Journal of Research in Science Engineering and Technology
Volume 9, Issue 2, April 2021, pp. 36-44

Journal of Research in Science Engineering and Technology

www.researchub.org

Software platform selection for business process automation management using a mixed MCDM method

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Abstract

One of the main concerns of organizations is access to the automation methods to improve their business processes. A considerable number of organizations use business process management (BPM) for effective improvement. Although many BPM projects have led to significant development in various fields as well as achieving competitive advantages, there are instances of organizations failing to implement proper BPM system. One of the most important reasons for failure is the indifference of organizations in identifying the most important criteria for selecting the appropriate system. Therefore, in this study, by reviewing the literature, effective criteria for selecting the best BPM software platform were extracted and classified into four categories of technical, vendor, organizational and developmental criteria according to the opinion of experts and organizational infrastructure. Then, the selection process was performed using a combination of multi-criteria decision-making methods. For this purpose, the interactive relationship between the components of the problem is first identified using the Decision-Making Trial and Evaluation Laboratory (DEMATEL) method. Then, using the Analytic Network Process (ANP) based on the Best-Worst Method (BWM), the most appropriate platform is selected. The proposed framework is applied in Snapp Company to show its applicability.

Keywords

Software platform selection, Business process management, multi-criteria decision-making, Analytic Network Process, Best Worst Method

1. Introduction

Today, the main concern of organizations is to access to the automation methods to improve the efficiency of their business processes. BPM includes a number of methods, techniques, and tools to be

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Received 16 February 2021 / Accepted 09 March 2021
DOI: https://doi.org/10.24200/jrest.vol9iss2pp36-44

used to design, implementation, management, and analysis of business processes(Rouhani & Zare Ravasan, 2017). Implementation process of BPM is classified into four phases: designing, performing, monitoring and improving of business processes. During the first phase which is a basis for other phases, business processes are modeled and documented to help the managers to gain a better understanding of their business and, if necessary, to make changes. Therefore, the use of appropriate tools to designing, executing, monitoring and improving business processes in order to increase the agility and efficiency of the organization is necessary and allows the organization to align operations with strategic goals (Kilic, Zaim, & Delen, 2014). So, the importance of choosing a suitable software for the organization is highly regarded. There are several BPM software platforms to automate structured processes with different features and structures. Since the implementation of each platform can have different results in each organization, choosing the best software to automate processes is recognized as one of the main concerns of process managers. Moreover, due to the multiplicity of criteria and their impact on the selection process, monitoring and adjustment of the most appropriate criteria is also important. Due to this importance, several studies have been conducted in recent years(Rouhani & Zare Ravasan, 2017). proposed a functional, non-functional and fuzzy evaluation method using the fuzzy TOPSIS approach to evaluate business process management system (BPMS)(Tsai, Lee, Shen, & Lin, 2012). presented a study on enterprise resource planning (ERP) criteria selection related to system quality and services provided by suppliers and its effects on ERP implementation success (Gürbüz, Alptekin, & Alptekin, 2012). Investigated the application of a combination of MCDM methods to evaluate different ERP alternatives (De León et al., 2013).presented a set of criteria and sub-criteria in five groups (i.e. financial, business, technical, software and vendor), with the aim of selecting and evaluating ERP systems. In (Kilic et al., 2014), the process of selecting the best software platform is examined by combining three decision-making methods including brainstorming, fuzzy hierarchical analysis process (FAHP) and TOPSIS. Also in another study (Kilic, Zaim, & Delen, 2015), the problem of ERP selection is addressed by examining three groups of financial, technical and business criteria and combining two MCDM methods including ANP and PROMETHEE (Ratono, Seminar, Arkeman, & Suroso, 2015). investigated the problem of selecting an appropriate software system using cost and quality standard criteria (ISO25010) and fuzzy multi-objective genetic algorithm. In (Czekster, Webber, Jandrey, & Marcon, 2019), by reviewing the literature of ERP selection, the most important criteria are selected including the cost, credibility, vendor resources, level of support and training, deployment experience, software feature set, ease of use, efficiency and reliability.

In this study, the most important criteria are first identified by reviewing the literature and then chosen using the opinions of experts. Next, by considering the cause-effect relationships obtained from the DEMATEL method, the network structure of the problem is formed. Then, the local weights of network's elements are calculated using the BWM. Finally, using the ANP technique, the final weights of the problem components are calculated and the best platform is selected.

The rest of the study is organized as follows. Section 2 states the problem and the research methodology is given in the third section. Numerical results are discussed in Section 4. Finally, concluding remarks are given in Section 5.

2. Problem definition

In recent years, process management team of Snapp Company has been able to structure and document the organization's processes. Due to the creation of organizational processes in the process design phase, it is necessary to use appropriate software in order to automate the processes. Each process documentation software has its own specific characteristics and implementation requirements. Due to low process maturity of Iranian organizations, the risk of process management projects is high and

impose a heavy cost on the organization in case of wrong decision. Therefore, selecting the most appropriate software for process automation is one of the issues that need to be decided by process management team of Company. Therefore, we intend to select the best software platform from the available options using decision making techniques. According to the expert (company process manager) there is internal and external relationships between the criteria and the model is compensatory, so the DEMATEL method to determine internal and external relationships and structural model, the BWM to extract local weights and finally the ANP method will be used to calculate the final weights. According to the review of research literature, most researches in selecting the appropriate BPMS have been done using AHP method. To the best of our knowledge, combination of DEMATEL, BWM and ANP techniques has been used for the first time in this study. The use of DEMATEL and ANP techniques leads to be application of research by considering relationships. Also, due to the multiplicity of criteria and subsequently matrices of pairwise comparisons, the use of BWM method as a new and efficient technique, reduced the volume of calculations. Moreover, in this research, development criteria have been studied along with other important criteria.

3. Research methodology

This study conducted in four phases. In the first phase, the literature on platform selection criteria is reviewed and the most repetitive criteria in the field of selecting the appropriate platform in the field of BPM are extracted. Then, using frequency of criteria, 16 repetitive criteria are selected and with opinions of experts, four future development criteria will be added to the research structure. In the second phase, the internal and external relationships of the problem components will be determined using the DEMATEL method. In the next phase, the local weights of each criterion are calculated using the BWM, and finally the weights obtained from the BWM; will be used in the fourth phase. In the final phase, the final weights are calculated and ranked using the ANP method. Figure 1 shows the steps of this research.

4. Results and Discussion

As mentioned, the first phase of the research deals with the selection of effective criteria. We extracted the frequently suggested criteria by reviewing the literature, and presented them in Table 1. Then, 16 criteria that had the highest frequency, were selected by experts' opinions. Also, due to the importance of future development of the selected platform, four criteria of risk, cloud processing capability, mobile processing capability and stability were added to the mentioned criteria and approved by experts. These criteria are listed in Table 2. The group of potential software as alternatives includes SAP (e_1), Oracle (e_2), Bizagi(e_3), IBM (e_4), Sharepoint (e_5), Activity (e_6) software.

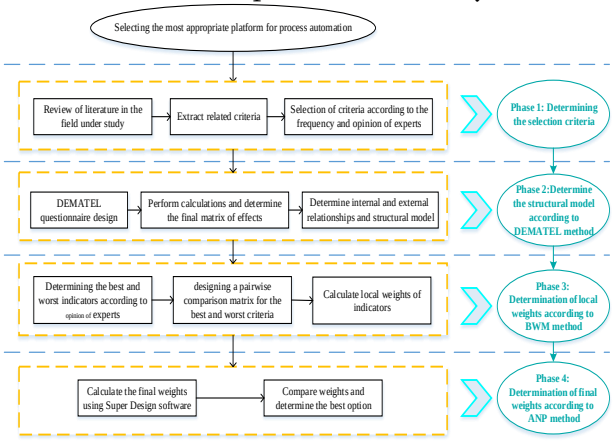

Fig.1. Conceptual model of research

Table (1): Criteria extracted from papers

	Organizational fit	Customization	Accuracy	Recoverability	Ease of use	Latest Technology	Flexibility	Upgrade ability	Security	Functionality	Reliability	Implementation time	Platform independent	Technical capability	Vendor Experience	Market position	Cross-module integration	Maintainability	Efficiency	Ease of integration with other systems	Vendor Support	Implementation Cost	Vendor Reputation	Training Performance	Ease of implementation
(Rouhani & Zare Ravasan, 2017)	✓	✓			✓				✓	✓	✓		✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	
(Gürbüz et al., 2012)	✓	✓						✓		✓	✓			✓		✓	✓				✓	✓	✓		
(Kilic et al., 2015)										✓	✓					✓	✓			✓	✓	✓			
(Kilic et al., 2014)	✓				✓		✓		✓	✓	✓							✓	✓						
(Czekster et al., 2019)		✓			✓						✓				✓	✓		✓	✓		✓	✓	✓	✓	
(Lien & Chan, 2007)			✓	✓	✓	✓			✓	✓	✓	✓							✓		✓	✓	✓		
(Ayağ & Özdemir, 2007)				✓	✓	✓	✓	✓	✓	✓	✓			✓			✓			✓	✓	✓	✓	✓	
(Ratkevičius, Ratkevičius, & Skyrius, 2012)		✓			✓	✓	✓	✓		✓	✓						✓			✓	✓	✓	✓		✓
(Garg & Khurana, 2013)		✓		✓	✓		✓	✓		✓	✓	✓	✓			✓					✓	✓	✓		
(Shukla, Mishra, Jain, & Yadav, 2016)	✓			✓	✓		✓	✓	✓	✓	✓			✓		✓	✓			✓	✓	✓	✓		✓
(Noureddine & Oualid, 2018)				✓	✓	✓	✓		✓	✓	✓						✓	✓		✓	✓		✓		

Table (2): Research criteria

criteria	Sub- criteria
Technical (A)	Flexibility (a_1)
	Security (a_2)
	Functionality (a_3)
	Upgrade ability (a_4)
	Reliability (a_5)
	Ease of use (a_6)
	Latest Technology (a_7)
	Customization (a_8)
	Cross-module integration (a_9)
Vendor (B)	Vendor Reputation (b_1)

	Market position (b_2)
	Vendor Support (b_3)
	Implementation Cost (b_4)
Organizational (C)	Organizational fit (c_1)
	Ease of integration with other systems (c_2)
Developmental (D)	Cloud processing capability(d_1)
	Stability (d_2)
	Mobile processing capability (d_3)
	Risk (d_4)

In the second phase, it is necessary to determine the internal and external relationships of the components and finally the network structure. Therefore, the structure of the problem are determined using the DEMATEL method. According to the final matrices, the decision-making structure are presented in Figure 2. After designing the network structure and determining the relationships, we form the pairwise comparisons matrix according to the unweighted supermatrix. After obtaining all the pairwise comparison matrices, local weights are obtained for each using BWM. Finally, in the last phase, by multiplying the final effects matrix (obtained by DEMATEL results) in the unweighted supermatrix, the weighted supermatrix is presented in Table 3. By plotting the network structure in the superdecision software and entering the corresponding weights, the final weights of the alternatives are calculated by the software and presented in Table 4.

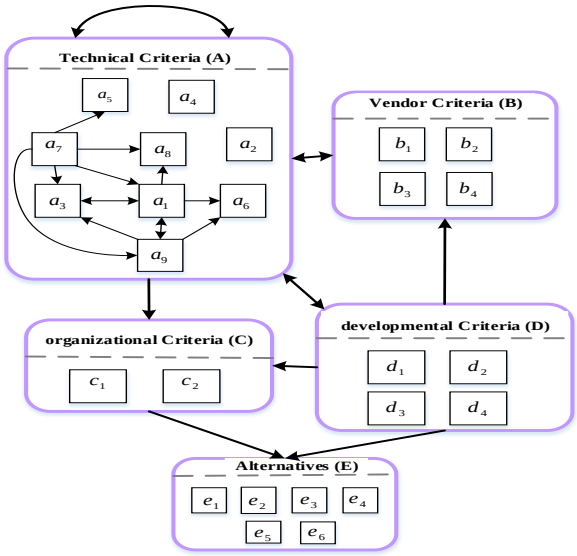

Fig. 2. Structural model

Table (3): Weighted super matrix

Weighted super matrix		A									B				C		D				E					
		a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	a_9	b_1	b_2	b_3	b_4	c_1	c_2	d_1	d_2	d_3	d_4	e_1	e_2	e_3	e_4	e_5	e_6
A	a_1	0	0	0.32	0	0	0	0.067	0	0.147	0.022	0.039	0.016	0.018	0	0	0.063	0.034	0.037	0.019	0	0	0	0	0	0
	a_2	0	0	0	0	0	0	0	0	0	0.049	0.037	0.035	0.03	0	0	0.113	0.135	0.081	0.432	0	0	0	0	0	0
	a_3	0.182	0	0	0	0	0	0.052	0	0.062	0.056	0.046	0.057	0.067	0	0	0.027	0.084	0.052	0.019	0	0	0	0	0	0
	a_4	0	0	0	0	0	0	0	0	0	0.021	0.028	0.011	0.016	0	0	0.047	0.057	0.052	0.026	0	0	0	0	0	0
	a_5	0	0	0	0	0	0	0.043	0	0	0.051	0.030	0.053	0.016	0	0	0.041	0.093	0.072	0.082	0	0	0	0	0	0
	a_6	0.068	0	0	0	0	0	0	0	0.109	0.025	0.034	0.054	0.047	0	0	0.075	0.036	0.058	0.063	0	0	0	0	0	0
	a_7	0	0	0	0	0	0	0	0	0	0.020	0.017	0.014	0.014	0	0	0.046	0.073	0.065	0.041	0	0	0	0	0	0
	a_8	0.034	0	0	0	0	0	0.037	0	0	0.022	0.037	0.016	0.017	0	0	0.038	0.079	0.078	0.031	0	0	0	0	0	0
	a_9	0.034	0	0	0	0	0	0.12	0	0	0.04	0.038	0.052	0.083	0	0	0.058	0.042	0.045	0.077	0	0	0	0	0	0
B	b_1	0.222	0.284	0.245	0.312	0.223	0.205	0.099	0.212	0.227	0	0	0	0	0	0	0.16	0.188	0.075	0.164	0	0	0	0	0	0
	b_2	0.112	0.042	0.076	0.097	0.046	0.116	0.049	0.101	0.076	0	0	0	0	0	0	0.062	0.066	0.029	0.058	0	0	0	0	0	0
	b_3	0.148	0.11	0.189	0.107	0.172	0.153	0.066	0.182	0.079	0	0	0	0	0	0	0.074	0.073	0.71	0.114	0	0	0	0	0	0
	b_4	0.113	0.163	0.09	0.083	0.158	0.125	0.385	0.105	0.216	0	0	0	0	0	0	0.104	0.072	0.22	0.064	0	0	0	0	0	0
C	c_1	0.408	0.397	0.41	0.387	0.402	0.41	0.332	0.402	0.41	0	0	0	0	0	0	0.222	0.217	0.22	0.211	0	0	0	0	0	0
	c_2	0.231	0.243	0.23	0.25	0.238	0.23	0.307	0.238	0.23	0	0	0	0	0	0	0.128	0.133	0.126	0.138	0	0	0	0	0	0
D	d_1	0.616	0.148	0.278	0.226	0.251	0.120	0.425	0.260	0.256	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	d_2	0.206	0.385	0.356	0.314	0.388	0.452	0.154	0.357	0.421	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	d_3	0.083	0.142	0.081	0.153	0.144	0.077	0.063	0.103	0.104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	d_4	0.096	0.325	0.185	0.408	0.217	0.351	0.358	0.280	0.220	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	e_1	0.044	0.050	0.045	0.043	0.044	0.036	0.035	0.041	0.043	0.025	0.041	0.031	0.036	0.019	0.019	0.026	0.032	0.025	0.049	0	0	0	0	0
	e_2	0.060	0.056	0.060	0.044	0.026	0.034	0.031	0.062	0.037	0.022	0.024	0.039	0.012	0.033	0.032	0.041	0.037	0.034	0.026	0	0	0	0	0
	e_3	0.063	0.09	0.097	0.113	0.065	0.063	0.037	0.063	0.045	0.043	0.042	0.036	0.068	0.037	0.034	0.036	0.03	0.025	0.044	0	0	0	0	0
	e_4	0.069	0.102	0.066	0.047	0.102	0.072	0.068	0.098	0.078	0.044	0.024	0.064	0.074	0.057	0.055	0.051	0.052	0.049	0.053	0	0	0	0	0
	e_5	0.036	0.015	0.018	0.027	0.047	0.058	0.055	0.063	0.052	0.032	0.032	0.010	0.010	0.018	0.012	0.011	0.035	0.04	0.011	0	0	0	0	0
	e_6	0.051	0.044	0.036	0.057	0.051	0.54	0.056	0.054	0.059	0.031	0.037	0.033	0.013	0.014	0.017	0.037	0.036	0.039	0.038	0	0	0	0	0

Table (4). Final ranking of Alternatives

Alternative	Weight	Rank
SAP	0.043	6
Oracle	0.143	4
Bizagi	0.1663	2
IBM	0.249	1
Sharepoint	0.14	5
Activity	0.1527	3

According to the results, the best software for implementation in Snapp Company is IBM with a weight of 0.249.

5. Conclusion

In a medium to large organization, a proper BPMS gives this opportunity to business environment to make daily changes to business processes according to competitive environment. BPM systems are software tools for running business processes that allow managers to analyze processes and make the necessary changes to the initial situation. Thus, it is important to select the right software platform that is consistent with the structure and goals of the company. Therefore, in this study, with considering the efficient criteria, the issue of selecting the appropriate software platform has been investigated. For this purpose, by reviewing the literature, the most important criteria have been extracted. These criteria were divided into technical, organizational and vendor criteria and another group of criteria were presented according to the experts of the company and were classified in the group of development criteria. Then, by combining MCDM methods, the problem of software selection has been done. These methods include the DEMATEL to determine the problem structure, the BWM to extract the local weights, and the ANP to determine the final weights. According to the research results, IBM software was selected as the most suitable software. This software has a higher performance than other platforms in relation to important criteria such as security, functionality, flexibility, vendor reputation and risk. Bizagi, Activity and Oracle softwares are in the next priorities, respectively. It is also necessary to explain that according to the final results, the criteria of security, cost, risk, functionality, organizational fit, reputation and vendor services are among the most important criteria in the selection process. Therefore, it is suggested to the case study that more attention be paid to these criteria when implementing the software platform. Conducting the current study with other criteria and MADM methods under uncertain conditions can be viewed as the future research direction.

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