

# **Fuzzy COPRAS Methodology for Project Provider Selection in Turkish Banking Sector**

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## **Abstract**

Business technology, product development, sales, human resources, and accounting construct the basis of the organizations while working together. Companies make use of project management to improve each of these components and to survive in competitive markets. Project management provides efficiency to the organizations for achieving organizational goals. Project management processes in whole company necessitate big effort, time, and money, yet also they become crucial in order to manage all the processes effectively, which may be quite difficult for organizations. Hence, outsourcing is an alternative manner to manage the projects in an efficient way while being able to focus on the core competencies. To that end, project provider selection is a significant managerial decision problem, which should be constructed as a multiple criteria decision making problem because of the presence of conflicting criteria. This work aims to determine the most suitable agile project provider alternative by employing fuzzy COPRAS, which identifies a solution relative to the ideal solution. The case study is conducted in Turkish banking sector for an IT project to be outsourced to a third party provider.

**Keywords:** Project Management, Provider Selection, Outsourcing, Fuzzy Decision Making, Fuzzy COPRAS

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## 1. Introduction

The marketplace has become more and more globalized, therefore firms require conducting their operations keeping up with changings in the market. Firms should obtain competitive advantages by considering performance measures such as flexibility, responsiveness, price, and quality. These objectives can be achieved by disintegrating organizational operations in order to focus on their core competencies (Gunasekaran et al. 2015).

Outsourcing, a term being utilized when a firm tends to disintegrate activities, is the practice of collaborating with a vendor instead of in-house personnel to carry out a job (Tsai et al. 2010; Liu et al. 2008). Outsourcing is an operational strategy that affects the performance of a value chain and a strategic component of operations management. Outsourcing helps reduce costs of assets, production costs, managerial and overhead costs and provide flexibility. Furthermore, clients can straightforwardly focus on their core competencies by outsourcing their peripheral activities (Gunasekaran et al. 2015).

Several organizations are not likely to outsource their activities because of the implementation issues, the risk of opportunistic behavior of the outsourcing provider, rising coordination and procurement costs and inadequate innovation. For maintaining competitiveness, outsourcing has to improve cost, production effectiveness and quality in the value chain systems. The requirement of benefitting from outsourcing opportunities obligates organizations to evaluate their efficiency. An efficiency analysis of outsourcing possibilities should reveal the evaluation strategies of providers. Potential service providers have to be evaluated and selected with a priori assessment process.

The objective of this study is to identify the most appropriate agile project provider in Turkish banking industry using fuzzy COPRAS methodology, which is applicable when data are imprecise and determines a solution relative to the ideal solution. In 2001, agile project management methodologies came forward in order to deal with the failures of traditional project management methodologies. Agile project management has been emerged from unpredictability of customer requirements, technology evolution, and unstable business environments (Lei et al. 2017). It was announced to eliminate the problems of traditional project management methodologies. In agile project management, processes are planned and managed iteratively.

Organizations which use agile methodology face some challenges about management practice which requires shift in mind-set to achieve success during a project. As agile involves collaboration and self-organization, traditional organizations in which employees used to work alone according to commend of their managers can also face with resistance to change. However, main point of agile focuses on self-organization and working as a team. Moreover, nowadays many companies look for professionals who have agile processing knowledge.

The remaining parts of this study are organized as follows. Section 2 explains fuzzy COPRAS methodology with its application steps. The following section provides case study that is conducted in Turkish banking sector. The final section delineates concluding remarks and future research directions.

## 2. Fuzzy COPRAS Methodology

The COPRAS (Complex Proportional Assessment) method is an MCDM (multi-criteria decision making) method that identifies a solution relative to the ideal solution. It was introduced by Zavadskas and Kaklauskas (1996).

The stepwise representation of the fuzzy COPRAS is given below.

**Step 1.** Identify the alternatives  $A_i$ , ( $i = 1, 2, \dots, m$ ), and required selection criteria  $C_j$ , ( $j = 1, 2, \dots, n$ )

**Step 2.** Construct the decision matrices that denote the importance weight of criteria, and the ratings of alternatives with respect to criteria.

**Step 3.** Normalize the decision matrix.

**Step 4.** Calculate the weighted normalized decision matrix. The weighted normalized value  $\tilde{v}_{ij}$  is calculated as

$$\tilde{v}_{ij} = w_j \tilde{r}_{ij}, \quad i = 1, 2, \dots, m; \quad j = 1, 2, \dots, n \quad (1)$$

where  $\tilde{r}_{ij}$  represents the normalized rating of the  $i$ th alternative regarding  $j^{\text{th}}$  criterion and  $w_j$  is the weight of the  $j^{\text{th}}$  criterion.

**Step 5.** Compute the sum of criteria value for benefit-related attributes for which the greater the performance value the more its preference as in Eq. (2)

$$\tilde{P}_i = \sum_j \tilde{v}_{ij} \quad (2)$$

**Step 6.** Compute the sum of criteria value for cost-related attributes for which the greater the performance value the less its preference as in Eq. (3)

$$\tilde{R}_i = \sum_j \tilde{v}_{ij} \quad (3)$$

**Step 7.** Compute the relative weight of alternatives as

$$\tilde{Q}_i = \tilde{P}_i + \frac{\tilde{R}_{\min} \sum_i \tilde{R}_i}{\tilde{R}_i \sum_i \frac{\tilde{R}_{\min}}{\tilde{R}_i}} \quad (4)$$

**Step 8.**  $\tilde{Q}_i = (q_i^1, q_i^2, q_i^3)$  is transformed to non-fuzzy via Eq. (5)

$$Q_i = \frac{(q_i^3 - q_i^1) + (q_i^2 - q_i^1)}{3} + q_i^1 \quad (5)$$

**Step 9.** Determine the priority of the alternatives ( $N_i$ ) using Eq. (6) and rank the alternatives.

$$N_i = \frac{Q_i}{Q_{\max}} 100\% \quad (6)$$

### 3. Case Study

In order to illustrate the proposed decision approach, a case study conducted in a Turkish bank is provided. The bank has five potential provider and they have no analytical procedure to determine the most suitable outsourcing provider. Success factors of outsourcing provider selection criteria are determined by reviewing the literature and by collecting experts' opinions as in Table 1.

**Table 1. Project provider selection criteria**

Label	Criterion
$C_1$	Top-level management support
$C_2$	Customer participation
$C_3$	Communication between team members
$C_4$	Project team's ability to react to change
$C_5$	Self-organizing and collaborating team
$C_6$	Level of project planning
$C_7$	Effective project manager skills

The evaluation is provided by a committee of three decision-makers that includes one director, one manager, and one specialist from process management department of the bank, who have all been working for more than three years in the case company. The experts provide their opinions by using the linguistic scale given in Table 2.

**Table 2. Linguistic scale**

Linguistic variables	TriangularFuzzy Number
VH	(0.75, 1, 1)
H	(0.50, 0.75, 1)
M	(0.25, 0.50, 0.75)
L	(0, 0.25, 0.50)
VL	(0, 0, 0.25)

The evaluations of the experts are provided in Tables 3-5.

**Table 3. Evaluation of the first decision maker**

	$C_1$	$C_2$	$C_3$	$C_4$	$C_5$	$C_6$	$C_7$
$A_1$	VH	L	L	M	M	H	M
$A_2$	M	H	VH	H	H	M	M
$A_3$	H	H	H	VH	VL	M	H
$A_4$	H	M	M	M	L	H	H
$A_5$	VL	M	M	L	H	L	M
<b>Weight</b>	L	VH	VH	VH	H	H	M

**Table 4. Evaluation of the second decision maker**

	$C_1$	$C_2$	$C_3$	$C_4$	$C_5$	$C_6$	$C_7$
$A_1$	H	VL	VL	L	L	H	VL
$A_2$	M	VH	H	H	M	L	M
$A_3$	M	M	H	H	L	H	M
$A_4$	H	H	M	H	M	M	H
$A_5$	VL	M	H	M	VH	L	M
<b>Weight</b>	VL	H	VH	H	M	M	L

**Table 5. Evaluation of the third decision maker**

	$C_1$	$C_2$	$C_3$	$C_4$	$C_5$	$C_6$	$C_7$
$A_1$	H	L	M	H	VL	M	L
$A_2$	L	VH	VH	VH	H	M	H
$A_3$	M	M	M	H	L	H	VH
$A_4$	VH	H	H	L	M	VH	VH
$A_5$	L	L	M	VL	M	VL	L
<b>Weight</b>	L	M	H	H	M	VH	M

The evaluations of decision makers are aggregated using arithmetic mean operator and the relative weights of the alternatives are computed as shown in Table 6.

**Table 6. Relative weights of the alternatives**

Alternatives	$\tilde{Q}_i$		
$A_1$	0.45	1.66	3.64
$A_2$	1.40	3.24	5.13
$A_3$	1.08	2.75	4.83
$A_4$	0.98	2.74	4.90
$A_5$	0.55	1.81	3.67

The final ranking of alternatives is obtained as in Table 7.

**Table 7. Ranking of alternatives**

	$Q_i$	$N_i$	Rank
$A_1$	1.916666667	58.93238	5
$A_2$	3.252314815	100	1
$A_3$	2.884259259	88.68327	2
$A_4$	2.875	88.39858	3
$A_5$	2.009259259	61.77936	4

#### 4. Concluding Remarks

Organizations utilize project management methodologies for enhancing all processes for surviving in competition and achieving organizational goals. Since project management

processes require big effort, time, and money, companies make use of outsourcing to manage the projects in an efficient manner while focusing on their core competencies. Hence, project provider selection is a crucial managerial decision issue, which should be considered as a multiple criteria decision making problem due to the presence of conflicting criteria. This study identifies the most suitable agile project provider alternative by using fuzzy COPRAS, which determines a solution relative to the ideal solution. The case study is performed in Turkish banking sector for an IT project to be outsourced to a third party provider. Future research will probably focus on developing a decision making procedure when the data contain hesitation along with fuzziness.

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