

## ORIGINAL PAPER

# Presenting a Model to Evaluate Factors Affecting Outsourcing of Health Information Technology Services

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doi: 10.5455/aim.2018.26.190-194

ACTA INFORM MED. 2018 SEPT; 26(3): 190-194

Received: Jun 30, 2018 • Accepted: Aug 10, 2018

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## ABSTRACT

**Introduction:** Outsourcing of health information technology services (OHITS) is an important process for healthcare organizations due to the lack of expert staff to respond rapid advance in IT and the security of patient's information. This study aimed at presenting a model to evaluate factors affecting OHITS. **Method:** This is a descriptive-analytic study, conducted in 2017. Participants were experts of IT and accounting field. This research was performed in four general steps: identifying the factors affecting OHITS through literature review; determining suitable indicators by Delphi technique; prioritizing the factors using Analytical Hierarchical Process (AHP), measuring the accuracy of research hypotheses by Partial Least Square (PLS) and calculating the Goodness Of Fit (GOF) criteria for the model. **Findings:** the most and the least important factors affecting OHITS were "motivation" and "selection of a provider" respectively. GOF criteria was 0.697, suggesting powerful model fitting. **Conclusion:** Using the model presented in this research, the healthcare managers and chief officers of IT will be able to decide consciously about outsourcing projects, and also manage the project better.

**Keywords:** Outsourcing, information technology, Partial Least Square.

## 1. INTRODUCTION

Organizations have to make innovative strategies in production or processes Because of highly competitive challenges (1). In today's commercial environment, Information technology (IT) is considered as a competitive resource (2).

Information technology services (ITS) outsourcing is seen as a strategic tool used by many firms either to reduce their total costs on ITS or to get access to capabilities not available in-house (3, 4). The outsourcing growth has brought about a fundamental change in the way ITS are organized and delivered, with increasing dependence on external providers, now frequently located offshore (5).

The decision to outsource ITS has become a viable strategic alternative in managing the increasingly complex ITS (6) thus, outsourcing activities, even when not directly related to core business, is a complex task (4). Outsourcing IT as a major competitive advantage would be increasingly important to improve efficiency and effectiveness (7).

Many healthcare organizations are exploring outsourcing as an approach to address demands for HIT (8). There can be benefits of outsourcing, such as gaining access to expertise and improving healthcare service levels (8). There are different reasons to outsource information technology including: concentration on the main capabilities, saving costs, improving services, accomplishing the business objectives, enhancing flexibility, eliminating routine problems and issues, enhancing the quality, increasing access to new technologies, and mitigating risks (4, 9-14) However, outsourcing strategy might brought some harm to company which should be taken into account while decision making. Potential harms include: danger on depending on third party, loss of control in IT assets, possible treat for opportunism, loss of flexibility, potential loss of competitive advantage in operational management, it can cause a decline of morale and performance of the remaining employees, long term cost savings are not guaranteed (14). On the other hand corresponding regulatory mandates about patients privacy

rights in healthcare industry have resulted in increased standardization of transaction processing, security, and privacy information (15). Thus healthcare organizations require more attention while outsourcing process.

In spite of potential benefits, After years of outsourcing corporate processes and operational functions, many outsourcing projects have failed (16). There are several reasons resulting in outsourcing failure such as: outsourcing activities that should not be outsourced, contractual hazards, technical challenges, unforeseen as well as overlooking the hidden costs of outsourcing, and selecting the wrong vendor (16-19). Diana suggests that managers of health care delivery system may not be considering significant factors affecting outsourcing process, when making sourcing decisions (20).

Outsourcing is not a new concept however, new technologies, delivery models, globalization and a more demanding end-user continue to provide impetus for outsourcing activities (21). As one of the key success factors in outsourcing IT projects is identification and evaluation of effective factors in IT outsourcing and their management. A comprehensive list of these factors needs to be considered when outsourcing to ensure it is successful. Regarding the developing trend of IT outsourcing projects in Iran and considering the fact that there has been no model capable of examining different dimensions of this field and, this research was performed with the aim of presenting a model that could make process of decision making less time consuming, less segmented and more efficient, to evaluate factors affecting outsourcing of health IT service.

**2. MATERIAL AND METHODS**

This is a descriptive analytical study, conducted at Shiraz University of medical sciences in 2017 with the aim of presenting a model to evaluate factors affecting outsourcing of IT services in health industry using fuzzy analytical hierarchy process (FAHP). All experts of IT field and financial affairs of the University and its affiliate units, which included 30 individuals, were invited to participate in this study. The inclusion criteria were having MSc degree and at least two years' work experience in IT and financial affairs field and the exclusion criteria included unwillingness to participate in the study and a working experience less than two years.

To identify the primary factors affecting ITS outsourcing of the health sector, literature were reviewed. Extracted factors were provided to the experts as a questionnaire in the first round of Delphi technique. 75% consensus was applied to select components. The determined consensus was not reached, so the second round of Delphi was conducted. The factors obtaining from Delphi technique were weighted due to the varied importance, so that more proper and reliable effective factors would be measured. In order to rank the factors, fuzzy analytical hierarchy process was employed. The AHP, developed by Thomas Saati, is one of the most comprehensive techniques designed for decision-making with multiple criteria and different options because it allows hierarchical formulation of the problem, the possibility of different quantitative and qualitative criteria consideration in the problem as well as the possibility of performing sensitivity analysis on the criteria and sub-criteria.

Analytical hierarchy process was based on paired com-

parison facilitating judgment and calculations; it also shows the consistency and inconsistency rate of the decision. All comparisons are performed as paired in this process. Decision-makers used oral judgments in these comparisons. Next, a checklist was prepared for performing paired comparisons, and the factors were arranged in two ahead of each other, and a spectrum ranging from high preference to least preference was used as Table 1 (2).

Verbal statement of status of comparison of i in relation to j	Fuzzy equivalent	Inverse fuzzy Equivalent
Equally Preferred	(1, 1, 1)	(1,1,1)
In between	(1, 2, 3)	$(\frac{1}{3}, \frac{1}{2}, 1)$
moderately Preferred	(2, 3, 4)	$(\frac{1}{4}, \frac{1}{3}, \frac{1}{2})$
In between	(3, 4, 5)	$(\frac{1}{5}, \frac{1}{4}, \frac{1}{3})$
Strongly Preferred	(4, 5, 6)	$(\frac{1}{6}, \frac{1}{5}, \frac{1}{4})$
In between	(5, 6, 7)	$(\frac{1}{7}, \frac{1}{6}, \frac{1}{5})$
very strongly Preferred	(6, 7, 8)	$(\frac{1}{8}, \frac{1}{7}, \frac{1}{6})$
In between	(7, 8, 9)	$(\frac{1}{9}, \frac{1}{8}, \frac{1}{7})$
Extremely Preferred	(9, 9, 9)	$(\frac{1}{9}, \frac{1}{9}, \frac{1}{9})$

**Table 1. The fuzzy spectrum equivalent to nine-degree scale of Saati in AHP technique**

To present the model, structural equations of the research hypotheses were analyzed individually using partial least squares (PLS) technique. Finally the general model of the research was tested using the same technique. There were several reasons behind selection of PLS method in this research. The most important reasons include: superiority of this method for small samples, abnormal data, constructive measurement models, suitable predictability, model complexity (large number of structures and indicators), exploratory research, development of theory, use of classified variables, and investigation of homogeneity, testing the theory and hypotheses, and testing hypotheses including modifying variables.

Descriptive statistics were analyzed using SPSS 22; to test conceptual model Lisrel software 8.8 was applied; to measure the significance of the relationships, t statistic has been calculated through bootstrapping technique; and the final model is output of smart PLS software 2.

**3. FINDINGS**

Out of total amount, 76 primary components were identified through literature review. At the end of the second round of Delphi the experts approved seven main categories of components and 30 subcategories. The results obtained from applying two rounds of Delphi technique are provided in Table 2 to identify the effective factors in outsourcing of health IT services.

Table 3 shows the final priority of the criteria and sub-criteria based on the AHP steps and the output of Super Decision software.

The top 10 ranks have been presented in Table 4, based on the final weights.

The measurement model has been presented for construct validity, and also divergent validity was investigated. Next, using PLS approach, the relations of the research variables and the major model have been presented. In the general model of the research shown in Figure 1, the measurement

No.	Main criterion	Secondary criterion	Sum of scores	Mean scores of experts
1	Quality	Investment on technologic planning and innovations	113	7.53
2		Successful contracts	106	7.07
3		Extent of provision of information security	121	8.07
4	Motivation	Extent of knowledge transfer	112	7.47
5		Concentration of the major capabilities	125	8.33
6		Access to outsource expertise/skills	119	7.93
7		Flexibility	120	8.00
8		Innovation and fast provision of services	106	7.07
9	Risk management	Concluding short-term contracts or change in the contract periodically to enhance flexibility	108	7.20
10		Keeping key capacities inside the company in spite of technology outsourcing	111	7.40
11		Employing an expert for legal issues to mitigate the legal risks	107	7.13
12	Strategic decisions	Proper selection of contractor	109	7.27
13		Contribution of the project in achieving the organizational objectives	114	7.60
14		Increasing the capacity for using key resources	117	7.80
15		Being responsive to ever-changing technology in the world	110	7.33
16	Risks	Characteristics of the provider and characteristics of the technology required	109	7.27
17		Information security risks	114	7.60
18		Inefficient estimation of resources and time, poor management and planning	110	7.33
19	Selection of provider	outsourcer or provider lack of skills in IT outsourcing projects	106	7.07
20		Leaving project by the key figures of the project	105	7.00
21		Breach of contract by the provider and the risks associated with legal matters	113	7.53
22	Financial	Similar experience	109	7.27
23		Extent of trust to the provider	107	7.13
24		Timely delivery	112	7.47
25		Quality of the provider management	105	7.00
26		Allocation of sufficient financial resources	108	7.20
27	Supplier	Defining a predictable cost structure	107	7.13
28		Management and human resources costs	115	7.67
29		Consideration of hidden and variable costs	110	7.33
30		Suitable budgeting and scheduling	109	7.27

Table 2. The mean scores of experts

the main criteria	Weight	Sub criteria	Initial weight	General weight	Rank
Quality	0.235	investment on technologic planning and innovations	0.310	0.0730	2
		Successful contracts	0.245	0.0576	6
		The level of information security provision	0.260	0.0612	4
Motivation	0.255	Extent of knowledge transfer	0.184	0.0434	9
		Concentration on major capabilities	0.345	0.0881	1
		Access to outsource skills/expertise	0.276	0.0703	3
		Flexibility	0.227	0.0579	5
		Innovation and Rapid Presentation of Services	0.152	0.0387	11
Risk management	0.090	concluding short-term contracts or changing contracts periodically to increase flexibility	0.370	0.0332	12
		keeping the key capacities inside the company in spite of outsourcing of technology	0.262	0.0235	17
		employment of experts for legal problems to mitigate legal risks	0.218	0.0196	20
Strategic decisions	0.146	proper selection of contractor	0.151	0.0136	27
		contribution of the project in achieving the organizational objectives	0.361	0.0528	7
		enhancing the capacity of use of key resources	0.165	0.0242	16
		Being responsive to ever-changing technology in the world	0.297	0.0434	8
Risks	0.080	characteristics of the provider and characteristics of the required technology	0.177	0.0259	14
		Information security	0.314	0.0252	15
		Inefficient estimation of resources and time, poor management and planning	0.170	0.0136	26
		outsourcer or provider lack of skills in IT outsourcing projects	0.202	0.0162	25
		leaving the project by the key figures of the project breaching the contract on the part of provider and the risks associated with legal issues	0.152	0.0122	29
Selection of provider	0.067	leaving the project by the key figures of the project breaching the contract on the part of provider and the risks associated with legal issues	0.152	0.0122	29
		similar experience	0.282	0.0188	21
		the extent of reliability of provider	0.261	0.0174	23
		timely delivery	0.274	0.0182	22
Financial	0.127	quality of the provider management	0.183	0.0121	30
		allocation of sufficient financial resources	0.326	0.0413	10
		defining a predictable cost structure	0.173	0.0220	18
		managerial and human resources costs	0.204	0.0259	13
		consideration of hidden and variable costs	0.135	0.0172	24
		suitable budgeting and scheduling	0.162	0.0205	19

Table 3. determining the final priority of indices using FAHP technique

model (relationship of each of the observable variables to the hidden variable) and path model (relationships of hidden variables with each other) have been calculated. In measuring the significance of relationships, t statistics has been calculated by bootstrapping technique, as provided in Figure 2.

Eventually, the relationship of the variables examined in

Top 10 sub-criteria of the effective factors in outsourcing of health IT services	
1	concentration on the major capabilities
2	investment on technology planning and innovations
3	access to outsource skills/expertise
4	the extent of information security provision
5	Flexibility
6	successful contracts
7	contribution of the project in achieving organizational objectives
8	Being responsive to ever-changing technology in the world
9	extent of knowledge transfer
10	allocation of sufficient financial resources

Table 4. Top 10 sub-criteria

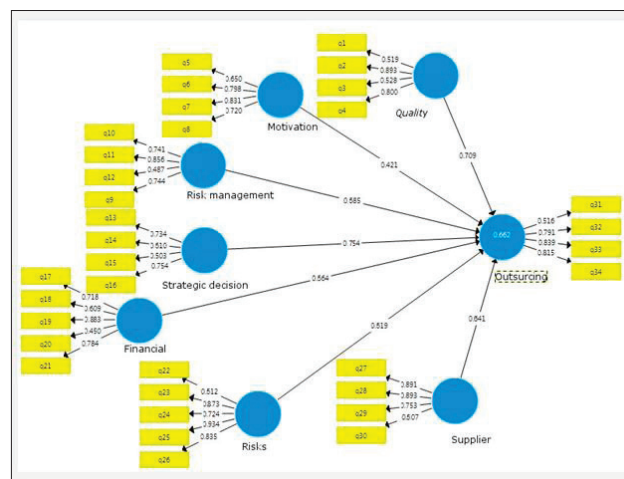


Figure 1. PLS technique of the general model of the research

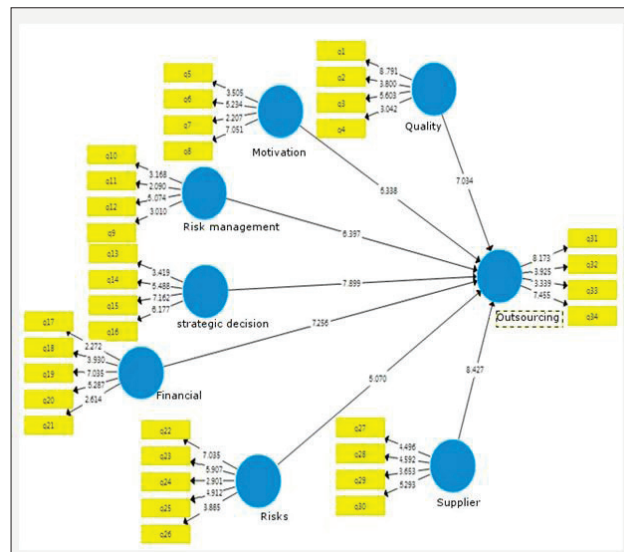


Figure 2. T-value statistics of the general model of the research using bootstrapping technique

each of the research hypotheses has been tested based on a causative structure using PLS technique.

**General fitting of the model (GOF criterion)**

This criterion is related to general part of structural equations models. This means that using this criterion the researcher can control fitting of the general part after investigating fitness of the measurement part and structural part of their research general model. GOF criterion was devised by

Tenenhas et al, which is calculated by the following formula (22):

Wetzels et al introduced three values of 0.36-0.025-0.01 as weak, medium, and strong values for GOF (14).

$$GOF = \sqrt{Avg(Communalities) \times R^2}$$

Calculation of GOF:

$R^2=0.662$

$$GOF = \sqrt{0.734 \times 0.662} = \sqrt{0.485} = 0.697$$

#### 4. DISCUSSION

According to the finding and presented model for evaluation of effective factors in health ITS at Shiraz University of medical sciences, all of the research factors had significant effects on outsourcing of health ITS. The results obtained from general fitting of the model indices suggest that the model has a good fitting.

Based on comparative viewpoints of the participants "Motivation", "quality", and "Strategic decisions" were the most important factors respectively. "Concentration on the major capabilities" was the most important sub-criteria in IT outsourcing.

Strategic planning of the health care organizations should be formulated in a way that creates active or agile organization instead of passive organizations. One of the main organizational policies is concentration on the main activities and relegation of other activities to outsources (23, 24). Decentralization policy should be applied because it seems practically impossible for a single organization to do well in all fields. Organizations should identify core tasks which can be performed by the organization itself as well as those which cannot. Barthélemy announced "Outsourcing activities that should not be outsourced" as an important reason resulting in outsourcing failure (19). To determine the tasks which should be performed in collaboration with other organizations is a very important decision for organization survival.

The "investment on technological planning and innovations" was the most important sub-criteria of "quality" affecting outsourcing of health ITS. In today's world which health care has become an industry, it is important to have a competitive advantage. In today's industrial economy, innovation has emerged as a main source of competitive advantage, but it is still completely elusive for organizations. Outsourcing is likely to emerge as a way to experiment with innovative technologies and even bring innovation into health care organizations. Outsourcing results in faster performance, increased quality of services, and time-saving for managers (25). Gonzalez consider "Access to new Technology" a reason for outsourcing (26). Tang et al considered quality as one of the determinant parameters in decision making for outsourcing (27). Other studies also believe that improving quality of IT services is one of the IT outsourcing reasons(28, 29). Thus, outsourcing has the potential to bring about business value in health care industry.

The third important factor was "Strategic decisions" and "contribution of the project in achieving the organizational objectives" as the most important sub-criteria. Managers should consider that outsourcing project is align with strategic plan of their health care organization. According to lit-

erature, providers have access to more advanced technologies and count on more motivated staff and better management systems to be able to gain a high-quality service coordination or control, or are more strongly committed than the internal staff to make the alliance with the organization work properly (30-32).

Although many studies (16, 17, 33) direct primary attentions of the healthcare organizations to the risks of the outsourcing projects, in this study risks had a less impact on outsourcing in comparison with other factors; however risk considerations are much highlighted in healthcare organizations due to the legal aspects and patient's rights. "Information security" is a very important sub-criteria and its related considerations should be clearly incorporated in outsourcing contracts.

"Financial factor" was among the top 10 sub-criteria in our study. Apparently, respondents believe that managers should be justified about investing on outsourcing since Outsourcing allows managers get rid of the additional costs and therefore, have the opportunity to use their existing resources in a more efficient manner and in different areas, on their basic capabilities (34).

"Selection of provider" was the least important factor. However, a more scientific decision making process for choosing outsourcing providers, is very important to increase the success rate of outsourcing; and even it is necessary to gather a multi-disciplinary team in order to select the best provider.

#### 5. CONCLUSION

This study suggests a decision model for evaluating factors affecting OHITS. "Motivation" and "selection of provider" were the most and the least important criteria in comparison with the other seven studied factors. Using the model presented in this research, the healthcare managers and chief officers of IT will be able to decide about outsourcing projects consciously and scientifically especially when criteria are numerous and inter-related, and there for best manage the process.

- **Acknowledgment:** This paper has been extracted from MSc thesis of Mohammad Shirdeli, MSc. student of health information management. The thesis was financially supported by Vice-chancellor for research affairs of Shiraz University of Medical Sciences with grant number 10767 and ethical code IR.sums.REC.1394.S1030. The author wish to thank all participants.
- **Conflict of interest:** On behalf of all authors, the corresponding author states that there is no conflict of interest.

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