data. However, larger group of experts may naturally lead to more complicated debates about the model's structural and evaluating process. It is suggested that the number of evaluators should be from three to seven. In this sense, the biases of evaluators in making the pair-wise comparisons can be limited. In addition, it should be noted that the complication of the evaluation procedure would increase along with the growth of the number of criteria and alternatives. Therefore, it is suggested that the potential factors should be initial presented to the expert team to eliminate the elements which is insignificant to the problem by the team before applying the analytic models. In real situation, the number of comparison elements at some level of hierarchy should be between five and nine (Saaty, 1994). In fact, it is observed, that an ordinary decision maker could not handle more than that number of elements simultaneously without being confused in evaluating processes.

The possibility of interdependent evaluation makes ANP more advantageous and flexible compare to AHP. However, the remarkable disadvantage is its complexity can increase when the number of factors and relationships increase (Sarkis and Talluri, 2002). To overcome this problem, the relative importance weights of factors can be calculated through Web HIPRE3+, Internet interactive software available for decision analysis (http://www.hipre.hut.fi). This software used standard eigenvalue matrix calculations to reach relative importance score for the large number of questions (Dou *et al.*, 2014, Zhu *et al*., 2010).

The sensitivity analysis facilitates decision maker to check the robustness of their evaluations. The practical implications of sensitivity analysis may also deeply present the factors that impact to final decision (Dou *et al*, 2014).

**Others observations**

In order to validate the relevance of these journals, the research also mentioned about the distribution of selected articles by journal with their impact factors as shown in Table-3.

**Table-3.** Distribution of selected articles by journal.

| Journal | Impact factor 2013 | No. of article | Percentage |
|---|---|---|---|
| International Journal of Production Research | 1.323 | 5 | 14% |
| Expert Systems with Applications | 1.965 | 4 | 11% |
| Journal of Cleaner Production | 3.59 | 4 | 11% |
| International Journal of Production Economics | 2.081 | 3 | 8% |
| European Journal of Operational Research | 1.843 | 3 | 8% |
| Supply Chain Management-An International Journal | 2.916 | 2 | 6% |
| Journal of Manufacturing Technology Management | - | 1 | 3% |
| International Journal of Managing Value and Supply Chains | - | 1 | 3% |
| Department of Information Management | - | 1 | 3% |
| Computers and Mathematics with Applications | - | 1 | 3% |
| Computers in Industry | 1.457 | 1 | 3% |
| Resources, Conservation and Recycling | 2.692 | 1 | 3% |
| International Journal of Environmental Science and Technology | 1.794 | 1 | 3% |
| Journal of Materials Processing Technology | 2.041 | 1 | 3% |
| Computers & Industrial Engineering | 1.69 | 1 | 3% |
| The Journal of Human Resource and Adult Learning | - | 1 | 3% |
| International Journal of Advanced Manufacturing Technology | 1.779 | 1 | 3% |
| International Strategic Management Review | - | 1 | 3% |
| Advances in information Sciences and Service Sciences (AISS) | - | 1 | 3% |
| Journal of Information and Computational Science | - | 1 | 3% |
| Industrial Marketing Management | 1.897 | 1 | 3% |
| **Total** | | **36** | **100%** |

The Table-3 illustrates the distribution of the 36 articles by the journal together with the name and impact factor of the journals. From the table we can see that the largest number of selected articles appear in the International Journal of Production Research with 5 papers (14%), following by the Expert Systems with Applications, Journal of Cleaner Production with 4 paper (11%), International Journal of Production Economics and European Journal of Operational Research with 3 papers (8%). The 17 remaining articles are found in the 16 others journal.

A further observation is offered by looking at the countries of corresponding of the authors. Selected papers were classified based on the country of the corresponding author and illustrated in Table-4

Following the analysis of the countries of corresponding of papers' authors, it shown that Taiwan shared the largest numerous selected papers which was twice as much paper as Turkey and tripled from India.

Moreover, the interesting point is that Taiwan, Turkey, China and India, are all Asian countries and are the most authors contributed researching to GSS. One of acceptable reasons is that Asian countries have a huge of resources and factories that are supplying for world's firms. As a result, the research community of this region will be encouraged on supply chain especially in GSS study.

**Table-4.** Classification by country.

| Country | No. of article |
|---|---|
| Taiwan | 12 |
| Turkey | 6 |
| China | 5 |
| India | 4 |
| USA | 3 |
| Denmark | 2 |
| England | 2 |
| Australia | 1 |
| Germany | 1 |
| **Total** | **36** |

## FUTURE WORK

The AHP or ANP were extended by using fuzzy theory to deal with the imprecision and uncertainty in human's judgments since it helps evaluators become more confident in making comparisons. Several papers concentrate on how to convert the script values into fuzzy number and revert it after fuzzy calculation. Most of them use triangular fuzzy number, a few only mention trapezoidal fuzzy number in theory but it has not been applied in the practical solving. For converting process three approached methods are utilized: Chang's extent analysis (1996), Center of Area (Sugeno, 1985), and Yager Index (1981). The Center of Area is commonly used in most of the cases that compute with simple membership functions.

## CONCLUSIONS

This research provides a literature review on the AHP/ANP approach for the decision making in terms of green supplier selection over the period 2002-2014. Firstly, it was found that the analytic approach could be used in almost all business areas. In addition, AHP/ANP method can be easily integrated into other methods to get the most benefits from each individual approach for solving problem purposes. Finally, the success factors of AHP/ANP implementation are also addressed to help the researchers and practitioners in making decisions with the analytic approach effectively. However, this paper has only concentrated on the AHP/ANP applications and less attention had been paid to improve the AHP/ANP procedure as well as to develop the criteria for making decisions. These issues will provide great opportunities for future research.

## REFERENCES

Ayhan M. B. 2013. A Fuzzy AHP Approach for Supplier Selection Problem: A Case Study in a Gear Motor Company. International Journal of Managing Value and Supply Chains. 4(3): 11-23.

Büyüközkan G. and Çifçi G. 2011. A novel fuzzy multi-criteria decision framework for sustainable supplier selection with incomplete information. Computers in Industry. 62(2): 164-174.

Büyüközkan G. 2012. An integrated fuzzy multi-criteria group decision-making approach for green supplier evaluation. International Journal of Production Research. 50(11): 2892-2909.

Büyüközkan G. and Çifçi G. 2012. A novel hybrid MCDM approach based on fuzzy DEMATEL, fuzzy ANP and fuzzy TOPSIS to evaluate green suppliers. Expert Systems with Applications. 39(3): 3000-3011.

Chan H. K., Wang X., Yee R. W. and Diaz-Rainey I. 2012. A two-stage fuzzy-AHP model for risk assessment of implementing green initiatives in the fashion supply chain. International Journal of Production Economics. 135(2): 595-606.

Chen C. C., Shih H. S., Shyur H. J. and Wu K. S. 2012. A business strategy selection of green supply chain management via an analytic network process. Computers and Mathematics with Applications. 64(8): 2544-2557.

Cheng J. H. and Tang C. H. 2009. An application of fuzzy Delphi and fuzzy AHP for multi-criteria evaluation on bicycle industry supply chains. WSEAS Transactions on Systems and Control. 4(1): 21-34.

Cheng Y. H. and Lee F. 2010. Outsourcing reverse logistics of high-tech manufacturing firms by using a systematic decision-making approach: TFT-LCD sector in Taiwan. Industrial Marketing Management. 39(7): 1111-1119.

Dou Y. and Sarkis J. 2010. A joint location and outsourcing sustainability analysis for a strategic offshoring decision. International Journal of Production Research. 48(2): 567-592.

Govindan K., Kaliyan M., Kannan D. and Haq A. N. 2014. Barriers analysis for green supply chain management implementation in Indian industries using analytic hierarchy process. International Journal of Production Economics. 147, 555-568.

Haq A. N. and Kannan G. 2006. Fuzzy analytical hierarchy process for evaluating and selecting a vendor in a supply chain model. The International Journal of Advanced Manufacturing Technology. 29(7-8): 826-835.

Handfield R., Walton, S. V., Sroufe R. and Melnyk S. A. 2002. Applying environmental criteria to supplier assessment: A study in the application of the Analytical Hierarchy Process. European Journal of Operational Research. 141(1): 70-87.

Hsu C. H., Wang F. K. and Tzeng G. H. 2012. The best vendor selection for conducting the recycled material based on a hybrid MCDM model combining DANP with VIKOR. Resources, Conservation and Recycling. 66: 95-111.

Hsu C. W. and Hu A. H. 2009. Applying hazardous substance management to supplier selection using analytic network process. Journal of Cleaner Production. 17(2): 255-264.

Huang S. Y., Wang C. Y. and Chiou C. Y. 2014. FAHP Application for Green Supplier Selection in Electronic Industry. The Journal of Human Resource and Adult Learning. 10(2), 49.

Humphreys P. K., Wong Y. K. and Chan F. T. S. 2003. Integrating environmental criteria into the supplier selection process. Journal of Materials Processing Technology. 138(1): 349-356.

Kahraman C., Cebeci U. and Ulukan Z. 2003. Multi-criteria supplier selection using fuzzy AHP. Logistics Information Management. 16(6): 382-394.

Kannan D., Khodaverdi R., Olfat L., Jafarian A. and Diabat A. 2013. Integrated fuzzy multi criteria decision making method and multi-objective programming approach for supplier selection and order allocation in a green supply chain. Journal of Cleaner Production. 47, 355-367.

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): 1161-1170.

Kuo R. J. and Lin Y. J. 2012. Supplier selection using analytic network process and data envelopment analysis. International Journal of Production Research. 50(11): 2852-2863.

Lee A. H., Kang H. Y., Hsu C. F. and Hung H. C. 2009. A green supplier selection model for high-tech industry. Expert systems with applications. 36(4): 7917-7927.

Lee T. R., Phuong Nha Le, T., Genovese A. and Koh L. S. 2012. Using FAHP to determine the criteria for partner's selection within a green supply chain: the case of hand tool industry in Taiwan. Journal of Manufacturing Technology Management. 23(1): 25-55.

Lu L. Y., Wu C. H. and Kuo T. C. 2007. Environmental principles applicable to green supplier evaluation by using multi-objective decision analysis. International Journal of Production Research. 45(18-19): 4317-4331.

Mani V., Agarwal R. and Sharma V. 2014. Supplier selection using social sustainability: AHP based approach in India. International Strategic Management Review. 2(2): 98-112.

Peng J. 2012. Research on the optimization of green suppliers based on AHP and GRA. Journal of Information and Computational Science. 9(1): 173-182.

Sarkis J., Meade L. M. and Presley A. R. 2012. Incorporating sustainability into contractor evaluation and team formation in the built environment. Journal of Cleaner Production. 31, 40-53.

Scott J. A., Ho W. and Dey P. K. 2013. Strategic sourcing in the UK bioenergy industry. International journal of production economics. 146(2): 478-490.

Senthil S., Srirangacharyulu B. and Ramesh A. 2014. A robust hybrid multi-criteria decision making methodology for contractor evaluation and selection in third-party reverse logistics. Expert Systems with Applications. 41(1): 50-58.

Shaw K., Shankar R., Yadav S. S. and Thakur L. S. 2012. Supplier selection using fuzzy AHP and fuzzy multi-objective linear programming for developing low carbon supply chain. Expert Systems with Applications. 39(9): 8182-8192.

Theißen S. and Spinler S. 2014. Strategic analysis of manufacturer-supplier partnerships: An ANP model for collaborative $CO_2$ reduction management. European Journal of Operational Research. 233(2): 383-397.

Tsai W. H. and Hung S. J. 2009. A fuzzy goal programming approach for green supply chain optimisation under activity-based costing and performance evaluation with a value-chain structure. International Journal of Production Research. 47(18): 4991-5017.

Tseng M. L., Divinagracia L. and Divinagracia R. 2009. Evaluating firm's sustainable production indicators in uncertainty. Computers and Industrial Engineering. 57(4): 1393-1403.

Tuzkaya G., Ozgen A., Ozgen D. and Tuzkaya U. R. 2009. Environmental performance evaluation of suppliers: A hybrid fuzzy multi-criteria decision approach. International Journal of Environmental Science and Technology. 6(3): 477-490.

Zhou R., Ma X., Li S. and Li J. 2012. The Green Supplier Selection Method For Chemical Industry With Analytic Network Process And Radial Basis Function Neural Network. Advances in Information Sciences and Service Sciences. 4(4): 147-158.

Zhu Q., Dou Y. and Sarkis J. 2010. A portfolio-based analysis for green supplier management using the analytical network process. Supply Chain Management: An International Journal. 15(4): 306-319.

Zhu Q., Dou Y. and Sarkis J. 2014. Evaluating green supplier development programs with a grey-analytical network process-based methodology. European Journal of Operational Research. 233(2): 420-431.

Further references included in text but not included in the 36 papers reviewed

Ahi P. and Searcy C. 2013. A comparative literature analysis of definitions for green and sustainable supply chain management. Journal of Cleaner Production, 52, 329-341.

Appolloni A., Sun H., Jia F. and Li X. 2014. Green Procurement in the private sector: a state of the art review between 1996 and 2013. Journal of Cleaner Production, 85, 122-133.

Chai J., Liu J. N. and Ngai E. W. 2013. Application of decision-making techniques in supplier selection: A systematic review of literature. Expert Systems with Applications, 40(10), 3872-3885.

Govindan K., Rajendran S., Sarkis J. and Murugesan P. 2013. Multi criteria decision making approaches for green supplier evaluation and selection: a literature review. Journal of Cleaner Production. pp. 1-18.

Genovese A., Lenny Koh S. C., Bruno G. and Esposito E. 2013. Greener supplier selection: state of the art and some empirical evidence. International Journal of Production Research. 51(10): 2868-2886.

Igarashi M., de Boer L. and Fet A. M. 2013. What is required for greener supplier selection? A literature review and conceptual model development. Journal of Purchasing and Supply Management. 19(4): 247-263.

Saaty T.L. 1980. The Analytical Hierarchy Process. McGraw-Hill, New York, USA.

Saaty T.L. 1994. Fundamentals of Decision Making and Priority Theory with the Analytic Hierarchy Process. RWS Publication, Pittsburgh, PA, USA.

Saaty T.L. and Vargas L.G. 1994. Decision Making in Economic, Political, Social and Technological Environments with the Analytic Hierarchy Process. RWS Publication, Pittsburgh, PA, USA.

Saaty Thomas L. 1996. Decision Making with Dependence and Feedback: The Analytic Network Process. Pittsburgh, Pennsylvania: RWS Publications. ISBN 0-9620317-9-8.

Saaty Thomas L.; Luis G. Vargas. 2006. Decision Making with the Analytic Network Process: Economic, Political, Social and Technological Applications with Benefits, Opportunities, Costs and Risks. New York: Springer. ISBN 0-387-33859-4.

Subramanian N. and Ramanathan R. 2012. A review of applications of Analytic Hierarchy Process in operations management. International Journal of Production Economics. 138(2): 215-241.

Seuring S. 2013. A review of modeling approaches for sustainable supply chain management. Decision Support Systems. 54(4): 1513-1520.

Wu C. and Barnes D. 2011. A literature review of decision-making models and approaches for partner selection in agile supply chains. Journal of Purchasing and Supply Management. 17(4): 256-274.