

Risk Analysis of IT Projects Implementation in Hospitals

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Abstract:

Objective:

The application of information technology (IT) is fundamental in the hospitals to stay competitive. In this regard, recognizing the main risks to the implementation of IT in hospitals can provide vast opportunities to improve its efficiency and help to make strategic decisions. This study aimed to search for the main risks of implementation of IT projects in the hospitals of Tehran.

Methods:

This was a practical and cross-sectional study which was conducted in the 18 hospitals of Tehran, Iran, 2018; in which a sample of 65 members were studied. The required data were collected using a questionnaire to examine seven main risks, including market, project management, human resources, technical, organizational, financial, strategic risks. The collected data were analyzed using SPSS 19.0. Additionally, the method used to test the risks in this study was structural equation modeling, which was ran using LISREL 9.30.

Results:

The results showed that among the seven main risks of to the implementation of IT in hospitals, the highest and lowest means were related to the human resource risks and the market risks, respectively. Also, according to the SEM, human resource risks and market risks had the highest and lowest effects, respectively.

Conclusion:

Announcing the use of IT in the hospitals, holding conferences about new IT developments with employees, suitable training, encouraging them to use IT tools, providing a motivating atmosphere to use IT tools for employees, are a few effective ways of overcoming the human resource risks.

Keywords:

Risk analysis, Information Technology, Hospitals, Human Resource Risks.

1. Introduction:

Today, the role of information technology in health systems is not unknown to anyone. Health organizations which have applied IT facilities, are the source of innovation and gaining competitive advantage. These hospitals compete in an environment characterized by short product life cycle, high uncertainty and high investment in research and development activities. Hospitals' susceptibility to government projects, low ownership of output and skills, high labor displacement, and other factors have created a highly volatile and high-risk environment at the hospital level (*Maria Lluch, 2011*). In turbulent environments, such as hospitals that face threats of survival, risk-based approaches can be effective in many cases.

Risk analysis enables hospital managers to identify and manage problems that may limit their ability to conduct initiatives and achieve optimal performance outcomes. Risk analysis begins with the identification of potential threats, and then the likelihood of occurrence of these threats is evaluated (*Morisio Maurizi, 2007*). To carry out risk analysis, it is necessary to identify the various conditions of projects in organizations to gather sufficient information for each situation. (*Na Kwan-sick, 2007*). This information includes a range of financial data, security protocols, marketing forecasts, and other information (*Han Wen-Ming, 2007*). Identifying these processes and data requires adopting a scientific approach to solving the research problem, which we will describe in this study.

So far, many studies have been conducted to determine the patterns of risk-taking behavior of the projects, but a model that can be used to examine the risks of IT projects in hospitals, has not been seen in literature. Therefore, it is necessary to develop a model for explaining the risk behavior of IT projects in hospitals and to evaluate and validate them in order to ultimately serve as a tool for decision-makers on value-added activities in the field of information and communication technology activities. In this research, we answer this important question: What are the main risks of implementing IT projects in hospitals?

In order to answer this question, in the next sections of the article, we will first review the history of research and its literature classification, in the third part the research methodology will be explained, and in the fourth part of the article, data collection, their classification, identifying the most important risk factors from the perspective of the experts, will be reviewed. The discussion

and conclusion part will summarize the works done and also provide solutions to the main risks obtained from results.

2. Literature Review

The risk in health information technology projects has a special position and not paying attention to this issue has put these projects in a serious challenge. This is why this issue attracted the attention of many researchers in this field and created various tools and methods for risk analysis in IT projects. When viewing varieties of barriers for HIT adoption, the same classes were extracted from widely differing care settings and HIT application systems on several occasions. Indeed, most of the studies aimed to mention all relevant barriers and didn't set out to target a selected barrier.

In this paper, at first we have looked for variety of risks using literature review and expert surveys. Then we grouped up them based on their concepts and effects into 7 general categories. These 7 groups include market risks, project management risks, human resource risks, technical risks, organizational risks, financial risks, strategic risks.

Following, the subgroups of these 7 items, along with their literature review, are described.

2.1. Market risks:

Market risk is subdivided into three subsets of: *Lack of Customer (Patient) Expectations for IT Facilities, IT Market Bad Conditions; The Competitors low Activities in IT Projects.*

Baccarini et al.(2004), identified the most important risk factors by sampling information technology experts in the western state of Australia (a combination of targeted targeting and snowball) and then ranking the risks. *Customer expectations* are one of the factors determined by them (Baccarini et al, 2004). Kemerer and Sosa (1991), examining various examples in the industry and defining the factors that cause the failure of information systems, identified a number of influential factors, including *market conditions and competitors' activities* (Kemerer and Sosa ,1991).

2.2. Project Management risks:

Project management risk is subdivided into four sub-categories: *Lack of risk management, change management, planning, project monitoring and control*.

In 2008, Bennerman identified a number of important factors with an interview and case study to evaluate risk and manage it in software projects. Two of the important factors identified by him are *risk management and change management* (Bennerman, 2008). Jun et al. (2011), from the perspective of the provider, assessed the impact of risk management and uncertainty in the project, on the performance of information systems projects from the perspective of the provider, using the PLS methodology. Then they identified important factors, two of which were *project planning and monitoring and control* (Jun et al, 2011).

2.3. Human Resource risks:

Human Resource risk is subdivided into five sub-categories: *Lack of Training, commitment and motivation of team members, team members expertise, team members experience, employees morale*.

Huang et al. (2004), used the Delphi method to identify risk and AHP approach in risk analysis and prioritization. *Training, commitment and motivation of team members* were the most important factors identified by them (Huang et al, 2004). Paré et al (2008), by prioritizing Delphi's critical risk factors for information systems, they identified the important factor of *team members' expertise* (Paré et al, 2008). Jun et al. (2011), considered one of the important IT risks in *the user experience* (Jun et al, 2011). Nazımog̃lu & Ozsen (2010), in order to dynamically analyze the risk of the delivery of information technology services, IBM, in an interview with IBM for information from ITIL and the ITSM measurement tool, highlighted the *morale of employees* as one of the most important risks (Nazımog̃lu & Ozsen, 2010).

2.4. Technical risks:

Technical risk is subdivided into three sub-categories: *Difficulty of software and hardware updates, Lack of technical equipment, security issues*.

Ojala et al (2006), they described *the software and hardware update* as one of the most important risk factors in a deep case study in three companies (Ojala et al, 2006). Yinghong & Changyong (2014), in their research on risk and interoperability in IT projects, using literature review and

modeling based on the failure structure, considered *technical equipment* as one of the most important risk factors (Yinghong & Changyong, 2014).

Fu (2008) in a risk assessment project on IT projects using a core component analysis, grouped the risk using a PCA-based approach and highlighted the security risks of technology as one of the most important factors (Fu, 2008).

2.5. Organizational risks:

Technical risk is subdivided into two sub-categories: *Inappropriate Organizational environment, Lack of organizational culture support.*

Dey et al. (2007), after undertaking risk management in software development projects along with a case study, referred to the *organizational environment* as one of the risks identified (Dey et al, 2007). Francoise et al. (2009), through a review of literature and the Delphi method, cited *organizational culture* as one of the key risks in the success of ERP projects (Francoise et al, 2009).

2.6. Financial risks:

Financial risk is subdivided into two sub-categories: *High hardware and software cost, Lack of financial management.*

Ram L. Kumar (2003), highlighted *the cost of hardware and software* as one of the most important risks in his research on risk management in real-time software projects (Ram L. Kumar, 2003). Aundhe & Mathew (2009), in their research with the goal of determining the marginal risk of outsourcing information technology from a service provider perspective using grounded theory, considered one of the most important risk factors as time and *budget management* (Aundhe & Mathew, 2009).

2.7. Strategic risks:

Strategic risk is subdivided into three sub-categories: *Project inappropriateness with the organizational process, lack of executive support, ambiguity in defining goals.*

Ojala et al (2006), captured the risks of human resource planning projects through a deep case study of interviewing and observation and then assessment. The *project's appropriateness with*

organizational processes was one of the most important risks it encountered in its research (Ojala et al, 2016). Francoise (2009), using a literature review and Delphi method to implement ERP, he described *executive support* as one of the most important identified risks (Francoise, 2009). Hartman & Ashrafi (2002), in a research aimed at project management in information systems and information technology industries, identified ambiguity in defining project objectives as one of the most important risks of such projects (Hartman & Ashrafi, 2002).

Despite the recent research into the risks of technology projects and the development of advanced tools and techniques in the field of health systems, IT risks continue to be challenging for experts and managers in this area. In this paper, we intend to analyze the risks of implementing health information technology projects in Iran.

3. Methodology

This was a practical and cross-sectional study which was conducted in the hospitals of Tehran, Iran, 2018. In order to collect data for this research, we first considered 20 of the best hospitals. It was intended that IT managers and experts in those hospitals would complete a questionnaire containing 7 main risk factors and 22 risk sub-factors in health IT projects that were received from recent literature review. Questionnaire was designed in 5-option Likert scale. These options for each of the identified risks were including “strongly disagree” with point 1 to “strongly agree” with point 5. Some explanations were given on the objectives of the study and the method of completing the questionnaire, and they were given sufficient time to complete the questionnaire. The collected data were analyzed by SPSS 19.0. Moreover, to further examination of the risk factors, the structural equation modelling (SEM) was also performed with LISREL 9.30. Note that a $p < 0.05$ was considered statistically significant.

3.1. Sampling

Of the 20 hospitals, only 18 hospitals accepted to cooperate, thus our hospital sample reduced to 18. In each of the sample hospitals, there were, on average, between 9 and 13 people who were experts and managers and somehow familiar with the subject of IT risks. At the end, our survey population reached to 206 people. Firstly, we used the Cochran formula (1963) below to determine the number of samples:

$$n = \frac{Nt^2 p(1-p)}{Nd^2 + t^2 p(1-p)} \quad (1)$$

In this, n is sample size, N total number of members of the statistical society, p ratio of success, t normal distribution coefficient (1.96), and d is confidence level (permissible error).

Estimating the rate of interview success with the above characteristics, based on the results of the distribution of 25 testing questionnaires, is equal to 0.52.

So the sample size was calculated as follows:

$$n = \frac{206(1.96)^2 0.52(0.48)}{206(0.1)^2 + 1.96^2 0.52(0.48)} = 65.4 \approx 65$$

3.2. Validity and reliability of the questionnaire

3.2.1. Validity

In general, overall validity indicates whether our tool is capable of measuring and measuring the variable or structure for which it was built.

To measure the validity of this tool, expert opinions (content validity) have been used. According to five university professors, interview questions have the necessary validity to collect data in terms of both appearance and content.

3.2.2. Reliability

Among the definitions that are given for reliability, one can refer to the definition given by Ibell and Freisby (1989): "The correlation between a set of scores and another set of scores in an equivalent test that has been obtained independently for a test group." Due to this, the capability coefficient is usually from zero (no communication) to +1 (complete communication). The reliability coefficient indicates how well the instrument, measures the stable characteristics of the subject or its variable and temporary characteristics.

One of the methods for calculating reliability is the use of the Cronbach formula, which is very popular and popular. This method is used to calculate the internal coordination of measuring instruments, such as questionnaires or tests that measure different attributes. In these tools, the

answer to each question can be different numerical values. The zero value of this coefficient indicates a lack of reliability and +1 denotes complete reliability.

Cronbach's alpha higher than 0.7 means acceptable reliability. The Cronbach's alpha of our questionnaire was 0.805, which indicates its acceptable reliability. It was calculated using SPSS. (Cronbach's alpha was calculated using data from 20 pre-test questionnaires.)

4. Results

In this section, the research findings are analyzed and analyzed based on methodology. In order to analyze the risk of IT projects, it is necessary to analyze the data based on descriptive and inferential statistical methods.

The results showed that most of the studied samples were males (73.8%), single (60%), in the age group of 31-40 (47.6%), had a bachelor's degree (51%), 11-20 years of job experience (52.3%) (Table 1).

As it can be seen in Table 2, among the 7 groups of main risks for the use of IT in hospitals, the highest and lowest means were related to "Human Resource Risks" (4.15) and "Market Risks" (2.64), respectively. On the other hand, among the subgroups studied, the highest and lowest means were related Lack of commitment and motivation of team members (4.4) and IT Market Bad Conditions (2.3), respectively.

Table 1. Demographic characteristics of the studied samples (N=65)

Variables		Frequency (%)
Gender	Male	48 (73.8%)
	Female	17 (26.2%)
Marital Status	Single	39 (60.0%)
	Married	26 (40.0%)
Education Level	Diploma	5 (7%)
	Associate Degree	8 (12.3%)
	Bachelor's Degree	33 (51%)
	Master's Degree	17 (26%)
	PhD	2 (3%)

Age Group	15-20	8 (12.3%)
	21-30	22 (33.8 %)
	31-40	31 (47.6%)
	41-50	4 (6%)
	>50	0 (0%)
Job Experience (Years)	1-10	21 (32.3%)
	11-20	34 (52.3%)
	>20	10 (15.3%)

Source: The author.

Table 2-The Frequencies and Means of Studied Risks and their subgroups

Groups	Variables	Subgroups	Strongly Disagree	Disagree	No comments	Agree	Strongly Agree	Mean	Total Mean
Market Risks	X1	Lack of Customer (Patient) Expectations for IT Facilities	2	31	21	9	2	2.6	2.64
		IT Market Bad Conditions	10	33	14	4	4	2.3	
	X3	Competitors low Activities in IT Projects	0	25	23	15	2	2.9	
Project Management Risks	X4	Lack of risk management	0	12	13	32	8	3.5	3.5
	X5	Lack of change management	2	15	22	14	12	3.2	
	X6	Lack of planning	1	8	14	28	14	3.7	
	X7	Lack of project monitoring and control	0	6	13	34	12	3.8	
Human Resource Risks	X8	Lack of Training	0	3	4	26	32	4.3	4.15
	X9	Lack of commitment and motivation of team members	0	1	3	29	32	4.4	
	X10	Lack of team members expertise	0	3	7	19	36	4.3	

	X11	Lack of team members experience	2	5	12	35	11	3.7	
	X12	Lack of employees morale	1	4	14	26	20	3.9	
Technical Risks	X13	Difficulty of software and hardware updates	0	1	19	30	15	3.9	3.7
	X14	Lack of technical equipment	1	3	15	34	12	3.8	
	X15	Security issues	2	5	22	20	16	3.6	
Organizational Risks	X16	Inappropriate Organizational environment	3	7	25	20	10	3.4	3.6
	X17	Lack of organizational culture support	0	3	21	26	15	3.8	
Financial Risks	X18	High hardware and software cost	0	1	16	23	20	4.03	4.08
	X19	Lack of financial management	1	2	19	8	35	4.1	
Strategic Risks	X20	Project inappropriateness with the organizational process	4	13	22	18	8	3.2	3.3
	X21	lack of executive support	3	5	28	22	7	3.3	
	X22	ambiguity in defining goals	4	9	21	19	12	3.4	

Source: The author.

In order to check whether the studied risks had any effects on the implementation of IT in hospitals and the amounts of their effects, the SEM (Structural Equation Modeling) with LISREL 9.30 were applied. The label amounts are calculated based on running the Standard model. Each of these labels shows the effect on the main latent variable (IT Risks).

As it can be seen in Figure 1, the results of SEM represented that “Lack of Customer (Patient) Expectations for IT Facilities” ($X_1=0.25$) among Market Risks, “Lack of change management” ($X_2=0.55$) among Project management Risks, “Lack of team members expertise” ($X_{10}=0.9$) among Human Resources Risks, “Difficulty of software and hardware updates” ($X_{13}=0.55$) among Technical Risks, “Inappropriate Organizational environment” ($X_{16}=0.48$) among Organizational Risk, “Lack of financial management” ($X_{19}=0.73$) among Financial Risks, “Project inappropriateness with the organizational process” ($X_{20}=0.45$) among Strategic Risks, had the largest effects on the implementation of IT projects in hospital. According to the results presented in the SEM, the entire of examined risks influencing the implementation of IT projects in hospitals were acceptable, among which the market risks (label=0.25) and human resource risks (label=0.78) had the highest and lowest effects, respectively.

Additionally, according to Table 3 and the results of the fitting variables (which are obtained from LISREL), the proposed model was suitable and also acceptable.

Table 3-Fitting variables of the proposed structural model

Fitting Variables	Values	Acceptable Range
χ^2	377	-
df	129	-
χ^2/df	2.92	$1 < x < 3$
P-Value	0.000	< 0.05
RMSEA	0.068	< 0.08
IFI	0.990	> 0.90
CFI	0.990	> 0.90

Source: The author.

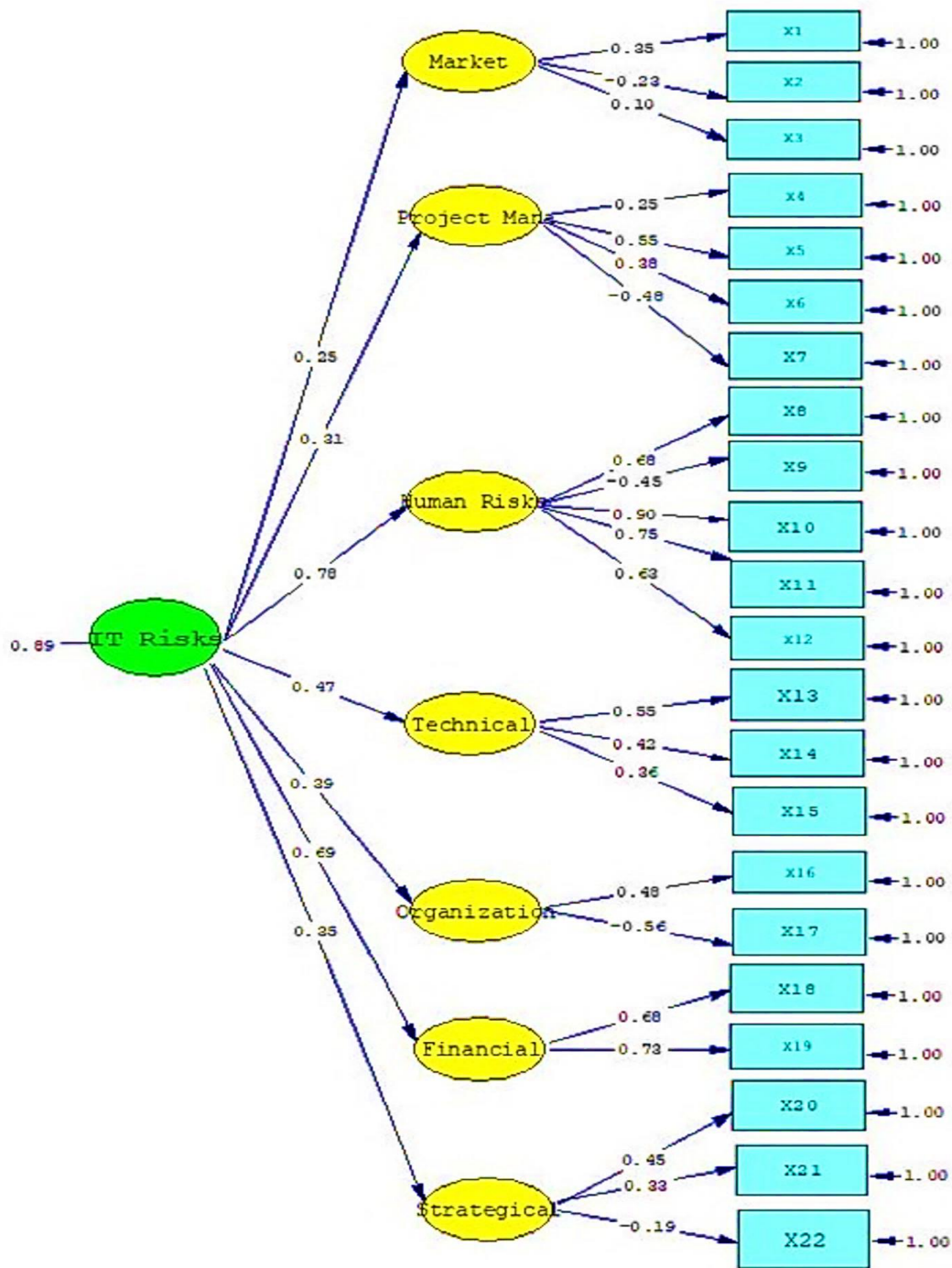


Figure 1. The effects of risks on the implementation of IT projects in hospitals

5. Discussion and Conclusion

Today, the use of IT has affected the performance of hospitals. However, there are some risks to the implementation of IT. In this regard, the present study was performed to examine such risks in hospitals in Tehran, Iran. In this research, the risk factors for implementing IT projects were identified after reviewing a wide range of studies and studies carried out in previous years and classified according to the literature review in seven main risk groups of market risks, project management risks, human resource risks, technical risks, organizational risks, financial risks, strategic risks. In the next step, by designing a 5-point questionnaire, the importance of these risks was determined by the experts, and the priority of each of them was determined at this stage. Then, in order to find out whether these factors has any effect on IT implementation in the hospitals or not, and the effect value of each of, SEM was drawn using the LISREL9.3 software.

In market risks, the item of Competitors low Activities in IT Projects had the highest mean. In order to overcome this risk, it is better to point out to staff that one of the criteria of superiority to competitors is the use of IT tools in the hospital. Therefore, if the rival hospital does not work well and you are active in this field, this can be a strong point for your hospital that can distinguish you from others.

In Project Management risks, the item of Lack of project monitoring and control had the highest mean. In order to overcome this risk, it is advisable to carry out the process of implementing IT projects in hospitals, with the help of an expert project manager and a project control expert to monitor and control the implementation of the project.

In human resources risks, Lack of commitment and motivation of team members had the highest mean. In order to overcome this risk, financial and morale encouragement for employees is one of the important ways to motivate them. There is a need to think about ways that managers can adequately appreciate the staff for the use of IT tools rather than paperwork at the hospital.

In management science, there are many motivational theories. The theory of hierarchy of needs presented by Abraham Maslow is one of the most famous among them. Maslow established his theory based on the assumption that there are four categories of needs within each person (categorized): 1-Physiological: includes hunger, thirst and refuge, and so on.

2-Safety: Safeguard against physical and emotional hazards. 3-Respect: Divided into internal and external parts, which include self-esteem, self-determination, progress, and reputation and attraction. 4-Self-Flourishing: A person tries to achieve something which he has the talent.

To motivate an employee, his position must first be identified in the hierarchy of needs, and then action is taken to meet those needs. The IT manager should pay attention to these kind of employees need to encourage them to use IT tools.

In general, in order to eliminate all other risks of human resources, Announcing the use of IT in the hospitals, holding conferences about new IT developments with employees, suitable training, encouraging them to use IT tools, providing a motivating atmosphere to use IT tools for employees, are a few effective ways.

In technical risks, Difficulty of software and hardware updates, had the highest mean. In this case, we have to use highly skilled software and hardware experts in the hospital. It is also necessary to use advanced technologies that are not expensive to upgrade.

In organizational risks, Lack of organizational culture support, had the highest mean. In this case, it is better to use the younger forces in the hospital. Training sessions can be organized to educate and express the importance of using and deploying IT tools in the organization. Certainly, management has a significant role to play in changing organizational climate and culture. The more an administrator is up-to-date and more connected with new technologies, the organization's members will also seek to learn more about them, and then eventually the organization's culture will change.

In the financial risks, Lack of financial management had the highest means. As we know, lack of financial resources and financial uncertainty are important challenges that can have adverse effects on the financial decision-making process in a hospital. Understanding the fundamentals of financial management and how financial information is provided and how costs are shared in a hospital helps its managers manage a dynamic picture of their activities and goals, especially the implementation of IT projects.

In the strategic risks, ambiguity in defining goals, had the highest means. If the goals of the organization are not identified, the route of the organization will not become clear, and when the direction of the organization's movement and its activities are unclear, there will be ambiguity and

deficiency of the organization and employees will be uncertain. Undoubtedly, this will reduce the effectiveness of the organization. As a result, the goals of IT implementation in hospitals should be well defined.

In general, since one of the most important factors in the success or failure of IT projects in the hospital is the growing risks in today's complex world, so neglecting such a large scale thing, would undoubtedly have adverse effects in the implementation of such projects in the hospitals. Therefore, it is suggested to the IT department in hospitals to study this issue by creating a department called risk analysis. Then by updating its information in this area, it will create more favorable conditions for the success of implementing IT projects.

In addition, many of the managers and caretakers who are active in the field of information technology projects in hospitals, believe that the technical risks and the IT projects time and cost risks are the most important risks in IT projects. But, according to the findings of this research, human resources risks are prioritized, and therefore, IT managers in hospitals are advised to pay more attention to this item, which unfortunately is less applied in Iran, and this is perhaps one of the main reasons for the failure of IT projects in hospitals.

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