AN EMPIRICAL IDENTIFICATION OF VENDOR SELECTION PROCESS VIA DEPLOYMENT OF MULTIPLE ATTRIBUTE DECISION MAKING (MADM): COMPARISON AMONG SWEDISH AND IRANIAN COMPANIES

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ABSTRACT

Decision making is a fundamental tool for managers; enable them to make logical decisions in critical situation between various options. This article concentrates mainly on the seller selection problem, or in some cases it also refers to vendor or supplier selection problem (SSP) and demonstrates how multiple attribute decision making (MADM) methods can be effectively used for vendor selection decision in project management procurement processes and supply chain environment. A case study has been carried out within the two different countries (Sweden and Iran) in order to help managers to choose the best alternatives among their preferences, practically.

Keywords: MADM, AHP, decision making, supplier selection problem, seller selection problem, DM (Decision Maker).

1. Introduction

The article concentrates mainly on seller selection problem (SSP) and demonstrates how the multiple attribute decision making (MADM) methods can be effectively used for vendor selection decision in various situations of project management and supply chain environment. This article presents the results of study on two different companies in how different outputs could be extracted by using Analytic Hierarchy Process (AHP) (Saaty, 1980).

2. Literature Review

Decision making is a fundamental tool for managers, and helps them to make more logical decisions in critical situation between different options. Every key person in any project encounters situations on a daily basis where a decision will help resolving problems.

According to Harris (2008), "Decision making is study of identifying and choosing alternatives based on the values and preferences of the decision maker", or "Decision Making is the process of sufficiently reducing uncertainty and doubt about alternatives to allow a reasonable choice to be made from among them".

One of the most important activities in procurement management process is the process of choosing among potential sellers that is stated in PMBOK, chapter 12 (2000). The performance of the seller becomes a crucial factor in project success, or failure. Rational and effective decision making in supplier selection process help organization to optimize cost and quality functions. Smaller cost reductions gained from suitable vendor not only have a considerable impact on profit of project but also lead to higher customer satisfaction that could also end up to competitive advantages for the organization. At this process, decision maker (DM) faces with multi-criteria problem which comprises both qualitative (intangible) and quantitative (tangible) factors. The nature of supplier selection processes usually is complex especially when company deals with a large variety of products and vendors.

Over the years, several solutions and methods have been emerged to address seller selection problem (SSP). Experience and studies proves that, there is no best way exist to evaluate and select supplier process and it is varied from organization to organization.

We must remember that in vendor evaluation and selection decisions, there are two things that are very important. The first one is what attributes should be used, and the second, what techniques can be used for comparing suppliers.

In purchasing function as a part of procurement process, we need to deal with many various sellers. The first step is to identify criteria in order to evaluate and rank the sellers. Naturally enough, there are several advantages behind the selection of an appropriate seller. For instance, reducing purchase risk, maximize overall value to the purchaser, decreasing project delay (on-time delivery), improving customer satisfaction, reduction of cost, and developing strategic alliance between supplier and purchaser which ultimately lead to competitive advantages. Dickson (1966) listed 23 attribute for suppliers' selection, based on a questionnaire of 273 purchasing which sent to agent and manager in the United States and Canada. As it can be seen from the table 1, there are various factors that influence vendor selection in a supply chain environment for example: performance of the supplier, technical capability, financial status, quality system of the supplier, geographical location, reputation, price and cost and so on.

The top fifteen criteria are ranked and presented at the following table1.

Table : Dickson's vendor selection criteria, Source: Dickson (1966)

Rank	Factor	Mean Rating
1	Quality	3.508
2	Delivery	3.417
3	History	2.998
4	Warranties and claim policies	2.849
5	Production facilities and capacity	2.775
6	Price	2.758
7	Technical capability	2.545
8	Financial position	2.514
9	Procedure compliance	2.488
10	Communication system	2.426
11	Reputation and position in industry	2.412
12	Desire of business	2.256
13	Management & organization	2,216
14	Operating controls	2,211
15	Repair service	2,187

An extensive review conducted by Bruno *et al.* shows a historical series of papers published about SSP based on the numbers and various countries contribution from 2003 to 2008. Table 2 represents the paper published in 68 scientific journals with the total number of 201 articles.

Table : Historical series of paper released about the SSP

Year	2003	2004	2005	2006	2007	2008	Total
Papers	21	13	18	37	47	65	201

Table 3 illustrates the number of papers published within different countries during 2003-2008.

Table 3: Number of papers published within different countries during 2003-2008.

Country	USA	Taiwan	Turkey	China	India	Total
No. papers	41	36	21	19	15	
	Iran	UK	Italy	Germany	Others	**201**
	14	8	8	6	33	

3. Hypotheses/Objectives

In order to achieve the goals of study we considered designing and developing a questionnaire in a form of a matrix based on the Dickson's criteria and some new modified ones as mentioned in Table 1. Five experienced project managers from three different companies have been selected as responsible to fill out the matrix. The matrix consists of seven main criteria as first level and they are also broken down into two sub-levels. Each sub-level could be divided into sub-criteria as well. After final developing

we submitted the questionnaire to the interviewees via email. After three weeks, data were collected and practically the process of analysis started.

4. Research Design/Methodology

This paper is an explanatory study helping from quantitative and qualitative methods that include three different knowledge purposes: explorative, diagnostic, and normative. Collected empirical data and analyses methods are used to find the problems and solutions. Expert knowledge and historical experiences are highly appreciated in this study as well. Graphical tools and histograms are vastly used to get an illustrated figure of problems in order to find concrete solutions especially in a visual point of view.

The case study approach is deployed for getting practical result. The data used in this thesis are generally collected through a developed questionnaire distributed to five project managers in Swedish and Iranian Companies and submitted by.

5. Data/Model Analysis

Decision maker (DM) requires considering several criteria. The following table addresses vendor selection criteria in manufacturing and retail area which is extracted from different written reviews and articles. This paper investigates the type of criteria, rank, and rating based on the Dickson's study as shown at the following Table 4.

Table 4: Selection of criteria and subcriteria

No.	Criteria (Level 1)	Level 2	Level 3
1	**Performance of the supplier**	Shipment Quality	o Rejection in incoming quality control o Rejection in the production line o Rejection from final customer o Sorting effort
		Delivery performance	o Compliance with the quality o Compliance due to date- lead time o Compliance with the packaging standard
		Service and communication	o Repair service o Reverse logistics o Availability and ease of contact o Communication system o Processing EDI (Electronic Data Interchange) o Training aids o Response to change- Quick response o R & D o Proactive
2	**Technical capability**	Technical cooperation	o Response to quality problem o Design / development capability o Level of cooperation and information sharing
		Employee profile	o Organizational structure o Number of employees (company size)

			○ Number of technical staff ○ Education
		Equipment	○ Response to quality problem ○ Design / development capability ○ Level of cooperation and inform
		Manufacturing	○ Production planning system ○ Lead time ○ Plant layout and material handling ○ Transportation, Storage ○ Safety ○ Environmental friendly ○ Production line flexibility
		Organization culture	○ Long term relationship ○ Reliability and trust ○ Management capability ○ Culture ○ Attitude
3	**Financial status**	Total revenue Profitability Credit rating Assets, capital and infrastructure Stability	
4	**Supplier quality system**	Management commitment	○ Quality assurance system ○ Internal audit ○ Continues quality improvement ○ Registered to ISO
		Process improvement	○ Quality techniques in process improvement ○ Process improvement
		Quality assurance in production	○ Rework ○ Statistical application ○ Application of advanced quality techniques ○ Corrective action response ○ Customer reference
		Inspection and experimentation	○ In process inspection and reliability test ○ Final process inspection and reliability tests ○ Product audits ○ Measuring and testing equipment ○ Calibration activities
		Quality staff	○ Number of quality staff ○ Education of quality staff
5	**Geographical location**	Local Global	
6	**Reputation**	History Current position in the	

		market Partner	
7	**Price and cost**	Discount Transportation cost Terms of payments Cost of reduction assistant Ordering cost	

6. Limitations

In order to cope with the order allocation problem, the combination between AHP and optimization methods such as Integer Programming and Multi-Objective Programming is suitable way to utilize. Sellers are ranked using AHP preferences; later, since seller is enable to provide the buyer with needed quantities, the optimization approach estimates quantity of purchasing from each chosen seller providing of maximum given target function.

7. Conclusions

Here below, in Tables 5, is a summary of results and a comparison of Sweden, Iran, Dickson' evaluations.

Table 5: Comparison of Sweden, Iran, Dickson' evaluations

Criteria	Swedish' Evaluation	Iran' Evaluation	Dickson' Evaluation
Performance of the Supplier	Top Priority	Extreme Importance	Extreme Importance
Geographical Location	Average Importance	Top Priority	Average Importance
Reputation	Considerable Importance	Considerable Importance	Considerable Importance
Financial Status	Average Importance	Extreme Importance	Considerable Importance
price & Cost	Considerable Importance	Average Importance	Considerable Importance
Technical Capability	Extreme Importance	Average Importance	Considerable Importance
Quality System of Supplier	Slight Importance	Slight Importance	NA

8. Key References

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