

Vendor Assessment Method: A Review

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Abstract— The paper presents vendor assessment methods in organizations. In competitive situations, vendor assessment is very important for the success of any organization. Essentially, the assessment used for ranking systems and recording vendor performance should cater to a variety of issues. Yet there is no specific method in place to measure and rate the vendor in projects. In this paper, a few methods used to evaluate vendors will be further discussed.

Keyword: Vendor Assessment Methods, Data Envelopment Analysis (DEA), Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP).

1. INTRODUCTION

Vendor assessment is the priority issue in operations management. Vendor assessment methods show the best method to be used in specific projects. The selected method will determine the success of the projects to be implemented. In this era of globalization, the choice of vendor organizations is constantly changing and thus requires various assessment methods. The researchers offer a variety of methods to support vendor assessment for making the right decision. Nowadays, vendor assessment represents the importance of functions in the organization. The methods have been previously developed to deal with vendor evaluation.

The main objective of vendor assessment method is to reduce the risk and the maximize value to the purchaser¹. Generally, the vendor assessment method is a complicated and complex process, particularly the process of implementing a ranking for each vendor to be selected. The process involves a large number of unstructured tender documents in many different formats such as texts, diagrams, forms and tables.

Such unstructured assessment documents are difficult to interpret by decision makers and may cause conflict in information sharing and the loss of information. There are various types of tenders associated with tender information technology. For

example, website development, software development and systems, the supply of computer hardware and so on. Decision makers are often likely to produce results based on subjective judgements depending on their experience. Accordingly, the use of a specific method is needed to ensure the successful implementation of projects and to enable the right decisions in vendor assessment to be made.

2. VENDOR ASSESSMENT METHODS

There are few methods that can be used in vendor assessment. Basically, the purpose in vendor assessment is to reduce purchase risks and maximize overall value to the buyer. The organization needs to choose vendors for long-term business durations. According to the approaches of vendor assessment, this process may require alternative commitments such as timing and travelling costs. Below are the steps involved in vendor assessment².

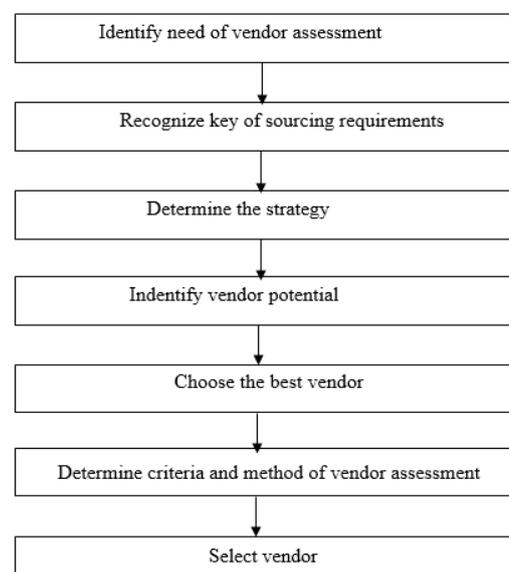


Fig.1. Vendor Assessment Process²

2.1 Analytic Hierarchy Process (AHP)

The purpose of the method is to define the effectiveness of the AHP approach to be used in vendor assessment to ensure accuracy in decision-making. The AHP is the decision support tool to resolve complex decision problems³. AHP allows the structuring of the problem using the hierarchy concept for making the right decisions. The AHP method can be used when the selected criteria have been found and ranking needs to be conducted to facilitate the decision-making process. Sometimes, the AHP method also can be used to rank judgments concerning the best criteria to be used for specific situations. Additionally, the AHP is highly suitable for vendor assessment and evaluation.

The AHP method can help to resolve complex decisions which involve a variety of purposes and in identifying what organizations need and want. The AHP was selected as a vendor assessment method for the following reasons.

- The AHP allows decision makers to priorities the best vendor⁴.
- The AHP can produce remarkable versatility and analyzing multiple issue for decision-making⁵.
- The AHP is compatibility within the additional to the hierarchy⁵.

An excellent review of the AHP method as follow.

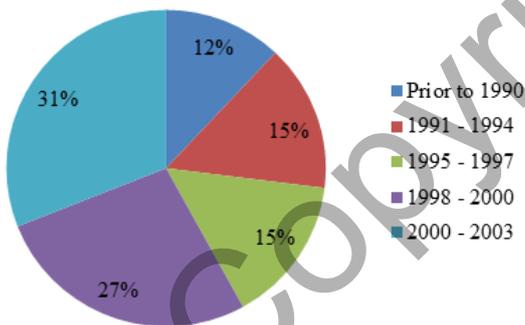


Fig.2. Review papers use of AHP method for few years¹¹

The AHP is uses throughout the world to make decisions in a variety of sectors such as medicine, education, business, industry, forecasting, planning and banking platform. This method as the most applied method in vendor assessment. Other researchers have also provided support that the AHP easily resolved vendor assessment, especially for group decision-making.

2.2 Data Envelopment Analysis (DEA)

DEA was developed to evaluate the relative

efficiencies of decision-making units (DMUs)⁶. For example, this method is suited to the banking sector, hospitals and research projects using input and output factors. Input factors are the resources used to create outputs while output captures the things generated from decision-making. This method is developed from the decisions made. Results are evaluated on the input and output in the vendor evaluation process. For example, provider A has demonstrated achievements in the use of costs and maximizes efficiency in the evaluation of providers without a rating from any other vendor. This method can help organizations make decisions in classifying more than one vendor.

These method uses to evaluate of vendors and can maximizes vendor efficiency rating without making the vendor ranking⁷. This method has consider as the best method for making decisions in the evaluation of vendors.

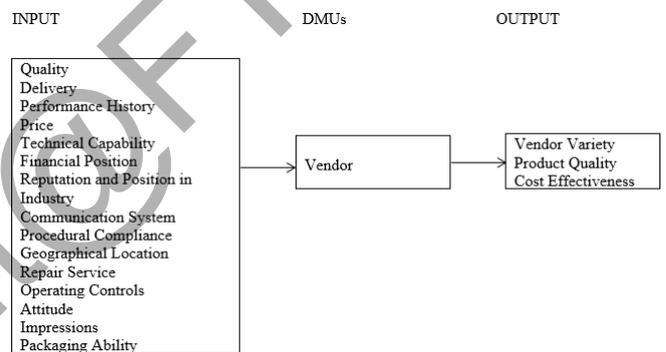


Fig.3. DEA Model Vendor Assessment⁹

This proposed model considers a variety of inputs and outputs. DEA focuses more on the calculation of operations efficiency whereas the vendors are to be considered once they have relative efficiency and produce output factors that are not produced by other vendors with similar inputs. DEA is also used to compare DMUs such as banking, individuals and sales outlets which use one or more input/outputs to measure relative efficiency. In this method, inputs are considered to influence products by the chosen output element. The relative efficiency will produce benchmarking of data to reduce the number of vendors.

2.3 Analytic Network Process (ANP)

The ANP was developed as a sub-topic to the AHP method. The ANP method is to be used for more extreme problems and decisions compared to the AHP. For those projects that involve dependence and interaction between the higher and lower levels, the decisions are unable to be built hierarchically. The ANP

is the one method that enables decision-making without any assumptions about the high and low level elements. Without the ranking or hierarchy, the ANP can still resolve the problem using the network. Essentially, ANP produce the framework with the decision-making without making the assumptions of independence level¹⁴. Software's like Excel, Ecnnet and Maple can be used as an application in ANP.

3. ADVANTAGES, DISADVANTAGES AND LIMITATIONS

3.1 The Analytic Hierarchy Process (AHP)

This method is very flexible and stable for system ranking and to identify the best vendor. Besides, the AHP is more specifically for hierarchy evaluation, prioritizing changes at the high level and prioritizing criteria at the lower level. This method enabled the ranking of vendors based on the decisions made in vendor assessment. The benefits include the use of hierarchy in order to assess vendor performance. The AHP provides a versatile environment in structuring and is capable of resolving complex issues in a multi criteria situation. At the same time, the AHP helps in group communication which comprises the questionnaire to compare the elements¹¹. To get more accurate vendor assessment, the two methods to be combined are AHP and Linear Programming (LP). This shows that the AHP can be integrated with any method to resolve the problem. For example, there is a combination of tangible and intangible elements such as the quantitative and qualitative. The output from this combination, the total of value purchasing (TVP) will increase due to optimum order quantity. Nevertheless, with this combination, the method can apply in vendor assessment without any constraints. The AHP method can handle extreme problems for vendor ranking, is also user friendly to evaluate vendor. This method will facilitate fast decision-making for managers in the organization.

Despite these advantages, there are a few disadvantages of using the AHP method. Sometimes, the AHP method will not consider the risks of vendor performance⁵. This will adversely affect vendor assessment. In certain processes, once some criteria are to be added in the AHP method, the whole process requires to be repeated. However, the AHP method makes the implementation inconvenient in terms of complexity element. The complexity cannot accept more than one person to work on this element. The AHP also requires the experience of those involved, based on knowledge provided for decision makers. Sometimes, the AHP method is not capable to resolve multi-persons

and multi-period problems.

3.2 Data Envelopment Analysis (DEA)

Any organization can increase their business when using DEA model as it can potentially improve operations. DEA can be uses as a tool for benchmarking and also in change management. In terms of multiple project, DEA is the best solution to handle multiple inputs and outputs and also capable of measuring input and output. Somehow, the lack of sources could be analyzed and could be quantified for each unit. This method does not require any assumptions for inputs and outputs related to the functions of vendor assessment. DMUs become efficiency comparing combination of peers.

Some advantages of DEA require ongoing research to make it stable and capable of producing the best results in vendor assessment. The DEA method creates a separate linear program and this will create problems for each DMU because the DEA has a standard formula.

3.3 Analytic Network Process (ANP)

The ANP method can be used by organizations which have various criteria and interactions. This method is suited to handling qualitative and quantitative criteria and produces accurate results. It provides a feedback mechanism in decision-making. The ANP method is capable of resolving problems that are not shown in a hierarchy and can be integrated with other methods to make it efficient and for facilitating fast decision-making in vendor assessment. For example, integrating the ANP with multi-objective programming to resolve problems in selecting the best vendor and to identify potential vendor performance. This integrated method can be applied in vendor assessment.

The limitations of this method is that it requires more effort, specifically in making more comparisons, as compared to the AHP. Sometimes, complex decisions require more complex methods to resolve the problem, thus increasing processing time and costs. Additionally, the combination of ANP with other methods can be conflicting and unsynchronized to select the best vendor. This happens as the vendor assessment process is ongoing and cannot be concurrent.

4. CATEGORICAL METHODS

In global industries, vendor assessment becomes important in evaluating organization performance and at the same time, it supports the methods used. The

researchers introduced the methods that can be used in multiple industries around the world. This approaches were having strong capability itself to resolve the vendor assessment. The table 1 below are illustrating the methods used in this paper.

Table 1. Categorical of Method

Author	Method	Description
Thomas L. Saaty, 1980	Analytic Hierarchy Process (AHP)	To resolve problem using hierarchy concept
Thomas L. Saaty, 1996	Analytic Network Process (ANP)	To resolve issue more complex than AHP
Charnes et al., (1978)	Data Envelopment Analysis (DEA)	To evaluate the efficiencies relative to decision-making units (DMUs)

5. CHALLENGES IN METHOD SELECTION

In 1997, World Bank should finance the reform of public procurement since the Public Procurement System has been experiencing problems with fraud and corruption. Consequently, part of the reform process was the establishment of the Public Procurement Oversight Board established under the Public Procurement and Disposal Act which has been in operation since July 1, 2007¹⁰. Its main function is to reducing of corruption in public procurement, ensure justice, improve integrity and enhance the efficiency of public procurement.

Public institutions spend up to 70% of expenses for purchased goods and services¹⁰. In developing countries, the procurement function is important in the delivery of services and the largest component of expenses. In order to achieve this, the acquisition carried out various measures ranging from supplier selection, supplier evaluation, selection and evaluation criteria for the establishment and training of staff to improve earnings.

6. IMPORTANCE OF METHOD

The significance of this study is to help policy-makers delegate explicit knowledge for obtaining useful information hidden within text documents. This is necessary so that the analyses can be implemented in a transparent and fair manner. The developed model acts as a detailed guide for decision makers to facilitate the vendor selection process. In addition, the use of this framework can help the process of obtaining information by identifying potential vendor information for use in decision analysis.

Next, the vendor evaluation system is made

transparent, fair, open, efficient and effective. This is essential to ensure the competitiveness and sustainability of economic growth and stability. Accordingly, the government has taken steps to automate business processes, especially those involving the procurement process by applying the electronic procurement system, one of which is the supplier evaluation system. In Malaysia, the Government Transformation Program (GTP) launched in 2010, focuses on the National Key Result Areas (NKRA) to prevent corruption.

These efforts demonstrate the government's determination to ensure accountability, integrity and transparency in the selection of vendors, as illustrated by MyProcurement. It addresses one of the major issues in the management of the National Tenders, particularly the activities related to decision-making in the evaluation of vendors.

7. CONCLUSION

It is hoped that new researchers would be able to enhance and extend the existing methods to be more efficient and reliable in resolving problems in vendor selection and assessment. The discussed methods illustrate their capacity for decision-making in determining and performing assessment for vendor selection. All the methods are deemed suitable for organizational decision-making.

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1. Akshay A. Patil, Madhav B. Kumthekar, Amarsinh B. Landage. 2016. A review of supplier evaluation and selection approaches in supply chain of construction industry. *International Journal of Engineering Research* 5(1): 120–122.
2. A. John Rajan. 2007. Decision-making models with composite scales for customer integrated vendor evaluation. Dr. Phi. Dissertation, Faculty of Mechanical Engineering, Anna University.
3. Evangelos Triantaphyllou and Stuart H. Mann. 1995. Using the analytic hierarchy process for decision-making in engineering applications: Some Challenges. *Inter'l Journal of Industrial Engineering: Applications and Practice*, Vol. 2, No. 1, Pp. 35-44.
4. Saaty, T. 1980. *The Analytic Hierarchy Process (AHP)*. N. Y. McGraw-Hill.
5. Farzad Tahriri, Mohammad Rasid Osman, Aidy Ali and Rosnah Mohd Yusuff. 2008. A review of supplier selection methods in manufacturing industries. *Suranaree J. Sci. Technol.* 15(3): 201-208.

6. Milan M. Martić, Marina S. Novaković and Alenka Baggia. 2009. Data envelopment analysis-basic models and their utilization. DOI: 10.2478/v10051-009-0001-6. Number 2.
7. Luitzen de Boer, Eva Labro and Pierangela and Morlacchi. 2001. A review of methods supporting supplier selection. *European Journal of Purchasing and Supply Management* 7: 75-89.
8. Amit Kumar Gupta, OP Singh and RK Garg. 2015. Analytic network process (ANP): An approach for supplier selection in an automobile organization. *European Journal of Advances in Engineering and Technology* 2(9): 83–89.
9. Ozden Bayazit. 2006. Use of analytic network process in vendor selection decisions. Benchmarking: *An International Journal*. Vol. 13 Iss 5 pp. 566 – 579.
10. Makabira, D.K., and Waiganjo, E. 2014. Role of procurement practices on the performance of corporate organizations in Kenya: A case study of Kenya national police service. *International Journal of Academic Research in Business and Social Sciences* 4(10): 369-384.
11. Omkarprasad S. Vaidya and Sushil Kumar. 2006. Analytic hierarchy process: An overview of applications. *European Journal of Operational Research* 169: 1–29.
12. Manjari Sahai, Prince Agarwal, Vaibhav Mishra, Monark Bag and Vrijendra Singh. 2014. Supplier selection through application of DEA. *I.J. Engineering and Manufacturing* 1: 1-9.
13. https://en.wikipedia.org/wiki/Supplier_evaluation.
14. Cevriye Gencer and Didem Gu'rpinar. 2006. Analytic network process in supplier selection: A case study in an electronic firm. *Applied Mathematical Modelling* 31 (2007) 2475–2486.
15. A. S. da Silva, L. P. Nascimento, J. R. Ribeiro, M. C. N. Belderrain. 2009. ANP and ratings model applied to supplier selection problem. *Proceedings of the International Symposium on the Analytic Hierarchy Process*.
16. Ajitabh Pateriya and Devendra Singh Verma. 2013. Supplier selection methods for small scale manufacturing industry: A review. *International Journal of Science and Research (IJSR)* 2(4): 319-322.
17. Akshay A. Patil, Madhav B. Kumthekar, Amarsinh B. Landage. 2016. A review of supplier evaluation and selection approaches in supply chain of construction industry. *International Journal of Engineering Research* 5(1): 120–122.
18. Cevriye Gencer and Didem Gu'rpinar. 2007. Analytic network process in supplier selection: A case study in an electronic firm. *Applied Mathematical Modelling* 31 (2007) 2475–2486.
19. K. Balakannan, Dr. S. Nallusamy and Gautam Majumdar. 2016. Hybrid DEA decision model for supplier evaluation and selection. *Int. Res. Jou. Mech. Mechatronics. & Auto. Engg.* 1(1): 39–47.
20. Kamlesh Nanaji and Prof. Emeritus M. R. Apte. 2015. Supplier selection process in the construction material purchasing function. *International Journal of Engineering Sciences & Research Technology* 4(6): 675–680.
21. Krishnendu Mukherjee. 2014. Supplier selection criteria and methods: Past, present and future. *International Journal of Operations Research* 1–24–in press.
22. Kurian John, Vinod Yeldho Baby, Georgekutty S.Mangalathu. 2013. vendor evaluation and rating using analytical hierarchy process. *International Journal of Engineering Science and Innovative Technology (IJESIT)* 2(3): 447–455.
23. Laura Vírveda Gallego. 2011. Review of existing methods, models and tools for supplier evaluation. Master Dissertation, Department of Management and Engineering, Linköping University.
24. Om Pal, Amit Kumar Gupta, R. K. Garg. 2013. Supplier selection criteria and methods in supply chains: A review. *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, 7(10).
25. Tak K. Mak and Fassil Nebebe. 2016. Factor analysis and methods of supplier selection. *Int. J. Sup. Chain. Management* 5(1): 1–9.
26. Temesgen Garoma and Shimels Diriba. 2014. Modeling and analysis of supplier selection method using analytical hierarchy process (AHP). *Science, Technology and Arts Research Journal* 3(1): 145–150.