Multiple Criteria Model Study of Outsourcing Service Countries in the East and Southeast Asia

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***Abstract*— Research background: Outsourcing decisions are very a complex and multifaceted process because decision-makers (DMs) have to make a complete evaluation considering multiple criteria which often may conflict with each other. The evaluation of outsourcing destination, then, basically is a multi-criteria decision making problem (MCDM). Overtime a great number of works have been carried out regarding this field. Unfortunately, few of them focus on solving the outsourcing problems. The purpose of this paper is to address the research gap by first reviewing the literature of MCDM methods and then constructing a simple MCDM-based model to help managements evaluate and select the best outsourcing location for their companies. This study utilizes the Analytic Hierarchy Process (AHP) approach to ratify the effectiveness of the MCDM-based model. Seven typical emerging countries are chosen from the East and Southeast Asian regions. To compute the final weight for each country, we asked for the opinion of 12 experts in the given field. The results of the empirical study show that among seven promising countries in East and Southeast Asia, China is the best country for the provision of outsourcing services in terms of cost competiveness and business environment. Generally, the MCDM model for outsourcing problems in this study works well in reality, especially with the case of the East and Southeast Asian region. This research provides several significant outsourcing theories and practices for decision-makers when selecting outsourcing destinations.**

Keywords *- Outsourcing, decision makers (DMs), multi-criteria decision making (MDCM), AHP.*

1. Introduction

The market has become global and therefore organizations need to adapt their operations accordingly. It is essential for managers to identify their best business decision-making strategy. The goal of management is not only maintaining competitive advantages over rivals, but also increasing returns from business operations in today's ever-changing market. Fortunately, outsourcing is a business strategy that allows firms to emphasize on core proficiencies and outsourcing non-core business portions to outside partners [1;2]. In the 1990s, organizations, influenced by the benefits of outsourcing on cost reduction, started to outsource functions in which they did not have expertise. This trend has enabled companies to maintain their competitive advantage holistically in order to respond to the evolving global market [3;4]. The decision makers must take into consideration internal and external environmental features as selection of an outsourcing method is a multifaceted problem [5]. Companies, which fail to accomplish outsourcing contracts, may experience a substantial amount of shortcomings, such as: loss of control or competitive advantages, increased costs, and even bankruptcy [6]. An absence of any proven method for decision makers (DMs) has been one of the major reasons for outsourcing failure [7]. The practice of assessing and choosing potential vendors requires a complete outlook of all contradicting criteria prevailing at both company and country level because it is a hectic process. In addition, selection of an ideal outsourcing provider is done under multiple criteria and is essentially considered a multiple criteria decision-making problem (MCDM) [8; 9]. For these reasons, this study attempts to help DMs in making accurate decisions in relation to the outsourcing field. Then, the study's purpose is to build a decision making model for outsourcing country evaluation based on the MCDM concept. Then, we will check the workability of the model by the empirical study with the help of the AHP approach. The region we selected to test the study model is in the East and Southeast Asia. Finally, we hope this paper will not

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only help to enrich the existing literature but also become a good reference for DMs in the relevant field.

2. Theoretical Background

2.1. Evaluation criteria for outsourcing service country

As argued previously, outsourcing has been a recognized term since the early 1990s because of its well-known attributes which include cost reduction [10], business focusing [11] and many others. Globalization has enabled companies to now outsource every part of their business production wise and its service processes [12]. Foreign outsourcing was first studied by Lawrence and Slaughter [13]. A measure of outsourcing is constructed by Feenstra and Hanson [14] to estimate imports of intermediate inputs into each industry. In conclusion, "outsourcing" has developed into a thought-provoking topic and has generated numerous researches. For example, outsourcing could promote productivity growth which could then promote economic growth [15; 16] and consumption [17]. In conjunction with the above, several explanations of outsourcing have been made. Outsourcing refers to a company's practice of migrating activities to offshore location outside of its country of origin [18]. Outsourcing is essentially seen as a practice that fulfils a contract with another company to undertake the primary task of the business process provision [19]. According to Mahalik and Satpathy, outsourcing is defined as the management decision to sign contracts with external organizations for the purpose of externalizing some parts of its business operations which were initially being conducted internally by the primary company [20].

Outsourcing is used by firms with the main aim of sustaining competitive advantage and increasing profits. Transaction cost theory has been used to explain the reasoning behind why firms outsource their services [21;22;23]. Strategic focus, risk analysis and so on, have emerged as important factors in today's economic situation when considering an outsourcing plan [24;25, 26]. This new trend of outsourcing has motivated more researchers to come up with solutions for problems associated with outsourcing. The MDCM approach is mostly used by DMs to solve conflicting goals based on collective group concepts [27]. The applications of this method are discussed in more detail in the next section. From the review of literature given above, a list of factors were selected namely costs, business atmosphere, human resources, and government policies from this study. These factors are summarized in Table 1 and used to build the hierarchy model in the empirical study part.

Table 1: Critical success factors

Criteria**	Sub-criteria**
Costs	Freight prices
	Salaries
	Taxes
	Real estate
Human resources	Workforce & efficiency
	Education level
	Technology readiness
	Language
	Culture
Business & economic environment	Stability
	Infrastructure
	Corruption
	Full outsourcing service
Government policies & legal framework	Regulation
	Fair trade
	Intellectual property
	Taxes incentives

2.2. A brief review in multi-criteria decision making (MCDM)

MCDM is concerned with structuring and solving decision and planning problems involving multiple criteria. The purpose is to support decision makers facing such problems. Several researchers have recommended that MCDM problems should be divided into two categories; multiple objective decision making (MODM) and multiple attribute decision making (MADM) [26]. MCDM method involves measuring the weights of relative performance of the decision criteria, and the performance of the alternatives in terms of each one of the decision criteria, then determining what is the ranking (or relative priorities) of the alternatives [28]. MODM is often used in programing problems or designing facets in order to obtain the optimal goal through evaluating the numerous interactions among the predetermined constraints. MADM is frequently adopted in evaluating and selecting attributes in which the set of decision has been restricted into predetermined substitutes. The scope of this study is primarily based on the most recognized branch of decision-making named MADM because of the specific characteristics of the outsourcing strategy.

Even though MADM approaches have been applied to various outsourcing problems in different situations at different times, they have some major aspects in common as follows [28]:

A set of alternatives: the final purpose of MADM is to find the best alternatives within a set of available options, for instance which is the optimal outsourcing service nation in East and Southeast Asia?

A set of attributes: these attributes can be goals, criteria or sub-criteria in which some of them maybe mutually conflicting.

Decision weights and decision matrices as illustrated in Fig. 1: Any MADM issue can be simply translated into a decision matrix form (M-by-N matrix) in which entry aij (where i = 1, 2, 3,… M-1, M and j = 1, 2, 3,…,N-1, N) shows the performance of alternative Aj when it is evaluated based on criterion Cj. Then in the matrix, the priority weights of the criteria (Wj) are also computed to rank the relative importance of attributes. These weights are normalized to add up to one. Generally, A MADM is basically summarized in Fig. 1 as follows:

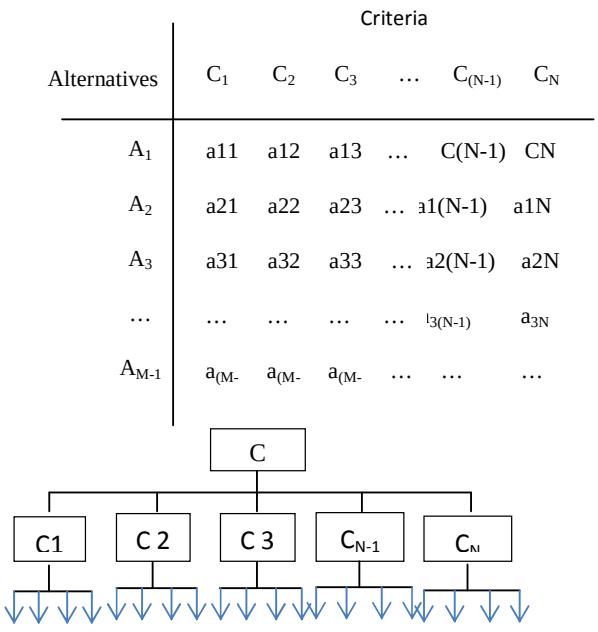

Figure 1. The simple MCDM model

2.3. The selection of the AHP method.

Multi-criteria decision-making (MCDM) plays a critical role in many real life problems. It is not an exaggeration to argue that almost any local or federal government, industry, or business activity involves, in one way or the other, the evaluation of a set of alternatives in terms of a set of decision criteria. Multiple criteria decision making-based (MCDM-based) is generally used when selecting any outsourcing service country. These methods can be both individual such as Data Envelopment Analysis (DEA), Analytic Hierarchy Process (AHP), Analytic Network process (ANP) etc. and assimilated, for example AHP and DEA, AHP and DEA, or AHP and Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE). Among those, as the most prevalent single approach, The AHP has been extensively applied to numerous different fields whether social political, economic, or management sciences [29]. The AHP can provide DMs with the sturdiness and elasticity needed to determine the most vital attributes of a set of alternatives through its hierarchy model [30]. Due to this, MCDM is used for problem solving in relation to the different fields of the outsourcing field. An example of this is the previous development of an AHP method for the supplier selection of automobile companies [31]. Recently, the AHP method has been applied to reconstruct a set of outsourcing partner evaluation systems in term of information system and information technology (IS/IT) [32]. To discuss more clearly about the AHP method, the study separates the original of AHP method into next section.

3. Methodology

3.1. *The brief discussion of the AHP method*

In order to apply the AHP method, it is necessary to construct a hierarchy expressing the relative values of a set of attributes. Decision-makers evaluate the relative importance of the attributes in each level based on the AHP scale. This scale in turn is used to direct decision-makers to express their preferences between each pair-wise comparison. They are required to select whether this element is of equal importance, somewhat more important, much more important, very much more important or absolutely important to another. These important intensities are respectively converted to numeral values in the AHP scale as 1, 3, 5, 7, 9 and 2, 4, 6, 8 are intermediate values. By using this scale, the qualitative judgments of evaluators are converted into the quantitative values, and thus construct out a pairwise comparison matrix.

The pairwise comparison matrix is made for all elements to be considered in the constructed hierarchy and the results from these comparisons are used to calculate a list of relative weights and importance of the factors (eigenvector) based on the Rad [33] method as follows:

Calculating the weight of the criterion i: $wi = \sqrt[n]{\prod_{j=1}^{n} aij} \; i = (1, \dots, n)$

Normalizing wi:

$wi = \frac{\overline{wi}}{\sum_{i=1}^{n} \overline{wi}} ; i = (1, \dots, n) where \; \overline{wi} \; is \; vector \; of \; the \; priorities$

Calculating the maximal Eigen value: $\lambda \, max = \sum_{i=1}^{n} \frac{\sum_{j=1}^{n} aijwj}{nwi}$

Then, the calculation of consistency index (CI) is carried out to measure whether the pairwise comparison matrix is consistent enough. We can obtain a consistency index by using the formula introduced by Saaty in 1971:

$$CI = \frac{\lambda \, max - n}{n - 1}, n \; is \; the \; order \; of \; matrix$$

Then, the consistency ratio is given by:

$$CR = \frac{CI}{RI}, where \; RI \; is \; random \; index \; of \; judment \; matrix$$

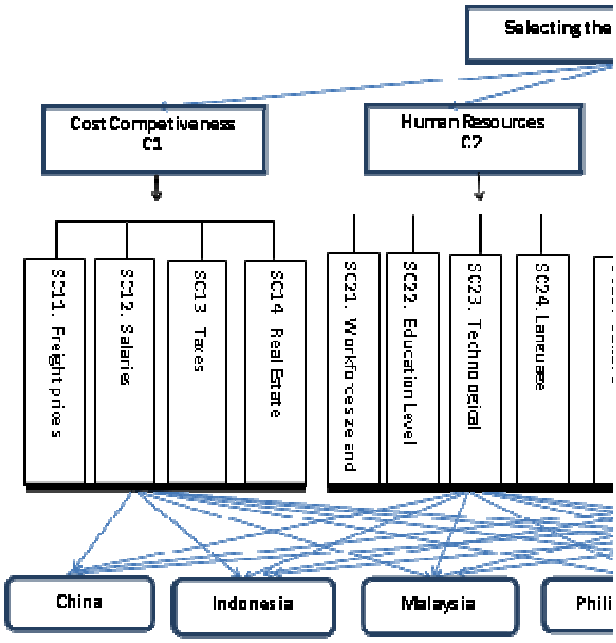

Figure 2. The hierarchy model for the problem of outsourcing destination selection

The value of random indices calculated by Saaty is shown in Table 3.

Table 3: Random indices calculated by Saaty 1977

n	3	4	5	6	7	8	9	10
RI	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

If the CR is smaller than 0.1, it is considered to be consistent enough, however, on the contrary, if the CR is much bigger than 0.1, it means that the comparison matrix is untrustworthy.

Finally, the study uses standard matrix calculations to synthesize and determine the most important factor (global priority) among a set of given attributes by adopting an additive aggregation with normalization of the sum of the local priorities to unity:

$$Pi = \sum wj \, . lij$$

Where: Pi is the global priority of the alternative i; lij is the local priority.

3.2. *MCDM model for the outsourcing country selection*

Problem modelling: To aid practitioners come up with an outsourcing decision under any multiple criteria problem, the study utilizes the AHP approach to assemble a hierarchy model (see Figure. 2), which can be distributed into four levels: first level is the overall goal (selecting the best outsourcing service destinations)

situated at the top of the hierarchy. The second level is the four main criteria: business and economic environment, cost competiveness, human resources, and government policy and legal framework. Each criterion in turn contains its sub-criteria which are placed in the third level. Finally, the bottom position of the hierarchy presents seven alternatives in which seven typically emerging countries in the East and Southeast Asia namely China, Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam were selected.

Questionnaire design and data collection: The questionnaire designed in this paper was based on the nine-point scale theory of Saaty, to make all possible pair-wise comparisons among attributes and alternatives (as shown in Table 2). For instance, two criteria are selected from the hierarchy model, namely cost competiveness (C1), and human resources (C2). Assuming that an expert thinks C1 is far more important than C2; say (7:1), then he will mark (✓) on the 7:1 blank. AHP questionnaire was administered to 12 experts who are working for different companies in different sectors concerning the outsourcing field in order to obtain experts' evaluation over pair-wise comparisons after completing the construct. Data retrieved was then used for analysis in the next section.

4. Results Of The Empirical Study

4.1. *Consistency test*

If the consistent level is less than or equal to 10%, the results can pass the consistency test when calculating priorities from the comparisons matrices according to Saaty's perturbation theory [30]. Expert opinions were given in three different stages in proportion to three separate levels of the hierarchy model in this research. The first level includes pairwise comparisons with regard to the overall goal. The second level is pair-wise comparisons among sub-criteria with regard to each criterion, trailed by the lowest level with regard to alternatives. With the assistance of Expert Choice software, the findings show that all of 12 experts who participated in the survey pass the test due to the consistent ratio being smaller than 0.1 as shown in Table 4.

Table 4: Consistent test for criteria

Experts	Weight (C1)	Weight (C2)	Weight (C3)	Weight (C4)	IR*
1	0.620	0.054	0.162	0.164	0.09*
2	0.510	0.095	0.186	0.209	0.02*
3	0.393	0.125	0.101	0.381	0.05*
4	0.403	0.044	0.355	0.198	0.04*
5	0.060	0.420	0.132	0.388	0.08*
6	0.528	0.052	0.210	0.210	0.03*
7	0.625	0.125	0.125	0.125	0.00*
8	0.188	0.527	0.212	0.073	0.09*
9	0.194	0.612	0.140	0.054	0.07*
10	0.611	0.121	0.204	0.063	0.04*
11	0.320	0.090	0.061	0.529	0.03*
12	0.599	0.210	0.133	0.058	0.08*

** Inconsistency ratio (IR)* ≤ 0.1*, it is acceptable*

4.2. *Combining and calculating the weight values*

After passing the test for the reliability and validity of questionnaires, the study combined 12 experts' judgments so as to obtain the pairwise comparison judgment matrices (PCJMs) for each level of the hierarchy. As a result, the inconsistent ration of each PCJM is at 0.00 (<0.1) which means that when combining 12 evaluators in the whole hierarchy, they are consistent in making judgments of pair-wise comparisons. In the meantime, the normalized priority weights obtained from PCJMs were used to synthesize the solution for outsourcing country selection problems.

4.3. *Synthesizing and calculating the global weights*

This phase uses the normalized priority weights attained from the Expert Choice's outputs to rank the relative significance of each criterion, and thereby to calculate the global priority weights of all sub-criteria. The global weights can be calculated by adding the local priority weights multiplied by the weights of criteria as shown in Table 5.

Table 5: The global weights of all sub-criteria

Rank	Criteria	Original weight	Sub-criteria	Local weight	Global weight
1	C1	**0.442**	SC11	0.206	0.091
			SC12	0.333	0.147
			SC13	0.299	0.132
			SC14	0.163	0.072
4	C2	**0.76**	SC21	0.354	0.062
			SC22	0.261	0.046
			SC23	0.169	0.030
			SC24	0.090	0.016
			SC25	0.126	0.022
2	C3	**0.201**	SC31	0.276	0.055
			SC32	0.257	0.052

			SC33	0.240	0.048
			SC34	0.227	0.046
3	C4	**0.180**	SC41	0.227	0.041
			SC42	0.252	0.045
			SC43	0.204	0.037
			SC44	0.317	0.057
Overall Inconsistency = 0.00					

Table 6 shows the priority of seventeen sub-criteria that was reorganized based on the global weights. As an outcome, four sub-criteria of cost competiveness occupy the highest priorities in the third level of the hierarchy. Specifically, employee salaries (SC12) is the chief element, followed by taxes (SC13), freight prices (SC11), and real estate cost (SC14). Then, workforce size and efficiency (SC21) is the fifth most important sub-criterion which pertains to the factor of business and economic environment. The element of tax incentives element (SC44) ranks of sixth importance, followed by stability of business and economic environment (S21).

Table 6: Ranking of sub-criteria

Rank	Sub-criteria		Global weight
1	SC12	Employee salaries	0.147
2	SC13	Taxes	0.132
3	SC11	Freight price	0.091
4	SC14	Real estate costs	0.072
5	SC21	Workforce size and efficiency	0.062
6	SC44	Tax incentives	0.057
7	SC31	Stability	0.055
8	SC32	Infrastructure situation	0.052
9	SC33	Corruption situation	0.048
10	SC22	Education level	0.046
11	SC34	Full outsourcing service	0.046
12	SC42	Fair trade protection	0.045
13	SC41	Government regulations	0.041
14	SC43	Intellectual property protection	0.037
15	SC23	IT capability	0.030
16	SC25	Culture	0.022
17	SC24	Language	0.016

4.4. *Determining the best outsourcing locations*

As said previously, the findings of this paper were based on experts' evaluations over four major criteria and seventeen sub-criteria given in the hierarchy. Seven typically emerging countries in East and Southeast Asia were chosen as the alternatives and arranged in the matrix to make pair-wise comparisons, in the empirical example. The summary in Table 7 showed that, China (C) is the leading country (0.24) for the provision of outsourcing service and it was assessed as being greatly more significant than the other six nations. Vietnam (V: 0.15) is the second most attractive country, followed by Singapore (S: 0.14), The Philippines (P: 0.13) and Thailand (T: 0.13). Malaysia (M: 0.11) and Indonesia (0.10) are the two less important countries in the region. Because each nation has its own competitive advantages there are some little differences among the selected countries in terms of pretermitted attributes. For instance, The Philippines have a population with greater aptitude for language, but Vietnam has lower labour costs. Singapore has an advanced infrastructure and skilled workers, whereas Thailand can offer outsourcing services at lower prices. Differences of weights of alternatives are shown in Table 7.

Table 7: Pairwise comparison judgment matrix of alternatives

	C	I	M	P	S	T	V
C	1	2.76	2.78	1.42	2.15	1.93	1.45
I		1	1.07	1.10	1.62	1.37	1.34
M			1	1.07	1.41	1.02	1.71
P				1	1.25	1.03	1.08
S					1	1.05	1.02
T						1	1.02
V							1
Pr	0.24	0.09	0.11	0.13	0.14	0.13	0.15

5. Discussion

The multiple criteria decision making (MCDM) approach has been extensively applied to various sectors due to its problem solving ability by evaluating a list of alternatives through a set of decision attributes. This paper focused on the outsourcing domain which is one of the most interesting issues of business strategy in today's market to find the best MCDM method for the optimal outsourcing destination problem because it is impossible for one research paper to cope with all of them. Therefore, numerous approaches have been used in the literature to help researchers and practitioners in applying the MCDM method to deal with outsourcing problems effectively.

This papers' aim is to introduce a simple MCDM model for outsourcing difficulties based on the wide-ranging review of given literature. In addition, the research attempts to establish the reliability of this model by providing readers the empirical example in relation to the problem of outsourcing country assessment and selection based on the AHP method. In the empirical study, seven growing countries in the East and Southeast Asia region and a set of key attributes are used to construct the hierarchy model.

As an outcome, China is the optimal outsourcing service country for decision makers in terms of the two most considered factors including cost competiveness and business and economic environment. This finding is hardly a surprise as China has been a famous destination for recent decades due to its surpassing advantages. However, other countries in the region like Vietnam, Singapore, or The Philippines are on the rise to become the attractive locations for outsourcing practitioners. The governments in these countries are attempting to improve macro environment factors such as infrastructures, education systems, business policies and so on. For these reasons, China is not the only option for decision makers, but the results will vary based on different outsourcing purposes. Those result in different decisions of business managers over year.

6. Conclusion

In general, the study has completed the said task that coming up with the simple MCDM model for the problem of outsourcing service country at the macro level. Based on the given model, decision makers are easier to see and evaluate the critical criteria for considering an outsourcing service vendor. Even though the pros and effectiveness of the MCDM have been comprehensively recognized by both academia and practitioners over the years, it can be resolved that there is no perfect MCDM method as of yet. Therefore, this topic is still valuable for prospective researchers to advance and ascertain the most effective MCDM approach under the numerous sectors.

Reference

[1] Loh, L. and Venkatraman, N. "Diffusion of Information Technology Outsourcing: Influence Sources and the Kodak Effect", 1992, *Information Systems Research*, vol. 3, no. 4, pp. 334-358.

[2] Applegate, L. and Montealegre, R. "Eastman Kodak Company: Managing Information Systems through Strategic Alliances", 1991, *Harvard Business School*, Boston, MA, Case 9-192 030.

[3] Holcomb, T. and Hitt, M. "Toward A Model of Strategic Outsourcing", 2007, *Journal of Operations Management*, vol. 25, no. 2, pp. 464-481.

[4] Lacity, M., Willcocks, L., and Rottman, J. "Global Outsourcing of Back Office Services: Lessons, Trends, and Enduring Challenges", 2008, *Strategic Outsourcing: An International Journal*, vol. 1, no. 1, pp. 13-34, 2008.

[5] Mary, A., Ozden, B., and Birsen, K. "A Case Study Using the Analytic Hierarchy Process for IT Outsourcing Decision Making", 2015, *International Journal of Information Systems and Supply Chain Management*, vol. 8, no. 1, pp. 60-84.

[6] Ross J. "IT Outsourcing: British Petroleum's Competitive Approach", 1995, *Harvard Business Review*, May-June, pp. 95-102.

[7] Lonsdale, C. "Effectively Managing Vertical Supply Relationships: A Risk Management Model For Outsourcing", *Supply Chain Management: An International Journal*, vol. 4, no. 4, pp. 176-83, 1999.

[8] Tajfar, A., Yari, A., and Kazemnejad, A. "Providing a Solution for Identification and Prioritization of IT Projects Outsourcing Factors using Analytic Hierarchy Process", 2016, *International Research Journal of Management Sciences*, Vol. 4, no. 4, pp. 225-234.

[9] Chen, J. K. C., Pham, Pham, V. K, Chang, C. S., and Nguyen, T. L. H. 2013, "Multiple criteria model for evaluation and selection of outsourcing service countries: A case study in the East and Southeast Asia" , *Proceeding in IEEE International Conference on Industrial Engineering and Engineering Management*, 2013.

[10] Spence, M. "Cost Reduction, Competition, and Industry Performance", 1984, *Econometrica*, vol. 52, no. 1, pp. 101-122.

[11] Wintera, M., Andersenb, E., Elvinc, R., and Levened, R. "Focusing on business projects as an area for future research: An exploratory discussion of four different perspectives", 2006, I*nternational Journal of Project Management*, vol. 24, no. 8, pp. 699–709.

[12] Lee, R., and Kim, D. "Implications of Service Processes Outsourcing on Firm Value", 2010, *Industrial Marketing Management*, vol. 39, no. 5, pp. 853-867.

[13] Lawrence, R. and Slaughter, M. "International Trade and American Wages in the 1980s: Giant

Sucking Sound or Small Hiccup? 1993, *Brookings Papers on Economic Activity*, no. 2, pp. 161

[14] Feenstra, A. and Gordon, H. "Globalization, Outsourcing, and Wage Inequality," 1996, *American Economic Review*, vol. LXXXVI, pp. 240-245.

[15] Maqbool-ur-Rahman, M. 2015, "Impacts of Globalization on Economic Growth-Evidence from Selected South Asian Countries", 2015, J*ournal of Management Sciences*, vol. 2, no. 1, pp. 185-204.

[16] Suleman, M. and Amin, T. 2015, "The Impact of Sectoral Foreign Direct Investment on Industrial Economic Growth of Pakistan", 2015, *Journal of Management Sciences*, vol. 2, no. 1, pp. 102-23.

[17] Nathan, T., Liew, V. and Wong, K. "Disaggregated Energy Consumption and Sectoral Outputs in Thailand: ARDL Bound Testing Approach", 2016, *Journal of Management Sciences*, vol. 3, no. 1, pp. 41-53.

[18] Venkatraman, N. "Offshoring without Guilt", 2004, *MIT Sloan Management Review*, vol. 45, no. 3, pp. 14 – 16.

[19] Frank, O., John, M., and Stephen, K. A. (2015). "Outsourcing strategies of mining industries: an empirical evidence from a developing nation", *International Journal of Supply Chain Management*, vol. 4, no. 4, pp. 90-101.

[20] Mahalik, D. and Satpathy, B. "Prioritization of Outsourcing in Hotel Industry: A Fuzzy AHP Multi Criteria Decision Making Approach", 2011, *South Asia Journal of Tourism and Heritage*, vol.4, no. 2, pp. 111-119.

[21] Liou, J. and Chuang, Y. "Developing A Hybrid Multi-Criteria Model For Selection of Outsourcing Providers", 2010, *Expert Systems with Applications*, vol. 37, no. 5, pp. 3755-376.

[22] Haji, H. and Biglary, F. "Identification of Risk Factors in IT Projects Outsourcing; A Survey in IT Companies Located in Tehran", 2013, *International Journal of Advanced Studies in Humanities and Social Science*, vol. 1, no. 10, pp. 1765-1775.

[23] Lee, H., Lee, H., and Kim, T. "Outsourcing Decision-Making Using Analytic Hierarchy Process: A Case Study of a Water Park", 2015, *International Information Institute* (Tokyo), Information, Nov, no. 18, pp. 11.

[24] Kotabe, M., Mol, M. and Murray, J. "Outsourcing, Performance, and the Role of E-commerce: A Dynamic Perspective", 2008, *Industrial Marketing Management*, vol. 37, no. 1, pp. 37-45.

[25] Wilding, R. and Juriado, R. "Customer Perceptions On Logistics Outsourcing In The European Consumer Goods Industry", 2004, *International Journal of Physical Distribution & Logistics Management*, vol. 34, no. 8, pp. 628-644.

[26] Mohanty, R. P., Sahoo, G, and Dasgupta J. (2012). "Identification of Risk Factors in Globally Outsourced Software Projects using Logistic Regression and ANN", *International Journal of Supply Chain Management*, vol. 1, no. 1, pp. 1-11.

[27] Belton, V. and Stewart, T. "Multiple Criteria Decision Analysis: An Integrated Approach", 2002, *Kluwer Academic Publishers*: Dordrecht, the Netherlands.

[28] Hwang C., and Yoo, K. "Multiple Attribute Decision Making: Methods and Applications", 1981, *Springer-Verlag*: New York.

[29] Triantaphyllou, E., Shu, B., Nieto, S. and Ray, T. "Multi- Criteria Decision Making: An Operations Research Approach", 1998, *Encyclopedia of Electrical and Electronics Engineering*, (J. G. Webster, Ed.), John Wiley & Sons, New York, 15, pp. 175-186.

[30] Saaty, T. "*The Analytic Hierarchy Process*". New York: McGraw-Hill, Inc. 1980.

[31] Noci, G. "Designing ''Green'' Vendor Rating Systems for the Assessment of A Suppliers Environmental Performance", 1997, European J*ournal of Purchasing and Supply Management*, vol. 3, no. 2, pp. 103–114.

[32] Yang, L. and Peng, J. "Comprehensive Evaluation for Selecting IS/IT Outsourcing Vendors Based on AHP", 2012, *Journal of Information & Computational Science*, vol. 9, no. 9, pp. 2515-2525.

[33] Xu, S. "Analytical Hierarchy Process Theory", *Tianjin University Press*, Tianjin, 1988