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Area of Application of Supplier Selection Problem: A Literature Review

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Abstract

Supplier selection problem is very promising area and decision making activity in which improper selection may lead an adverse impact on overall strategic performance of the Original Equipment Manufacturer (OEM). Area of application relates to the premises in which the problem of supplier selection was defined and relevant criteria, alternative and environment considered. An attempt has been made to select and reviewed fifty-one articles of last ten years of paper published with two classifications that is area of application and environment area. Our survey recommends the probable future research in terms of area of application and decision environment.

Keywords: Supplier selection, Area of application, Decision environment.

1. Introduction

Suppliers are the back bone of any Original Equipment Manufacturer (OEM) and are the major stakeholder of their supply chain. They have a major contribution in OEM's profitability, quality of the product, delivery schedule, customer satisfaction and market competiveness. Thus, appropriate choice of supplier becomes an important decision making area in any business process. Proper selection of suppliers can significantly reduce manufacturing cost, decrease production lead time, increase customer satisfaction, and strengthen corporate competitiveness. Recent literature shows that OEM's now-a-day's intend to build long-term relationships with suppliers for sustainable business (Wang & Yang, 2009). Purchasing managers always face the challenges and difficulties When selecting the right suppliers. Careful assessment is required because suppliers have their own strengths and weaknesses prior to handle them particulars orders. The supplier selection would be straight forward if only one criterion is considered but in real situations range of criteria is adopted for the purpose of defining the real situations then the problem gets multi-criteria decision making. In multi-criteria decision making problem, a set of criteria depends upon situation adopted by researcher and it reveals that the problem like supplier selection and evaluation are situation

specific means that not all method related to supplier selection would be applicable for all every possible occurrences. Often they assume, in all buying situations explicitly or implicitly, that their method is applicable, at most, a method or procedure was applied to a particular industry for considered criterion, could not be applicable a different industry. However, the existing articles on methods do not sufficiently address for this contextual issue (De Boer et. at. 2001). Earlier, at least, three papers have been reviewed based on literature on supplier selection and evaluation models (De Boer et al. 2001, Ho William et al. 2010, Chai Junyi et al. 2013). Chai et al. (2013) reviewed the articles published from 2008 to 2012 by focusing on decision making methodologies. However, previous literature reviews having two major limitations. First, reviewed articles were considered from the data base published from 2008 to 2012. Second, the application of Decision Making (DM) techniques by categorizing into two parts, one is independent approach and another is integrated approach technique were considered. This challenging area contributes different situations and different area of application and previous literature survey did not consider area of application and problem environment considered which also affects the supplier selection problem and evaluation. Therefore, we hopeful that the newly and orderly survey with different approaches is useful for presenting the most recent effort on this promising area. In this paper, we collected the 51 journal articles published from last ten years and based on last ten years papers collected we attempt to examine the two issues, including (i) which area of application being focused more? (ii) Which decision environment gets attention more? The remaining paper is adjusted as follows: section 2 describes the area of application, section 3 describes the observation and analysis and section 4 conclude the paper.

2. Area of Application

2.1. Manufacturing

Nine out of fifty-one articles (19%) cover manufacturing as area of application while highlighting the supplier selection problem and evaluation. Based on our survey Liu and Hai (2005) considers ten suppliers out of one was selected by applying with eight criteria and thirteen sub-criteria, selected sixty respondents from the company having designation of manager and supervisor, by which prioritize the order of criteria or sub-criteria. Chan and Kumar (2005) considers manufacturing company in assembling process with risk factor in the selection of global supplier selection with four criteria and describes the linguistic level of comparison between supplier and expert. Chen et al. (2006) highlighted the fuzziness situation to calculate the distances to fuzzy positive-ideal solution (FPIS) and fuzzy negative-ideal solution (FNIS) simultaneously to calculate the ranking order of all suppliers with five criteria. Ha and Krishnan (2008) outlines hybrid method which evaluates the combined supplier score (CSS) to enable the customer to do single sourcing and multiple sourcing, a Supplier map (SM) has been drawn for positioning of supplier performance efficiency. Levary (2008) presented a realistic case study on a Midwest manufacturer importing a key component essential to its assembly operation from a foreign supplier

located in Wuhan, China for evaluating the best supplier in which supplier reliability were considered as criteria. Vinodh et al. (2011), Rajesh et al. (2013), Guo et al. (2014) and Ware et al. (2014) presented the paper as explained above with integrated method.

2.2 Automobile

Eleven out of fifty-one articles (21%) cover the automobile as area of application in which Bevilacqua et al. (2006) selects medium to large industries for manufacturing of clutch coupling to test the efficacy of the supplier problem and to rank the potential supplier by Fuzzy Suitability Index (FSI). Celebi et al. (2008), Boran et al. (2009), Kokangul and Susuz (2009), Yousefi et al. (2010), Aksoy et al. (2011), Dursun and Karsak (2013), Kannan et al. (2013), Kumar et al. (2014) and Yazdani (2014) adopted automobile industry as area of application while using integrated model to solve the supplier related problem.

2.3 Electronic Industry

Eight out of fifty-one articles (15%) cover the automobile as area of application in which Chan and Chan (2004) solve the decision problem related to manufacturers of sophisticated semiconductor assembly equipments with multi-item, multi-criteria for the development of supplier selection model. Lee et al. (2009) describe the supplier selection problem as multiobjective in nature of TFT-LCD manufacturer to evaluate the performance of manufacturer and weight of criteria is calculated, Lee Amy (2009) also describe TFT-LCD manufacturers by incorporated Benefit, opportunities, Cost and Risk (BOCR) as major criteria. Onut et al. (2009) handled supplier problem in the telecommunication industry in GSM sector includes both tangible and intangible factor relates to multi criteria decision making problem under the fuzziness. Wu (2009) apply the Dempster–Shafer theory with grey related analysis to tackle the fuzziness of supplier problem by using both qualitative and quantitative data. Lang et al. (2009), Chen and Chao (2012), Chen and Wu (2013) consider the supplier selection problem by considered the area as electronic industry.

2.4 Computer Manufacturer

Two papers out of fifty-one journals cover (4%) computer manufacturer as area of application in which Chen and Wang (2008) developed best possible alternatives by providing rational systematically. Deng et al. (2014) highlights the issues with the integration of product line design and supplier selection simultaneously and Pareto optimal product line designs was determined.

2.5 Airplane Industry

Two papers out of fifty-one journals cover (4%) Airplane Industry as area of application in which Aghai et al. (2014) present supplier selection model by adopting the factor like quantitative, qualitative, risk and volume discount using real life problem related to airplane industry. Liou et al. (2014) select the data from Taiwanese company were demonstrated with taking assumption that criterion is independent nature with gap weighted analysis.

2.6 Fertilizer Industry

Rouyendegh et al. (2014) consider uncertainty with complex multi criteria problem and

proposed by triangular fuzzy number, competitive advantage and long term relationship was achieved.

2.7 Ink Cartridge Company

Hou and Su (2007) adopted mass customization environment to assist manufacturer to evaluate supplier selection problem for the procedure of product design and manufacturing and finds the issues like competitive priorities is one of key factor for the survival of market.

2.8 Logistic System

Faez et al. (2009) conclude proposed model in fuzzy environment to find the order allocation and vendor selection mathematical programming to achieve the buyer's demand and vendor capacity.

2.9 Paper Production

Kara (2011) proposed supplier selection model in unknown environment by classifying the research phase into three categories such as pre-research phase, pre evaluation phase and evaluation phase to rank the potential supplier under qualitative data to overcome the issues of multi-product and multi-period.

2.10 Pharmaceutical Company

Talluri and Narasimhan (2003) evaluate the vendor performance variability measures related problem with nonparametric statistical technique by max-min approach to find out the maximum and minimum efficiency of vendor with flexible number of alternatives.

2.11 Postal Services

Qian Li (2014) proposed market-based strategy with increase or decrease in cost, delivery time, service level, or quality by analyzing of deterministic delivery time and stochastic delivery time and concept of lean manufacturing, cost reduction, flexible manufacturing, better delivery time and optimum service level were focused as per market strategies.

2.12 Railway Industry

Baruno et al. (2012) show the duality between theoretical approaches and empirical applications and discussed the implication with potential barrier for firms to adopt such model.

2.13 Raw Material

Ayuso et al. (2003) present supplier selection by pure 0-1 programming with Branch and Fix Coordination (BFC) algorithmic approach under uncertainty.

2.14 Refrigerator Plant

Ustun et al. (2008) raised the two question regarding supplier selection, which supplier is best and how much should be purchased from the best possible supplier which considers both factors tangible and intangible with fourteen criteria. Demirtas and Ustun (2009) consider inventory lot sizing, multiple suppliers with single product and adopted fourteen criteria were classified by BOCR (benefit, opportunity, cost and risk) to identify the best possible supplier.

2.15 Steel Industry

Punniyamoorthy et al. (2011) adopted the survey based result by participating 151

respondents to integrate the structural equation modeling (SEM) and considered the uncertainties and supplier selection score. Kar (2014) suggested in which group decision making was handled with geometric mean and discriminate analysis was handled by fuzzy.

2.16 Textile Industry

Chan and Chan (2010) consider textile industry as a fast changing market in which alternatives and criteria changes time to time and implemented to solve the problem of supplier. Chen (2011) identified strategy using strengths, weaknesses, opportunities and threats (SWOT) analysis and mathematical model. Shaw et al. (2012) select the textile supply chain and highlighted the issues related to carbon emission and carbon house gas.

2.17 Watch Firm

Liao et al. (2011) consider both tangible and intangible criteria to acquire multi aspiration levels and using linguistic variable instead of numerical values give the accurate result.

2.18 Washing Machine Company

Kilincci et al. (2011) defined main attribute and sub-attribute for supplier selection and hierarchy structure by calculating weight of criteria and alternating with fuzzy to achieve best possible supplier.

2.19 Service Company

Amin et al. (2009) select best Internet service provider (ISP) based on qualitative criteria and quantitative matrices have been discussed for triangular fuzzy logic by consideration of three perspectives such as customer, performance, and competition. Chai and Liu (2014) proposed believable rough set (BRS) approach with criteria analysis, rough approximation, decision rule induction, and a scheme for rule application to validate the real supplier problem.

3. Observation and Analysis

In this paper, we reviewed 51 journal articles of last ten years on the basis of area of application while solving supplier selection and evaluation problem. The following sub-section covers the some observation on the basis of these articles.

3.1 Most focused area of application

The first objective of this paper is to be found out most focused area of application in the literature of supplier selection and evaluation. The automobile Industry is most focused followed by manufacturing firm, electronics industry, textile industry, computer manufacturer, refrigerator plant, service company, steel industry, washing machine company, watch firm, Fertilizer Company, Ink Cartridge, Logistic System. The most authors interested to develop individual model or integrated model related to supplier selection. After that, automobile industry contributes 21% article, manufacturing firm contributes 19%, and electronics industry contributes 15% of research paper when solving supplier selection as shown in Table 1. Airplane industry, computer manufacturer, refrigerator plant, service company and steel industry all are contributed only 4 % article and remaining area of applications contribute only 2% article of published related to supplier selection and evaluation problem. De Boer et al. (2001) discussed in his paper that supplier related problem is situation specific; it means that the

criteria will be different for different area of application that is why it gets more realistic. Supplier selection model proposed by many authors in specific area of application might be applied to another area but not surely it is accurately applicable.

Table 1: Distribution of Paper

Area of Application	No. of Paper	Contribution
Airplane Industry	2	4%
Automobile Industry	11	21%
Computer Manufacturer	2	4%
Electronics Industry	8	15%
Fertilizer Company	1	2%
Ink Cartridge	1	2%
Logistic System	1	2%
Manufacturing Firm	9	19%
Paper Production	1	2%
Pharmaceutical Company	1	2%
Postal Services	1	2%
Railway Industry	1	2%
Raw Material	1	2%
Refrigerator Plant	2	4%
Service Company	2	4%
Steel Industry	2	4%
Textile Industry	3	6%
Washing Machine Company	1	2%
Watch Firm	1	2%
Total	**51**	**100%**

3.2 Environment of Area

The second objective of this paper is to find the environment of area. It means that in which situation the author solve the supplier related problem. We classify it into deterministic and uncertainties situation. 32% paper (16 out of 51) considered as uncertainties environment of area and 69% papers (35 out of 51) with consideration of deterministic environment of area while solving supplier problem and evaluation.

Chai et al. (2013) suggested in his review paper that decision environment defined by uncertainties, decision goal and problem formulation. In studies of decision making, decision environment which does not involve directly or indirectly the uncertainties then it was related to deterministic situations, otherwise, uncertainties area of environment. Mathematical model are the major decision technique by which the author tackle the deterministic type of decision environment and fuzzy set theory, stochastic programming, neural network handled the uncertainties situation of supplier problem. In fig. 1 shows the categorization of decision situation. Fig 1 Decision situations

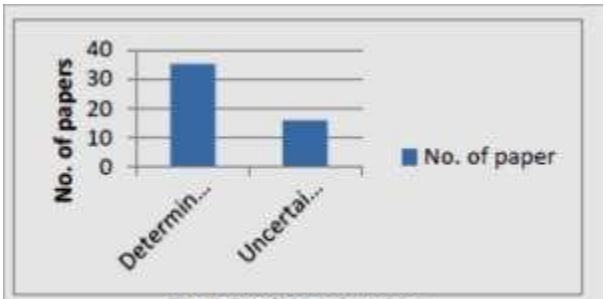

Fig 1 Decision situations

4. Conclusion

This paper consists of literature review based on area of application related to supplier selection and evaluation of last ten years. First, it was revealed that the most focusing area is automobile followed by manufacturing and electronics industry. Second, it was accepted that uncertainties is the more realistic and accurate decision environment than deterministic. It guides the researcher for future work that construction or project related area would be more valuable or challenging

while dealing the supplier selection problem which was not considered by author based of my knowledge. Our study has two limitations. First, our systematic review considered only last ten years of articles and second, only focuses on area of application related to supplier selection and evaluation problem.

Reference

[1] Aghai Shima, Naser Mollaverdi and Mohammad Saeed Sabbagh, (2014), A fuzzy multi-objective programming model for supplier selection with volume discount and risk criteria, Int J Adv Manuf Technol, Vol. 71, pp. 1483–1492.

[2] Aksoy Aslı and Nursel Ozturk, (2011),Supplier selection and performance evaluation in just-in-time production environments, Expert Systems with Applications, Vol. 38, pp. 6351–6359.

[3] Amin Saman Hassanzadeh and Jafar Razmi, (2009), An integrated fuzzy model for supplier management: A case study of ISP selection and evaluation, Expert Systems with Applications, Vol. 36, pp. 8639–8648.

[4] Ayuso a. alonso, l.f. escudero, A. garín, m.t. ortuño and G. pérez, (2003), An Approach for Strategic Supply Chain Planning under Uncertainty based on Stochastic 0-1 Programming, Journal of Global Optimization, Vol. 26, pp. 97–124.

[5] Bruno Giuseppe, EmilioEsposito, Andrea Genovese and RenatoPassaro, (2012), AHP-based approaches for supplier evaluation: Problems and perspectives, Journal of Purchasing & Supply Management, Vol. 18, pp. 159–172.

[6] Bhattachary Arijit, John Geraghty and Paul Young, (2010), Supplier selection paradigm: An integrated hierarchical QFD methodology under multiple-criteria environment, Applied Soft Computing, Vol. 10, pp. 1013–1027.

[7] Bilsel Ufuk and A. Ravindran, A multiobjective chance constrained programming model for supplier selection under uncertainty, Transportation Research Part B, Vol. 45, pp. 1284–1300.

[8] Bevilacquaa M., F.E. Ciarapicab and G. Giacchetta, (2006), A fuzzy-QFD approach to supplier selection, Journal of Purchasing & Supply Management, Vol. 12, pp. 14–27.

[9] Boran Fatih Emre, Serkan Genc, Mustafa Kurt and Diyar Akay, (2009), a multi-criteria intuitionistic fuzzy group decision making for supplier selection with TOPSIS method, Expert Systems with Applications, Vol.36, pp.11363–11368.

[10] Celebi Dilay and Demet Bayraktar, (2008), An integrated neural network and data envelopment analysis for supplier evaluation under incomplete information, Expert Systems with Applications, Vol. 35, pp. 1698–1710.

[11] Chan Felix T. S. and Hing Kai Chan, (2010), An AHP model for selection of suppliers in the fast changing fashion market, Int J Adv Manuf Technol, Vol. 51, pp. 1195–1207.

[12] Chen Yueh-Hsiang and Ru-Jen Chao, (2012), Supplier selection using consistent fuzzy preference relations, Expert Systems with Applications, Vol. 39, pp. 3233–3240.

[13] Chen Ping-Shun and Ming-Tsung Wu, (2013)

A case study, Computers & Industrial Engineering, Vol. 66, pp. 634–642.

[14] Chen Yuh-Jen, (2011), Structured methodology for supplier selection and evaluation in a supply chain, Information Sciences, Vol. 181, pp. 1651–1670.

[15] Chen Lisa Y. and Tien-ChinWang, (2009), Optimizing partners' choice in IS/IT outsourcing projects: The strategic decision of fuzzy VIKOR, Int. J. Production Economics, Vol. 120, pp. 233–242.

[16] Chan F.T.S. and H K Chan, (2004), Development of the supplier selection model—a case study in the advanced technology industry, Journal of Engineering Manufacture, Vol. 218, pp. 1807-1824

[17] Chena Chen-Tung, Ching-Torng Linb and Sue-Fn Huang, (2006), A fuzzy approach for supplier evaluation and selection in supply chain management, Int. J. Production Economics, Vol. 102, pp. 289–301.

[18] Chan Felix T.S. and Niraj Kumar, (2005), Global supplier development considering risk factors using fuzzy extended AHP-based approach, Omega International Journal of Management Science, Vol. 35, pp. 417 – 431.Chai Junyi, James N.K. Liu and Eric W.T. Ngai, (2013), Application of decision-making techniques in supplier selection: A systematic review of literature, Expert Systems with Applications, Vol. 40, pp. 3872–3885.

[19] Demirtas Ezgi Aktar and Ozden Ustun, (2009), Analytic network process and multi-period goal programming integration in purchasing decisions, Computers & Industrial Engineering, Vol. 56, pp. 677–690.

[20] Deng S., R. Aydin, C.K. Kwong and Yun Huang, (2014), Integrated product line design and supplier selection: A multi-objective optimization paradigm, Computers & Industrial Engineering, Vol. 70, pp. 150– 158.

[21] De Boer Luitzen, Eva Labro and Pierangela Morlacchi, (2001), A review of methods supporting supplier selection, European Journal of Purchasing & Supply Management, Vol.7, pp.75-89.

[22] Dursun Mehtap and E. Ertugrul Karsak, (2013), A QFD-based fuzzy MCDM approach for supplier selection, Applied Mathematical Modelling, Vol. 37, pp. 5864–5875.

[23] Faeza F., S.H.Ghodsypoura and C.O'Brien, (2009), Vendor selection and order allocation using an integrated fuzzy case-based reasoning and mathematical programming model, Int. J. Production Economics, Vol. 121, pp. 395–408

[24] Guo Xuesong, Zhengwei Zhu and Jia Shi, (2014), Integration of semi-fuzzy SVDD and CC-Rule method for supplier selection, Expert Systems with Applications, Vol. 41, pp. 2083–2097.

[25] Ho William, Xiaowei Xu and Prasanta K. Dey, (2010), Multi-criteria decision making approaches for supplier evaluation and selection: A literature review, European Journal of Operational Research, Vol. 202, pp. 16–24.

[26] Ha Sung Ho and Ramayya Krishnan, (2008), A hybrid approach to supplier selection for the maintenance of a competitive supply chain,

Expert Systems with Applications, Vol. 34, pp. 1303–1311.

[27] Hou Jiachen and Daizhong Su, (2007), EJB-MVC oriented supplier selection system for mass customization, Journal of Manufacturing Technology Management, Vol. 18, pp. 54-71.

[28] Kannan Devika, Roohollah Khodaverdi, Laya Olfat, Ahmad Jafarian and Ali Diabat, (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, Vol. 47, pp. 355-367.

[29] Kar Arpan Kumar, (2014), Revisiting the supplier selection problem: An integrated approach for group decision support, Expert Systems with Applications, Vol. 41, pp. 2762–2771.

[30] Kara Selin Soner, (2011), Supplier selection with an integrated methodology in unknown environment, Expert Systems with Applications, Vol. 38, pp. 2133–2139.

[31] Kilincci Ozcan and Suzan Aslı Onal, (2011), Fuzzy AHP approach for supplier selection in a washing machine company, Expert Systems with Applications, Vol. 38, pp. 9656–9664.

[32] Kokangul Ali and Zeynep Susuz, (2009), Integrated analytical hierarch process and mathematical programming to supplier selection problem with quantity discount, Applied Mathematical Modeling, Vol. 33, pp. 1417–1429.

[33] Kull Thomas J. and Srinivas Talluri, (2008), A Supply Risk Reduction Model Using Integrated Multicriteria Decision Making, IEEE Transactions on Engineering Management, Vol. 55, pp. 3.

[34] Kumar Amit, VipulJain and SameerKumar, (2014), A comprehensive environment friendly approach for supplier selection, Omega, Vol. 42, pp. 109–123.

[35]Lee Amy H.I., (2009), A fuzzy supplier selection model with the consideration of benefits, opportunities, costs and risks, Expert Systems with Applications, Vol. 36, pp. 2879–2893.

[36] Lin Rong-Ho, (2009), An integrated FANP– MOLP for supplier evaluation and order allocation, Applied Mathematical Modelling, Vol. 33, pp. 2730–2736 Levary Reuven R., (2008), Computers & Industrial Engineering, Vol. 55, pp. 535–542.

[37] Liou James J.H., Yen-Ching Chuang and Gwo-Hshiung Tzeng, (2014), A fuzzy integral-based model for supplier evaluation and improvement, Information Sciences, Vol. 266, pp. 199–217.

[38] Liao Chin-Nung and Hsing-Pei Kao, (2011), An integrated fuzzy TOPSIS and MCGP approach to supplier selection in supply chain management, Expert Systems with Applications, Vol. 38, pp. 10803–10811.

[39] Liu Fuh-HwaFra nklin and Hui Lin Hai, (2006), Int. J. Production Economics, Vol. 97, pp. 308–317.

[40] Ming-Lang Lang Tseng, Jui Hsiang Chiang and Lawrence W. Lan, (2009), Selection of optimal supplier in supply chain management strategy with analytic network process and choquet integral, Computers &

Industrial Engineering, Vol. 57, pp. 330–340.

[41] Önüt Semih, Selin Soner Kara and Elif Isik, (2009), Long term supplier selection using a combined fuzzy MCDM approach: A case study for a telecommunication company, Expert Systems with Applications, Vol. 36, pp3887–3895

[42] Punniyamoorthy M., P. Mathiyalagan and P.Parthiban, (2011), A strategic model using structural equation modeling and fuzzy logic in supplier selection, Expert Systems with Applications, Vol. 38, pp. 458–474.

[43] Qian Li, (2014), Market-based supplier selection with price, delivery time, and service level dependent demand, Int. J.ProductionEconomics, Vol. 147, pp. 697–706.

[44] Rajesha G. and P. Malligab, (2013), Supplier Selection Based on AHP QFD Methodology, Procedia Engineering, Vol. 64, pp. 1283 –1292.

[45] Rouyendegh Babak Daneshvar and Thomy Eko Saputro, (2014), Supplier selection using integrated fuzzy TOPSIS and MCGP: a case study, Procedia - Social and Behavioral Sciences, Vol. 116, pp. 3957 – 3970.

[46] Shaw Krishnendu, Ravi Shankar, Surendra S. Yadav and Lakshman S. Thakur, (2012), Supplier selection using fuzzy AHP and fuzzy multi-objective linear programming for developing low carbon supply chain, Expert Systems with Applications, Vol. 39, pp. 8182–8192.

[47] Talluri Srinivas and Ram Narasimhan, (2003), Vendor evaluation with performance variability: A max–min approach, European Journal of Operational Research, Vol. 146,pp.543–552.

[48] Ustun Ozden and Ezgi Aktar Demırtas, (2008), An integrated multi-objective decision-making process for multi-period lotsizing with supplier selection, International Journal of Management Science, Vol. 36, pp. 509 – 521.

[49] Vinodh S., R. Anesh Ramiya and S.G. Gautham, (2011), Application of fuzzy analytic network process for supplier selection in a manufacturing organisation, Expert Systems with Applications, Vol. 38, pp. 272–280.

[50] Ware Nilesh R., S.P. Singh and D.K. Banwet, (2014), A mixed-integer non-linear program to model dynamic supplier selection problem, Expert Systems with Applications, Vol. 41,pp. 671–678.

[51] Wu Desheng (Dash), (2009), Supplier selection in a fuzzy group setting: A method using grey related analysis and Dempster–Shafer theory, Expert Systems with Applications, Vol. 36, pp. 8892–8899.

[52] Yazdani Morteza, (2014), An integratedMCDM approach to green supplier selection, International Journal of Industrial Engineering Computations, Vol. 5, pp. 443–458.

[53] Yang Taho and Chih-Ching Hung, (2007), Multiple attribute decision making methods for plant layout design problem, Robotics and Computer-Integrated Manufacturing, Vol. 23, pp. 126–137.38 Int. J. Res. M.M.A.Engg, 2015, 1(4), 27-38

[54] Yousefi Ali and Abdollah Hadi-Vencheh, (2010), An integrated group decision making model and its evaluating by DEA for automobile industry, Expert Systems with Applications, Vol. 37, pp. 8543–855

[55] Yazdani Morteza, (2014), An integratedMCDM approach to green supplier selection, International Journal of Industrial Engineering Computations, Vol. 5, pp. 443–458.