Integrated SWOT-AHP Approach in the Assessment of GSCM in Turkey*

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Abstract: In recent years, companies have increasingly been concerned about the environmental impact of their production activities. Green Supply Chain Management (GSCM) is considered as an appropriate tool to reduce the environmental impact of operations while the performance of the producers' operations increases. The literature suggests that further research is needed on institutional pressures, performance and environmental practices, especially in developing countries.

In this study, the strengths and weaknesses, opportunities and threats of GSCM in Turkey were examined systematically by SWOT analysis, which was constructed on a numerical basis. SWOT analysis is a systematic tool used to identify weaknesses and strengths for an enterprise, an application or sector, as well as for identifying opportunities and threats. In the classical SWOT matrix, this study has been used in conjunction with the Analytic Hierarchy Process (AHP) because the weight of the criteria is unclear. It has been pointed out that the weight of the SWOT criteria and its sub-criteria can be weighted thanks to the eigenvector account made by constructing pair-wise comparison matrices with AHP. The aim of the study is to present an application for improving the numerical direction of the SWOT analysis for GSCM in Turkey.

Keywords: Green Supply Chain Management, SWOT, AHP, Decision Making

JEL Codes: C61, M19, L6

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1. Introduction

In recent years, companies around the world have expressed increasing concern about the environmental impacts of their activities, such as legal regulations, pressure from customers and competitors (Govindan et al., 2014). To respond to this challenge, organizations are integrating environmental practices into their ongoing strategic thinking. They consider many environmental programs that are part of organizational and technological projects as possible alternatives for achieving or maintaining a competitive advantage (Hollos et al., 2012).

According to Large & Thomsen (2011), there is no difference between a firm and its stakeholders in the eyes of many firms. Leading company in a particular supply chain is generally responsible for the negative environmental impact of all organizations in the supply chain. For this reason they are responsible for the environmental performance of the entire supply chain. In this context, Green Supply Chain Management (GSCM) is extremely important. According to Bowen et al. (2006), GSCM is an increasingly accepted concept and is defined as procurement plans and actions of a company that takes environmental concerns as part of Supply Chain Management (SCM). These plans and actions aim to enhance the environmental performance of both suppliers and customers. GSCM can be considered as the integration of environmental concerns into the implementation of SCM within the organization including reverse logistics (Sarkis et al., 2011).

The GSCM approach is also considered as a feasible alternative to increase the operational performance of companies while reducing the environmental impacts of enterprises (Zhu et al., 2012). Green et al (2012) argue that the adoption of such practices performed by firms leads to more environmental and economic regulations and as a result of which operational and organizational performance is improved.

Many topics have been examined in the context of the GSCM. Reasons for companies to implement green procurement practices and the investigation of the effects on the performance of such applications are among the topics examined. Institutional pressure and government regulations are the most important factors that encourage companies to implement GSCM practices. Mitra (2009), in his study on this issue, reviewed the relationship between institutional pressures and environmental management practices and regulatory activities, and stated that this relationship is positive. Zhu et al (2013) show that corporate pressures have improved the adoption of these practices in China.

In this study, Turkey's strengths and weaknesses, opportunities and threats were identified within the scope of GSCM. SWOT analysis has been applied in the light of the information obtained from existing literature and experts. The Analytical Hierarchy Process (AHP) was used to determine which of the criteria that emerged as the result of the SWOT analysis is more important. The aim of the study is to determine the factors that should be taken into account in the development of the strategies related to GSCM so that environmental awareness can be adopted in firms in Turkey.

2. Green Supply Chain Management

In recent years, many researches and studies have been made on the concept of GSCM in the literature. The greening history of the supply chain was inspired by reverse logistics surveys in the 1990s (McKinnon, 2010). The GSCM idea first appeared in 1996 at the Michigan State University in a study entitled "Environmentally Responsible Manufacturing" (Wang and Luo, 2010). Van Hoek (1999) then noticed the relationship between logistics environmental work and reverse logistics, and this relationship was extended to the whole chain study (McKinnon, 2010). Hsu&Hu (2008) defined GSCM as a used approach to improve the performance of processes and products according to the requirements of environmental regulations. Hervani et al. (2005) stated that GSCM is the sum of Green Purchasing, Green Production / Material Management, Green Distribution / Marketing and Reverse Logistics. In short, YTZY includes traditional supply chain management practices that combine environmental criteria (Gilbert, 2001). Although the GSCM concept was introduced in the 1990s, it is still a new application in such countries as China, Turkey and India which are underdeveloped or developing. For this reason, it is important to analyze the GSCM practices in these countries and see how well these countries have used GSCM in their main industries.

In Turkey, voluntary practices of GSCM have not yet been sufficient except for large-scale corporate firms, but it encourages that they make an effort. Nevertheless, it should promote environmental-oriented management mentality in such efforts as to have government support and encouragement, to be an environmentally-responsible active citizen, to support organized social movements in environmental awareness, and especially to have the necessary standards in industrial enterprises

that threaten environmental health. Thus, this will increase the practice of GSCM in Turkey if the practices are initiated not only with the request of the suppliers or internal/external customers, but also with legally mandatory, including enforcement of certain sanctions implemented in all enterprises (operating at national and international field).

3. Methods

3.1. SWOT Analysis

The most popular method used in strategic analysis is the analytical model known as SWOT analysis. This method also evaluates strengths, weaknesses, opportunities and threats (Leanrned, et al., 1965). In the market, organizations must be aware of internal and external factors that can affect their success or failure to work successfully and effectively. Learned et al.(1965), in their study, point out that SWOT analysis is a simple yet effective tool whose factors are determined by organizations.

Internal factors of SWOT analysis include strengths and weaknesses. Analyzing these factors means defining and evaluating the organizational aspects that the organization can influence the success or failure of its adopted strategies. External factors include opportunities and threats. Analyzing these factors means to investigate environmental factors that cannot be controlled by the organization but which may affect their performance (Tavana, et al., 2016).

SWOT analysis generally does not provide full evaluation, but when used properly, it forms a basic reference point for formulating a valid strategy. The main shortcoming of the SWOT is that it only makes qualitative assessments of the identified factors (Görener, et al., 2012). They do not quantify factors or allow alternatives to be overlaid. Integrating SWOT with AHP ensures that this problem is not overcome.

3.2. Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process is a method developed by Thomas L. Saaty at the Wharton School of Business in the 1970's with the aim of solving multi-criteria decision problems (Leader, 2015). The Analytic Hierarchy Process is one of the selection methods in which more than one decision maker can be included in the process in decision problems involving many alternatives (Paksoy et al., 2013). The most important feature of the AHP is that the decision maker tends to break apart until the problem is a hierarchical relationship with each other. At the top of the hierarchy is the main goal of the decision maker. In the lower levels, the criteria to be considered for achieving this goal are listed. At the bottom of the hierarchy, decision alternatives are included (Aktaş et al., 2015). Problems where the method is used only for benchmarking purposes may not include alternatives at the lowest level.

When using the AHP method, criteria and alternatives are subject to binary comparisons by decision makers. In the comparison, 1-9 scale of Saaty is used (Önder and Önder, 2015). In AHP, judgments are transformed into a comparison matrix (Timor, 2011). In practice, the answer of the question "How important is the factor in the factor column on the line", comparing the columns to the columns, should be given for each comparison (Özdağoğlu, 2011). The steps of the method can be expressed briefly as follows (Saaty, 1990, Aktaş et al., 2015, Gürsakal, 2015):

Step I - Creating a Hierarchical Structure:

As a first step, a hierarchical structure in which goals, criteria and alternatives are included is established. Within the hierarchy, the influence of the upper level members on the lower level members is revealed. This structure is shown in Figure 1.

Step II-Making of Pair-wise Comparisons:

The stage in which the criteria are compared between themselves and the alternatives are compared within the scope of the criteria. Binary comparisons use a scale from 1 to 9. The values in this scale are presented in Table 1.

If one factor is important compared to the other; 1, 3, 5, 9. In the case of triviality, the opposite values (1/3, 1/5, etc.) can be used. The values in the diagonal of the pair-wise comparison matrices are 1. (N-1) / 2 pair-wise comparisons are performed on a square matrix with n rows and n columns. An exemplary matrix is shown in Table 2.

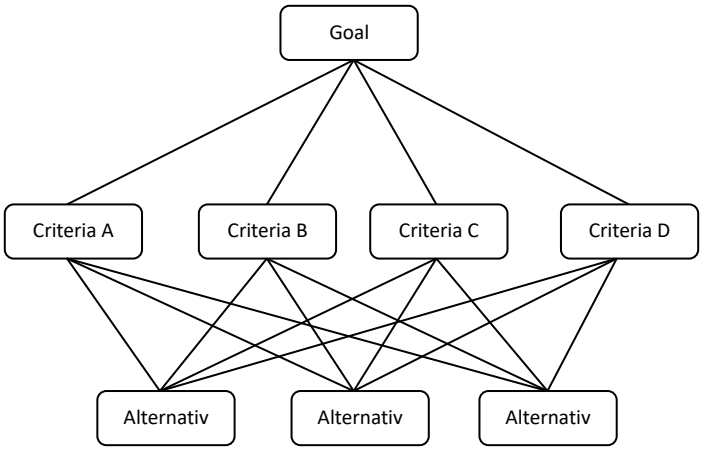

Figure 1. General Structure of AHP

Table 1. Importance Ratings Used in Pair-wise Comparisons (Saaty, 1980, Timor, 2010)

Numerical Rate	**Verbal Judgement of Preference**
1	Equal importance
3	Weak importance of one over another
5	Essential or strong importance
7	Demonstrated importance
9	Absolute importance
2,4,6,8	Intermediate values between the two adjacent judgment
Reciprocal of above numbers	If activity i has one of the above numbers assigned to it when compared with activity j, then j has the reciprocal value when compared with i

Table 2. Pair-wise Comparison Matrix

	1	**2**	**3**	**…**	**n**
1	w1/w1	w1/w2	w1/w3	**…**	w1/wn
2	w2/w1	w2/w2	w2/w3	**…**	w2/wn
3	w3/w1	w3/w2	w3/w3	**…**	w3/wn
…	**…**	**…**	**…**	**…**	**…**
N	wn/w1	wn/w2	wn/w3	**…**	wn/wn

Tablo 3. RI Values (Saaty & Tran, 2007)

Number of criteria to be compared	RI Value
1	0.00
2	0.00
3	0.52
4	0.89
5	1.11
6	1.25
7	1.35
8	1.40
9	1.45
10	1.49

All comparison matrices configured for solution of the problem must be consistent at acceptable levels (Taha, 1997). When the consistency ratio (CR) is 0.1% higher, the problem should be reworked and binary comparisons should be observed (Özdağoğlu, 2011). The consistency rate is calculated as (Zhou and Shi, 2009; Gursakal, 2015):

CR = CI / RI (1) (1)

CI = λmax – n / n – 1 (2)

CI: Consistency Index

RI=Random Index

Random index is calculated for random matrices of 1-10 factors with random values between 1-9. In the consistency rate calculation, values created in this scope (Table 3) are used. The CI value is determined by the formula in equation (2). In the equation, λmax represents the largest eigenvalue, while n represents the matrix size.

Step III: Determination of the Critical Values of the Criteria and the Appropriate Alternative

The criteria are divided into two priorities: local and global importance values. Local priorities are the significance values of the hierarchy-bound metrics of the upper level. Global priority is equal to the measure local priority multiplied by the priority value of the top level measure. At the point of order of the alternatives; Each sub-measure used in the evaluation of alternatives, the weight values obtained by multiplying the preferences of alternatives according to that sub-measure are used (Aktaş et al., 2015) The alternative, which has the highest weight, emerges as an alternative, which should be preferred for solution of the decision problem.

3.3. Integrated SWOT-AHP Approach

The AHP provides the determination of the weight of the existing criteria using binary comparison matrices. Generally the strengths and weaknesses or threats and opportunities arising from the SWOT analysis are not classified according to their weight (Yüksel & Dağdeviren, 2007). For this reason, especially in analyzes where the number of criteria is high, it is necessary to determine the importance levels of the criteria while the strategies are being created. The AHP method can help to model the main criteria of the SWOT analysis and the sub-criteria that emerged hierarchically (Kangas et al, 2001, Kajanus, 2004). The expression of the Hierarchical structure SWOT is shown in Figure 2 (Gallego & Juízo, 2011).

4. The Proposed SWOT –AHP to Evaluate Decision Criteria in GSCM: A Case Study

At the core of the research is the identification of the strengths, weaknesses, opportunities and threats of GSCM applications in Turkey. The main reason for using the AHP method is to determine the weight of criteria and to be able to direct the strategies accordingly. The methodology used in the research is summarized in Figure 3.

As indicated in Figure 3, the decision-making team has been identified. This team consists of 4 people, 2 academic and 2 sector employees. Each decision maker in the team has created their own SWOT matrix of GSCM. Brain storms were then carried out to reveal the final state of the SWOT matrix in which common criteria were identified. The finalized SWOT matrix was evaluated using pair-wise comparison in the AHP method using the Expert Choice 11 program. The weights of all the criteria that make up the SWOT matrix are set forth. Steps have been taken to determine the most important and determine the strategies. The SWOT matrix emerging in the direction of expert opinion is expressed in Table 4.

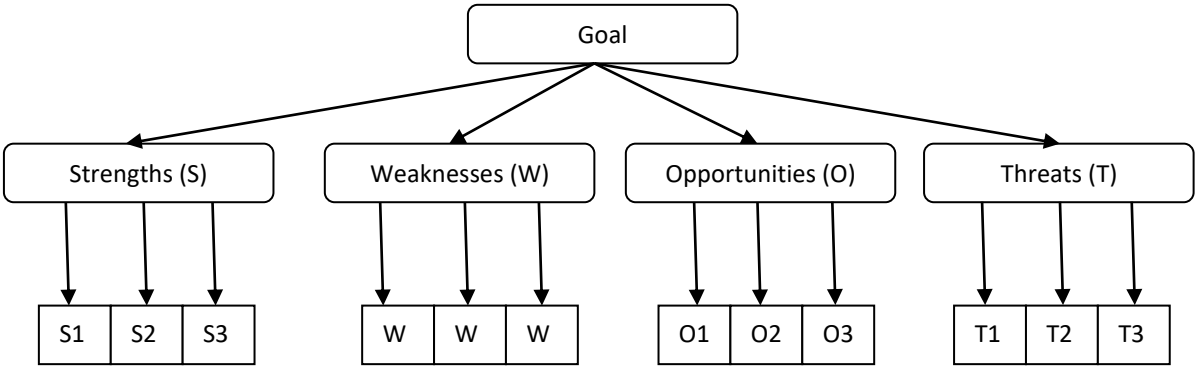

Figure 2. Hierarchically structured SWOT matrix

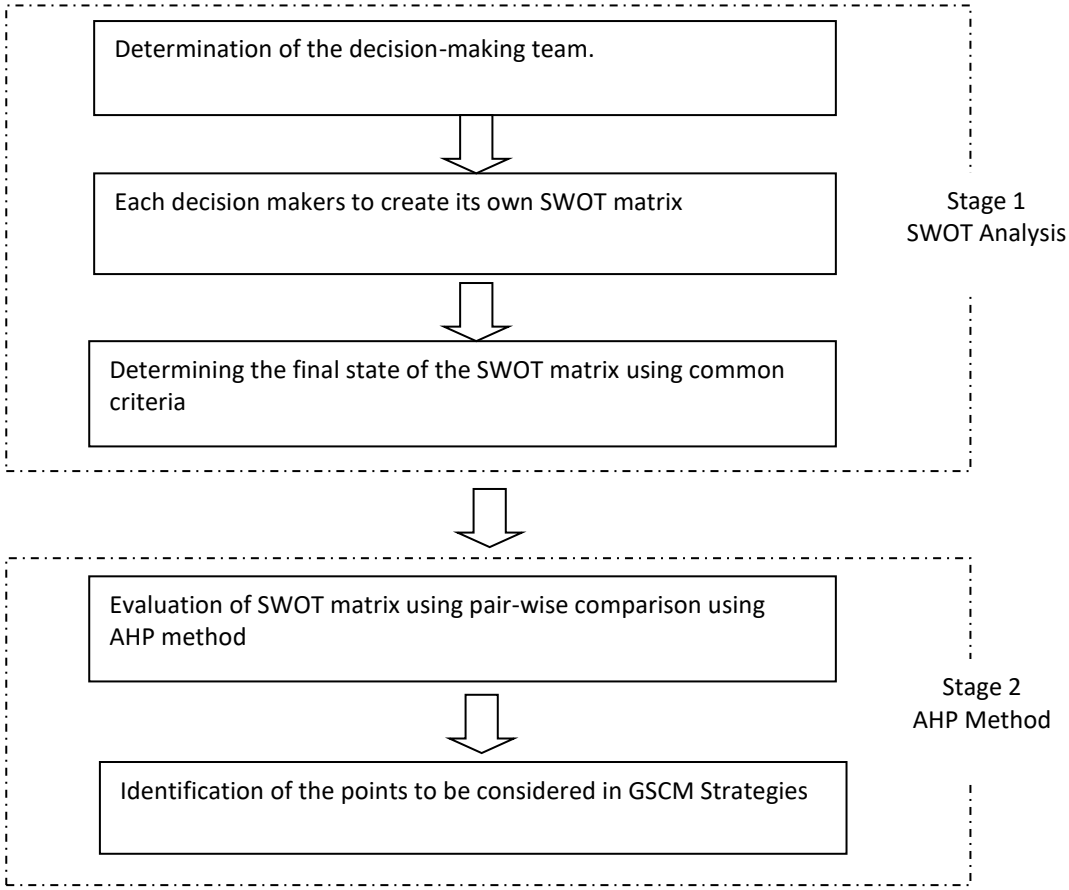

Figure 3. Methodology Constructed within SWOT-AHP Approach

First, the matrix in Table 5 was obtained as a result of calculating the geometric mean of the pair-wise comparisons of the main groups in the SWOT analysis. At this stage, it can be said that decision makers have the idea of focusing on the advantages and threats in the field of GSCM within the framework of the formation of strategies.

After determining the values and matrix consistency ratios for the comparison of the SWOT criteria, the weight of the sub-criteria in each SWOT criteria have been passed step by step in Table 6-7-8-9.

The integrated weights of all the factors involved in the SWOT analysis are shown in Table 10. As a result of the study made in line with the opinions of the expert working group, as the superiority of Turkey in the field of GSCM; rising corporate image and product reputation. The weakness of Turkey in this area has emerged as a co-operation difficulty in managing all the links in the supply chain. The weight of the opportunities for GSCM is government incentives offered to manufacture green products. In the threat criteria, the most important thing is the lack of implementation of GSCM as well as the import barriers and competition losses experienced in international markets.

Table 4. SWOT matrices for GSCM in Turkey

Strengths (S)	Weaknesses (W)
(S1) Decrease in product life cycle costs. (S2) The increase in the productivity of the organization's productivity. (S3) Rising corporate image and product reputation. (S4) Competitive advantage.	(W1) One or more connections in the chain, superficial green applications. (W2) Cooperation difficulty in managing all the links in the chain. (W3) R&D expenditures made to find green solutions. (W4) Opportunistic behavior due to lack of mutual trust.
Opportunities (O)	**Threats (T)**
(O1) Increase in consumer demand for green products / services. (O2) Government incentives offered to manufacture green products. (O3) Awareness of environmental standards.	(T1) Import barriers and competition losses suffered in international markets, together with the failure to implement GSCM. (T2)Additional inspection and documentation costs to meet international market standards. (T3) Increase in counterfeit green products due to lack of international green certification system.

Table 5. Pair-wise comparisons of SWOT criteria

Opportunity	O1	O2	O3	Local weight
O1	1	1/2	1/2	0.196
O2	2	1	2	0.493
O3	2	1/2	1	0.311
CR=0.05				

Table 6. Pair-wise comparisons among strengths sub-criteria

Criteria	S	W	O	T	Local weight
S	1	5	3	4	0.554
W	1/5	1	1	1/3	0.095
O	1/3	1	1	1/3	0.113
T	1/4	3	3	1	0.239
CR=0.07					

Table 7. Pair-wise comparisons among weakness sub-criteria.

Strength	S1	S2	S3	S4	Local weight
S1	1	1	1/3	3	0.218
S2	1	1	1/4	1	0.148
S3	3	4	1	3	0.511
S4	1/3	1	1/3	1	0.124
CR=0.06					

Table 8. Pair-wise comparisons among opportunities sub-criteria

Weakness	W1	W2	W3	W4	Local weight
W1	1	1/3	2	3	0.218
W2	3	1	4	8	0.560
W3	1/2	1/4	1	5	0.167
W4	1/3	1/8	1/5	1	0.056
CR=0.07					

Table 9. Pair-wise comparisons among threats sub-criteria

Threats	T1	T2	T3	Local weight
T1	1	4	4	0.661
T2	1/4	1	2	0.208
T3	1/4	1/2	1	0.131
CR=0.05				

Table 10. Composite Significance Ratings Related to Factors in SWOT Analysis

SWOT criteria	Local weights of SWOT criteria	SWOT sub-criteria	Local weights of sub-criteria	Global weights of sub-criteria	Global rank
Strengths	0.554	Decrease in product life cycle costs.	0.218	0.120	3
		The increase in the productivity of the organization's productivity.	0.148	0.081	4
		Rising corporate image and product reputation	0.511	0.283	1
		Competitive advantage.	0.124	0.068	5
Weaknesses	0.095	One or more connections in the chain, superficial green applications.	0.218	0.020	11
		Cooperation difficulty in managing all the links in the chain.	0.560	0.053	7
		RD expenditures made to find green solutions.	0.167	0.015	12
		Opportunistic behavior due to lack of mutual trust.	0.056	0.005	13
Opportunities	0.113	Increase in consumer demand for green products / services.	0.196	0.022	11
		Government incentives offered to manufacture green products.	0.493	0.055	6
		Awareness of environmental standards.	0.311	0.035	9
Threats	0.239	Import barriers and competition losses suffered in international markets, together with the failure to implement GSCM.	0.661	0.157	2
		Additional inspection and documentation costs to meet international market standards.	0.208	0.049	8
		Increase in counterfeit green products due to lack of international green certification system.	0.131	0.031	10

Global weight of "subcriterion" = (local weight of "subcriterion") × (local weight of corresponding SWOT group)

5. Conclusion and Suggestions

GSCM practices in Turkey are not fully implemented due to problems such as failure to control the chain, fake green applications, avoided R&D spending and opportunistic behaviors. Owing to these reasons, they need to carry out their strategies in the field of GSCM in Turkey in a planned manner. Implementing a basic and easy-to-understand tool, such as SWOT analysis at the start-up phase, will help in the direction in which it should move.

It has been found that some of the basic criteria are more important in the application of Turkey in the context of SWOT analysis of the situation related to GSCM. Primarily, strategies should be determined by considering these criteria. It should maintain its strengths as much as possible, such as rising corporate image and product reputation. It is necessary to keep the stakeholders of the company's chain under continuous control in order to fully implement the green approach throughout the supply chain. R&D practices should be concentrated on by collaborating with other stakeholders in the chain and lack of mutual trust should be abolished. Requests should be made to increase green practices for governmental incentives on a sectoral basis. Training on GSCM should be given importance at all points in the chain in order to increase environmental awareness. It is necessary to obtain the necessary certification documents in an effort to avoid encountering import-export barriers and loss of competition. In this way, fake green applications are also prevented.

After this phase of the study, strategies should first be planned within SWOT analysis framework in four alternative groups. Analysis should be conducted by using the same or different decision-making methods as to how much the strategies will maximize or minimize the factors. Thus, it can be determined which strategies should be prioritized. It is clear that the significance levels can vary according to experts who make comparisons as in all multi-criteria decision making methods. Therefore, a comprehensive survey study involving more stakeholders can be conducted. If stakeholders such as academicians from different universities and experts from different sectors are also reached, a more objective study will emerge where different factors are brought to light. Besides, fuzzy set analysis can be applied at points where opinions cannot be expressed with exact figures.

References

Aktaş, R., Doğanay, M. M., Gökmen, Y., Gazibey, Y., & Türen, U. (2015). Sayısal Karar Verme Yöntemleri. İstanbul: Beta Yayıncılık.

Bowen, F., Cousins, P., Lamming, R., & Faruk, A. (2006). Horses for courses: explaining the gap between the theory and practice of green supply. Greening the supply chain, 1, 151-172.

Gallego-Ayala, J., & Juízo, D. (2011). Strategic implementation of integrated water resources management in Mozambique: An A'WOT analysis. Physics and Chemistry of the Earth, Parts A/B/C, 36(14), 1103-1111.

Gilbert, S. (2001). Greening supply chain: Enhancing competitiveness through green productivity. Tapei, Taiwan, 16.

Govindan, K., Kaliyan, M., Kannan, D., & 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.

Görener, A., Toker, K., & Ulucay, K. (2012). Application of combined SWOT and AHP: a case study for a manufacturing firm. Procedia-social and behavioral sciences, 58, 1525-1534.

Green Jr, K. W., Zelbst, P. J., Meacham, J., & Bhadauria, V. S. (2012). Green supply chain management practices: impact on performance. Supply Chain Management: An International Journal, 17(3), 290-305.

Gürsakal, S. (2015). Karar Verme. Editörler: Mustafa Aytaç ve Necmi Gürsakal, Dora Yayınları, Bursa.

Hervani, A. A., Helms, M. M., & Sarkis, J. (2005). Performance measurement for green supply chain management. Benchmarking: An International Journal,12(4), 330-353.

Hollos, D., Blome, C., & Foerstl, K. (2012). Does sustainable supplier co-operation affect performance? Examining implications for the triple bottom line. International Journal of Production Research, 50(11), 2968-2986.

Hsu, C. W., Hu, A. H., (2008). Green supply chain management in the electronic industry. International Journal of Environmental Science & Technology, 5(2), 205- 216.

J. Manag. Sci. 37 (1).

Kajanus, M., Kangas, J., & Kurttila, M. (2004). The use of value focused thinking and the A'WOT hybrid method in tourism management. Tourism management, 25(4), 499-506.

Kangas, J., Pesonen, M., Kurttila, M., & Kajanus, M. (2001). A'WOT: integrating the AHP with SWOT analysis. In Proceedings of the sixth international symposium on the analytic hierarchy process ISAHP (pp. 2-4).

Large, R. O., & Thomsen, C. G. (2011). Drivers of green supply management performance: Evidence from Germany. Journal of Purchasing and Supply Management, 17(3), 176-184.

Leader, Z. (2015). Reading Blake's Songs (Vol. 3). Routledge.

Learned, A., Christensen, C., Andrews, R. S., & Guth, D. (1965). Business Policy: Text and Cases (Homewood, Illinois: Irwin).

McKinnon, A. (2010). Green logistics: the carbon agenda. Heriot-Watt University, Edinburgh, United Kingdom. Electronic Scientific Journal of Logistics ISSN.

Mitra, S. (2009). Analysis of a two-echelon inventory system with returns. Omega, 37(1), 106-115.

Önder, G.,& Önder E., (Ed.) (2015). Analitik Hiyerarşi Süreci. Editörler: Bahadır Fatih Yıldırım ve Emrah Önder, Çok Kriterli Karar Verme Yöntemleri, 2. Baskı, Bursa: Dora Yayıncılık.

Özdağoğlu, A. (2011). Çok Ölçütlü Karar Verme Yöntemleri ve Uygulama Örnekleri. TMMOB MMO Yayınları, (579).

Paksoy, T., Pehlivan, N. Y., & Özceylan, E. (2013). Bulanık küme teorisi. Nobel Yayınları, Ankara.

Saaty, T. L. (1990). How to make a decision: the analytic hierarchy process. European journal of operational research, 48(1), 9-26.

Saaty, T. L. (1980). Analytic hierarchy process. John Wiley & Sons, Ltd.

Saaty, T. L., & Tran, L. T. (2007). On the invalidity of fuzzifying numerical judgments in the Analytic Hierarchy Process. Mathematical and Computer Modelling, 46(7), 962-975.

Sarkis, J., Zhu, Q., & Lai, K. H. (2011). An organizational theoretic review of green supply chain management literature. International Journal of Production Economics, 130(1), 1-15.

Taha, H. A. (1997). Yöneylem Araştırması, Çevirenler: Ş. Alp Baray ve Şakir Esnaf, İstanbul: Literatür Yayınları.

Tavana, M., Zareinejad, M., Di Caprio, D., & Kaviani, M. A. (2016). An integrated intuitionistic fuzzy AHP and SWOT method for outsourcing reverse logistics. Applied Soft Computing, 40, 544-557.

Timor, M. (2010). Yöneylem araştırması. Türkmen Kitabevi.

Timor, M. (2011). Analitik hiyerarşi prosesi. Türkmen Kitabevi.

Van Hoek, R. I. (1999). From reversed logistics to green supply chains. Supply Chain Management: An International Journal, 4(3), 129-135.

Wang, M., & Luo, X. (2010). The study of Green Supply Chain Management: A case study of BYD, a Chinese car manufacturer. Bachelor's Thesis in Industrial Management and Logistics, University of Gavle, Sweden.

Yüksel, İ., & Dagdeviren, M. (2007). Using the analytic network process (ANP) in a SWOT analysis–A case study for a textile firm. Information Sciences, 177(16), 3364-3382.

Zhou, Y. D., & Shi, M. L. (2009). Rail transit Project risk evaluation based on AHP model. In Information and Computing Science, 2009. ICIC'09. Second International Conference on (Vol. 3, pp. 236-238). IEEE.

Zhu, Q., Sarkis, J., & Lai, K. H. (2012). Examining the effects of green supply chain management practices and their mediations on performance improvements. International journal of production research, 50(5), 1377-1394.

Zhu, Q., Sarkis, J., & Lai, K. H. (2013). Institutional-based antecedents and performance outcomes of internal and external green supply chain management practices. Journal of Purchasing and Supply Management, 19(2), 106-117.