

A SUPPLIER SELECTION MODEL FOR SOFTWARE DEVELOPMENT OUTSOURCING

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This paper presents a multi-criteria decision making model used for supplier selection for software development outsourcing on e-marketplaces. This model can be used in auctions. The supplier selection process becomes complex and difficult on last twenty years since the Internet plays an important role in business management. Companies have to concentrate their efforts on their core activities and the others activities should be realized by outsourcing. They can achieve significant cost reduction by using e-marketplaces in their purchase process and by using decision support systems on supplier selection. In the literature were proposed many approaches for supplier evaluation and selection process. The performance of potential suppliers is evaluated using multi criteria decision making methods rather than considering a single factor cost.

Keywords: Supplier evaluation, Supplier selection, Multi-criteria decision making, E-marketplace, Software development outsourcing

JEL: P13, L81

1. Introduction

Today, outsourcing is considered a competitive strategy to improve the competitiveness of an organization. There are many barriers which can affect the success of a software development outsourcing. Some research suggests that most outsourced development projects do not succeed. The primary cause is the lack of customer preparation about the selection criteria and other important factors which have to take into account in the supplier selection process.

Identifying, gathering, and analyzing the appropriate information to aide in the selection of a qualified supplier is essential in properly preparing to outsource, and critical to outsourcing success. With appropriate supplier selection the company can achieve significant cost reduction and can increase its productivity. The potential benefits that come from outsourcing create a new demand and a successful market that have 10.000 suppliers in 175 countries. Many organizations have failed on her outsourcing action because of improper preparation and consideration. A study showed that 45% of the companies engaged into an outsourcing project would classify their project as a success.

In this paper we review some important aspects of supplier selection from the literature than we will propose a conceptual model for supplier selection on software development outsourcing which can be used on e-marketplace.

2. Literature review

Supplier evaluation and selection problem has been studied extensively. We can mention three important literature reviews – Weber at al. (1991), L. De Boer at al. (2001), W. Ho at al. (2010) – in which the authors present the main criteria's and methods utilized in supplier evaluation and selection. Weber (1991) based its review on Dickson 23 supplier evaluation criteria. Dickson (1966) concludes that the major supplier selection criteria proposed in the most researches are quality delivery, net price, geographical location, production facilities and capacity. W. Ho (2010) analyzed papers from 2000-2008 periods and found that nowadays in the literature numerous individual and integrated approaches were proposed to solve the supplier selection problem. They are capable to handle multiple quantitative and qualitative factors. They find that the most important individual approach is DEA and the most popular integrated approach is AHP-GP. H. Shyr and H. Shih (2006) present an effective model for supplier selection using ANP and modified TOPSIS techniques. They observe also that most popular

criterion used for evaluating the performance of suppliers is quality, followed by delivery, price or cost, and so on.

Degraeve et al. (2000) analyses the supplier selection models proposed in the literature from a total cost of ownership perspective. He concluded that all mathematical programming models perform better than the rating models because they approach the problem in a more objective way by optimizing an explicitly stated objective function.

Several studies have been conducted on the process of outsourcing dealing with different aspects of this matter. Smith et al. (1996) have presented a framework that addresses issues that arise in the context of the offshore outsourcing of software development. The proposed framework links projects and sites, including environmental aspects. Krause et al. (1998) have developed a process model for supplier development based on an exploratory study.

Regarding the supplier selection on outsourcing problem little research has been found in the literature. Almeida (2001) has studied the maintenance contract selection problem based on a multicriteria model, which uses contributions from multiattribute utility theory (MAUT). Dulmin and Mininno (2003) have presented a multicriteria decision aid method, to approach a suppliers selection model, which is applied in the context of the rail transportation. Valluri and Croson (2005) have studied the performance of a supplier selection model, which displays a reward and punishment profile under incomplete information. Their study is based on outsourcing of tangible products and is not adequate for service outsourcing.

3. Supplier selection criteria for software development outsourcing

The process of e-procurement using an e-marketplace can be illustrated with the following figure.

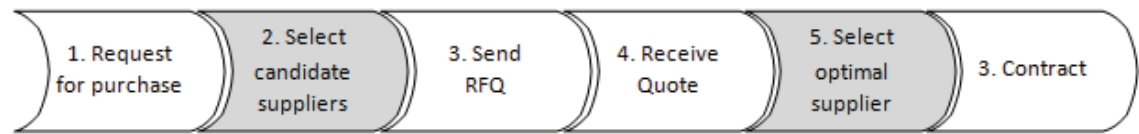
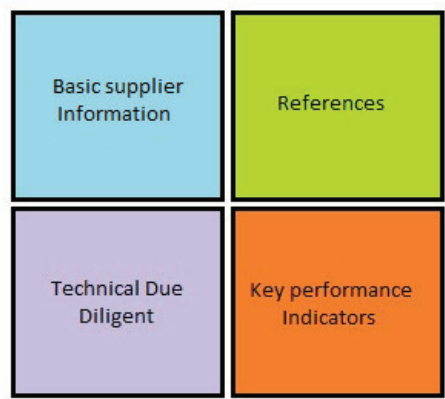


Figure 1. E-procurement process

The supplier selection process starts with potential supplier selection. In this first step the client company has to isolate a handful of potential suppliers from a field of thousands. There is necessary an assistant tool which help the client in what information to look for, how to get the information, how to assess the information to locate those suppliers that best suited for the task. The information need to be evaluated by the client can be group in 4 categories.

3.1. Basic vendor information



The basic supplier information group is necessary for having an elementary insight about de supplier background and capabilities. A list of basic information is presented in Table 1.

Figure 2: Vendor selection information grouping

Basic Supplier information	
Location	Country and city of suppliers
Year founded	Year when the supplier start its activities.
Number of Technical Resources	Number of development, testing and management resources that supplier employs.
Average rate	Average hourly/monthly rate of a developer, tester, and project manager.
Technical Capabilities	Technical skill set (development languages, databases)
Applications Previously Developed	Types of applications developed for their clients (document management, business intelligence, etc.)
Major Clients	Most important clients
List of Certifications	CMM, ISO, etc.

Table 1: Basic information about the supplier

3.2. References

The reference information is almost always positive; otherwise the supplier wouldn't provide the reference. This reference information represents the best objective information that the supplier can provide. By measuring the degree of praise offered by de reference can give some inspection to the general capabilities of the potential supplier. Basing the buying decision on only this information would be a mistake. What works for one organization may not work for another. This is why different business models, experiences, and available resources of each organization interested in outsourcing will play a major role in the execution of the outsourcing initiative.

3.3. Technical Due diligence

This group of information involves a detailed discussion with some of the supplier's technical resources. Topic of discussion should include: Development process, development tools, project management, and technical skills/certification. The technical resources provided by the vendor to answer a potential client's due diligent questions are the best resources that a supplier has to offer. The information gained during due diligent may be not shows clearly the actual technical expertise that you can expect on your project. Technical due diligent indicates generally the supplier capabilities.

3.4. Performance indicators

The performance indicators are the best information based on the client can select a well qualified software development outsourcing supplier. This information offer de specific and objective insight about the performance of potential supplier. The key performance indicators group contains the most important information on the supplier selection process. Until recently this type of information was impossible to be collected. But this thing was changed and there are new way to gather this type of information.

Key performance indicators	
On-Time Delivery	Indication of the supplier's ability to deliver the specified work on schedule. Calculated via client feedback.
On-Budget	Indication of the supplier's ability to deliver the specified work within budget. Calculated via client feedback.
Quality	An acceptable level of quality can differ from client to client. This KPI provides an indication of the supplier's ability to deliver on an agreed upon level of quality. This measurement is calculated via a combination of client feedback.
Productivity	An indication of the supplier's speed, responsiveness, and related effectiveness. Calculated via client feedback
Client Satisfaction	The level of satisfaction with the supplier. Calculated via client satisfaction surveys.
Ability to Manage Change	Most projects have some element of change that is required as the project progresses. This is an indication of the supplier's ability to plan, prepare, and respond to the inevitable change requests. Calculated via client feedback.

Table 2: Key performance indicators

4. Supplier selection model on the e-marketplace

The supplier selection model in software development outsourcing utilizes the six criteria described in Table 2: on-time delivery, on-budget, quality, productivity, client satisfaction, ability to manage changes. As a supplier evaluation method we will use the Multi Attribute Utility Theory (MAUT). “MAUT allows the decision-maker to quantify and aggregate multiple objectives even when these objectives are composed of conflicting attributes. The decision-makers preferences are modeled in order to obtain a multi attribute utility function, for instance $U(c_i, t_i, d_i)$. This function aggregates utility functions for all criteria or attributes. That is an analytical function is obtained which combines all criteria through a synthesis function. Each particular analytical form for this function has preferential independence conditions to be evaluated, in order to guarantee that the decision maker’s preferences are associated to the basic axioms of the theory” Teixeira, (2007). According to this MAUT the utility of a supplier can be calculated with the formula:

$$U(s) = \sum w_i f_i(x_i)$$

$U(s)$: supplier utility

x_i : criteria(attribute)

w_i : importance of attribute x_i represented by a numeric value

f_i : utility function applied to attribute x_i

On the marketplace clients when registries sign a contract agreement and take the obligation that they will give feedback about every selected and contracted supplier. The feedback is to rate in a 1(very dissatisfied) to 4 (very satisfied) scale of the supplier’s performance. The evaluation of each supplier will be calculated as the average of the individual evaluations gave by the clients.

For the utility function we will use the linear function having the formula $u=ax+b$.

The weights are given by the client depending which is the most important selection criteria in its case. The weights are introduced by a specific form on the e-marketplace interface. The suppliers will be ranked according to their calculated utility from the bigger utility value to the smallest.

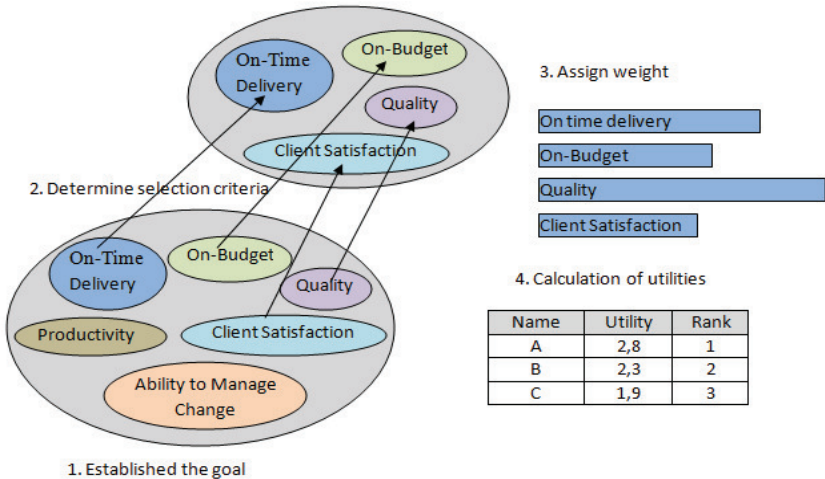


Figure 3: Supplier selection process model

4.1. Example of the utilization of the supplier evaluation model:

- 1. Establish the goal:** A typography company wants to outsource the development of software for supporting different form types used in business as invoice, delivery note, bill, etc. The company makes a search on the e-marketplace based on basic supplier information presented in Table 1. Based on the basic supplier information and references the company chose the potential suppliers.
- 2. Criteria selection:** The client company considers that for his case on-time delivery, on-budget, quality, productivity and client satisfaction are the key factors.

3. Assign weight: On-Time Delivery – 20%, On-Budget -20%, Quality – 30%, Productivity – 15%, Client Satisfaction – 15%.

4. Calculation of utilities: Supplier A – $U(s)=2,81$. (Table 3)

5. Ranking the suppliers bases on the utility value

In this example the supplier selection model for software development outsourcing indicate supplier B having the biggest utility value (3.54, bigger than A's utility – 2.8, D's utility – 2.2 and C's utility – 1.98).

Critereia/Clients evaluation	Client ₁	Client ₂	Client ₃	Client ₄	Eval/Criteria	Weight
On-Time Delivery	2	3	4	3	3	20,00%
On-Budget	4	3	4	4	3,75	20,00%
Quality	2	1	3	2	2	30,00%
Productivity	3	4	2	3	3	15,00%
Client Satisfaction	2	3	3	3	2,75	15,00%
Ability to Manage Change	1	2	3	4	2,5	
U(s): Supplier A	2,81					100,00%

Table 3: Calculation of Supplier A utility value

5. Conclusions and future work

In this article we have presented a model of supplier evaluation and selection for software development outsourcing in e-marketplace. We have detailed the information group that are necessary to take proper supplier selection decision. We presented also the supplier evaluation criteria specifically for software development outsourcing. We proposed a supplier evaluation method based MAUT theory. Finally we presented an example of using the proposed model.

As future work we propose to evaluate the possibility of using alternative methods and criteria for supplier selection. For example we can use the ELECTRE method for supplier evaluation in our model. We can include other supplier selection criteria like: performance history, warranties and claim policies. The evaluation and complaints received from clients in supplier evaluation enhance the collaborative nature of supplier selection model for e-marketplace presented.

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