



ELSEVIER

Available online at www.sciencedirect.com



Procedia Computer Science 3 (2011) 1602–1608

Procedia
Computer
Science

www.elsevier.com/locate/procedia

WCIT-2010

The impact of information technology on risk management

Maryam Teymouri^a*, Maryam Ashoori^b

^a Department of Computer Science Engineering, Institute of Iran Industrial Research, Qazvin, Iran

^b Graduate Master of Engineering, Industrial Engineering, Tehran, Iran

Abstract

In many organizations, information system and IT infrastructure have been considered as the most strategic capital and valid information is an important factor leads to business success. In this paper we investigate IT effects on project risk management which is vital in any industrial and business activities as a continuous and forecasting process. Risk management involves identifying the potential risks, measuring, monitoring and controlling them in an organization to meet its strategies and objectives and causes to decrease the undesired effects in project life cycles. It also has a main rule in strategic management of the organization by controlling the threads. In this paper we have estimated the effects of IT usage on 50 Iranian oil companies by analyzing the data which have been provided by questionnaires. Three different indices-cost, time, and performance-have been utilized to evaluate information technology impact on risk management. Our results illustrate the positive impact of information technology on risk management especially in optimizing time of process rather than cost and performance.

© 2010 Published by Elsevier Ltd. Selection and/or peer-review under responsibility of the Guest Editor.

Keywords: Risk Management; Strategic Management; Project Management; Information Technology; Evaluation Indices;

1. Introduction

Most of the organizations which have determined policy and objectives consider existed risks in their activities and try to protect their stakeholder profits by controlling them. Risk management is one of the main scopes of project. Its positive impact on planning, decision making, avoiding the bad events, and giving a proper response to the risky situation is remarkable.

In this paper, we don't want to define risk management and its advantages. We intend to investigate effects of information technology on risk management, so different people ideas in risk management discipline of Iranian companies have been collected by questionnaire to analyze information technology impacts on their work.

The ability of people to use information technology tools and also their knowledge of risk management process can be effective on results. People who are in main activity of the firms have different ideas in contrast to supporting parts staff. Although most of the results show positive impacts, in some sections we meet unsatisfied results.

Information technology may have direct or indirect effect on efficiency and effectiveness of risk management process. So this paper considers the impacts of information technology on three indices which show efficiency and effectiveness of process: time, cost, performance. In the following we focus on literature review, then the rule of

* Maryam Teymouri. Tel.: 00982813789001; fax: 00982813789004

E-mail address: m.teymouri@iir.ac.ir.

information technology is the subject of next part, and finally results collected of questionnaires will be analyzed to accept or reject the hypothesis.

2. Literature Review

McGaughey et al. [13] indicated that risk management is both a science and an art to identifying the treats, assessing and controlling them by energy saving methods. Loudon [12] believes that hardware, software, and network tools can be helpful in providing valid data which facilitate risk management process.

And while different work groups have access to general information, some items can be restricted to be access by all people [2]. Jabbari Gharabagh et al. [11] claimed that by using information technology tools, more integrated data to be access by risk management staff and so the risks of different planning and operational sections are monitored related together and the management of them can be integrated [9].

While using information technology may cause unpredicted risks which are not agreed with organization objectives [3], organization can control the risks by implementing information technology properly and defining IT policy according to organization objectives. Since boosting efficiency and effectiveness is the main strategy in most projects, we consider these matters in defining hypothesis regard to evaluating information technology impacts on risk management.

Davis et al. [6] resulted that information technology decreases time of processes in risk management by helping to follow the matters systematically. Information technology utilities accompany with Business Process Reengineering can effect on saving energy and resources that leads to controlling the cost of processes [1]. There is also evidence that stakeholder participation can enhance the quality of environmental decisions by considering more comprehensive information [15] which leads to effectiveness of process.

Advanced IT tools help to save valuable information about project and lessons learned concept appear through projects, so the experience of last project moves to new one and leads to better schedule, better budgeting, more communications, and spending more time on requirements not repeated affair [14], [7].

Risk management has stages of identifying risks, assessing risks, addressing and controlling them, and finally reviewing and reporting risks. In any stage IT can facilitate flexibility, compatibility, and integration of processes [17], [8], [16], [4]. Helland [10] pointed that organization should be aware that generating and distribution of information may threat their profits, so IT tools implementation effectively can create more secure situation.

3. HYPOTHESIS

We expect firms engaging in IT modern tools to experience a difference in their risk management performance. This suggests the following hypothesis:

HYPOTHESIS 1: Information technology has positive effects on time of risk management process.

HYPOTHESIS 1: Information technology has positive effects on cost of risk management process.

HYPOTHESIS 1: Information technology has positive effects on performance of risk management process.

4. Research Method

Our approach in this study was a survey and the instrument for data collection was a questionnaire. Data were collected from 50 Iranian firms active in oil production fields.

A set of items, based on the hypothesis, were developed and aggregated into 3 scales, time, cost, and performance for measuring information technology impacts on risk management process. There were also items which showed kind and size of organization, number of their staff, and number of active projects. We tried to choose the firms which were expected to have advanced operational and management tools. People who were selected to fill the form were specialists and managers in risk management discipline and had enough experience in this field. A five-point

Likert scale was used to measure each of the dimensions identified. They were anchored at the ends with “Strongly” and there is an item to identify the case of “Not Applicable” and is considered “Zero” in calculation.

As Cooper noted [5], to improve the validity and reliability of the survey data, the measurement instrument was evaluated by pre-testing the questionnaire prior to its administration. In this paper we used logical approach which was done in two steps: 1- Personal interviews were conducted with some participants in order to see if the items are understandable, they also check length of the questionnaire, sequence of questions, sensitivity of the items, and the time needed to complete it. The participants were academic with practical experts in the fields of risk management. The instrument was modified regarding to the comments of participants. After pre-testing, the questionnaire was sent to a group of ten respondents in positions similar to those of final respondents. They were asked to answer the questions and suggest any modifying views concerning our questions. We then applied slight modifications and prepared the final draft.

In order to assess the reliability of instrument, we calculated Cronbach’s alpha for criteria of research variables. The reliability coefficient (Cronbach’s alpha) was above 0.70, 0.829, and approved the questionnaire reliability.

5. Dependent and Independent Variables

While information technology was considered as independent variable, time, cost, and performance of risk management process served as dependent variables.

6. Sampling

Questionnaires were sent out to oil production firms in Iran. We have selected the top 50 firms with respect to their yearly turnover. In average, we considered 6 persons who are experienced in risk management. So the statistical society is 300 people and for identifying sampling we used of the following quotation:

$$n = NZ_{\alpha/2}^2 P(P-1) / N\epsilon^2 + Z_{\alpha/2}^2 P(P-1) \quad (1)$$

Where n is the sample size, N is population size, Z is the value for selected alpha level of .025 in each tail = 1.96, $(p)(p-1)$ = estimate of variance = .25, ϵ is the acceptable margin of error which is 0.1

So 73 questionnaires were given to skillful people that 63 of them were returned completely, 6 of them were not returned and 3 ones were incomplete.

7. FINDINGS

The findings of this study are demonstrated in two parts:

1-Firms features which have been shown in the form of descriptive analysis in the following table.

Table1. Descriptive Analysis

| | | |
|---------------------|---------------------|-------------------------------|
| Organization Type | Private - 59.4% | Public - 40.6% |
| Projects Period | Year - 26.6% | Month - 73.4% |
| Projects Widespread | Organization - 3.1% | Through Organizations - %21.9 |
| | | Through Cities - %43.8 |
| | | Through Countries - %31.2 |
| IT Usage | Low - 6.2% | Medium - 42.2% |
| People | | High - 51.6% |
| IT experience | Low - 6.2% | Medium - 21.9% |
| | | Good - 64.1% |
| | | Perfect - 7.8% |

2- The purpose of this part is to investigate the relationship between information technology and risk management according to mentioned hypothesis. The findings of this study are demonstrated in the form of one-tailed binomial test to accept or reject the hypothesis. To test the hypothesis, we consider 5 as highest degree and 3 as an acceptable

degree for answers of each question. So the accepted ratio is $3/5=0.6$ and we have:

H0 : $P \geq 0.6$ (No Positive Impact of IT)

H1 : $P < 0.6$ (Positive Impact of IT)

The Tables below show the observed ratio for each question.

Table2. Statistical Analysis – Time Index

| 7 questions related to IT effects on time of risk management | Groups | Ratio | Number | Observed Ratio | Test Ratio | Error Margin |
|---|---------------|--------------|---------------|-----------------------|-------------------|---------------------|
| IT effects on decreasing time of searching | Group 1 | ≤ 3 | 11 | .2 | .6 | .000(a,b) |
| | Group 2 | > 3 | 53 | .8 | | |
| | Total | | 64 | 1.0 | | |
| IT effects on decreasing time of identifying risks of project | Group 1 | ≤ 3 | 23 | .4 | .6 | .000(a,b) |
| | Group 2 | > 3 | 41 | .6 | | |
| | Total | | 64 | 1.0 | | |
| IT effects on decreasing time of evaluating risks of project | Group 1 | ≤ 3 | 21 | .3 | .6 | .000(a,b) |
| | Group 2 | > 3 | 42 | .7 | | |
| | Total | | 63 | 1.0 | | |
| IT effects on improving time schedule | Group 1 | ≤ 3 | 22 | .3 | .6 | .000(a,b) |
| | Group 2 | > 3 | 42 | .7 | | |
| | Total | | 64 | 1.0 | | |
| IT effects on decreasing time of reporting risks of project | Group 1 | ≤ 3 | 13 | .2 | .6 | .000(a,b) |
| | Group 2 | > 3 | 51 | .8 | | |
| | Total | | 64 | 1.0 | | |
| IT effects on using information and making them integrated for doing project more rapidly | Group 1 | ≤ 3 | 11 | .2 | .6 | .000(a,b) |
| | Group 2 | > 3 | 53 | .8 | | |
| | Total | | 64 | 1.0 | | |
| IT effects on giving time priority to the risks of projects | Group 1 | ≤ 3 | 33 | .5 | .6 | .106(a,b) |
| | Group 2 | > 3 | 31 | .5 | | |
| | Total | | 64 | 1.0 | | |

Table3. Statistical Analysis – Cost Index

| 7 questions related to IT effects on cost of risk management | Groups | Ratio | Number | Observed Ratio | Test Ratio | Error Margin |
|---|---------------|--------------|---------------|-----------------------|-------------------|---------------------|
| IT effects on decreasing cost of identifying risks of project | Group 1 | ≤ 3 | 32 | .5 | .6 | .067(a,b) |
| | Group 2 | > 3 | 32 | .5 | | |
| | Total | | 64 | 1.0 | | |
| IT effects on decreasing cost of evaluating risks of project | Group 1 | ≤ 3 | 29 | .5 | .6 | .017(a,b) |
| | Group 2 | > 3 | 34 | .5 | | |
| | Total | | 63 | 1.0 | | |
| IT effects on decreasing cost of controlling risks of project | Group 1 | ≤ 3 | 31 | .5 | .6 | .054(a,b) |
| | Group 2 | > 3 | 32 | .5 | | |
| | Total | | 63 | 1.0 | | |
| IT effects on decreasing cost of reporting | Group 1 | ≤ 3 | 24 | .4 | .6 | .000(a,b) |

| | | | | | | |
|--|---------|------|----|-----|----|-----------|
| risks of project | Group 2 | > 3 | 39 | .6 | | |
| | Total | | 63 | 1.0 | | |
| | Group 1 | <= 3 | 29 | .5 | .6 | .012(a,b) |
| IT effects on decreasing cost of project due to making its status more clear | Group 2 | > 3 | 35 | .5 | | |
| | Total | | 64 | 1.0 | | |
| | Group 1 | <= 3 | 30 | .5 | .6 | .023(a,b) |
| IT effects on forecasting project budget more exactly | Group 2 | > 3 | 34 | .5 | | |
| | Total | | 64 | 1.0 | | |
| | Group 1 | <= 3 | 39 | .6 | .6 | .432(b) |
| IT effects on giving cost priority to the risks of projects | Group 2 | > 3 | 24 | .4 | | |
| | Total | | 63 | 1.0 | | |

Table4. Statistical Analysis – Performance Index

| 15 questions related to IT effects on performance of risk management | Groups | Ratio | Number | Observed Ratio | Test Ratio | Error Margin |
|---|---------------|--------------|---------------|-----------------------|-------------------|---------------------|
| IT effects on identifying objectives of project more closely | Group 1 | <= 3 | 38 | .6 | .6 | .507(a,b) |
| | Group 2 | > 3 | 26 | .4 | | |
| | Total | | 64 | 1.0 | | |
| IT effects on improving performance of identifying risks of project | Group 1 | <= 3 | 29 | .5 | .6 | .017(a,b) |
| | Group 2 | > 3 | 34 | .5 | | |
| | Total | | 63 | 1.0 | | |
| IT effects on improving performance of evaluating risks of project | Group 1 | <= 3 | 34 | .5 | .6 | .241(a,b) |
| | Group 2 | > 3 | 28 | .5 | | |
| | Total | | 62 | 1.0 | | |
| IT effects on deleting reworking in sections | Group 1 | <= 3 | 20 | .3 | .6 | .000(a,b) |
| | Group 2 | > 3 | 43 | .7 | | |
| | Total | | 63 | 1.0 | | |
| IT effects on detection and removing conflicts of sections | Group 1 | <= 3 | 29 | .5 | .6 | .012(a,b) |
| | Group 2 | > 3 | 35 | .5 | | |
| | Total | | 64 | 1.0 | | |
| IT effects on participating stakeholders of project | Group 1 | <= 3 | 31 | .5 | .6 | .040(a,b) |
| | Group 2 | > 3 | 33 | .5 | | |
| | Total | | 64 | 1.0 | | |
| IT effects on reliability and validity of exchanged information | Group 1 | <= 3 | 21 | .3 | .6 | .000(a,b) |
| | Group 2 | > 3 | 43 | .7 | | |
| | Total | | 64 | 1.0 | | |
| | Group 1 | <= 3 | 25 | .4 | .6 | .001(a,b) |

| | | | | | | |
|---|---------|------|----|-----|----|-----------|
| IT effects on forecasting risks of future same projects | Group 2 | > 3 | 39 | .6 | | |
| | Total | | 64 | 1.0 | | |
| IT effects on increasing information security | Group 1 | <= 3 | 24 | .4 | .6 | .000(a,b) |
| | Group 2 | > 3 | 39 | .6 | | |
| | Total | | 63 | 1.0 | | |
| IT effects on monitoring and continuously process improvement | Group 1 | <= 3 | 28 | .4 | .6 | .009(a,b) |
| | Group 2 | > 3 | 35 | .6 | | |
| | Total | | 63 | 1.0 | | |
| IT effects on making integrated information to improve trade of project | Group 1 | <= 3 | 16 | .3 | .6 | .000(a,b) |
| | Group 2 | > 3 | 47 | .7 | | |
| | Total | | 63 | 1.0 | | |
| IT effects on improving performance of risk management due to making clear the process of the project | Group 1 | <= 3 | 31 | .5 | .6 | .054(a,b) |
| | Group 2 | > 3 | 32 | .5 | | |
| | Total | | 63 | 1.0 | | |
| IT effects on changing the techniques of the risk management | Group 1 | <= 3 | 37 | .6 | .6 | .528(a,b) |
| | Group 2 | > 3 | 25 | .4 | | |
| | Total | | 62 | 1.0 | | |
| IT effects on categorizing risks of projects | Group 1 | <= 3 | 35 | .6 | .6 | .275(a,b) |
| | Group 2 | > 3 | 28 | .4 | | |
| | Total | | 63 | 1.0 | | |
| IT effects on making relation between different steps of risk management | Group 1 | <= 3 | 22 | .4 | .6 | .000(a,b) |
| | Group 2 | > 3 | 40 | .6 | | |
| | Total | | 62 | 1.0 | | |

For any question, if the error margin is less than 0.05, H0 is rejected and H1 is approved. So we can see the IT positive impact. While the error margin more than 0.05 approves the H0 and reveals the low impact of IT. About the rows which show error margin less than 0.05, we also consider observed ratio of group1. As it becomes less than 0.06, the IT impact is higher.

In the “Time” section, we see incredible positive impact of IT in 6 related questions which shows IT can optimize the time of identifying, evaluating, addressing, and reporting the risks of projects.

In the “Cost” section, we see acceptable result only in responses to question NO.4 which shows IT can optimize the cost of reporting the risks of projects and no positive impact on other stages.

Finally In the “Performance” section, table reveals good results in IT impacts on reporting the risks by creating integrated data base. It leads to delete reworking and effects indirect on time and cost of process. It also helps more data to be access by stakeholders and implementing lesson learned concept which means using last projects experience in same new ones. Another point which can be effected by IT positively is the data security which is strongly related to IT proper implementation and controlling the data systems perfectly.

8. Limitations

Since Information Technology and also Risk Management are still areas which need to improve in some Iranian companies, we couldn't consider them in our analysis. On the other hand, due to questionnaire limitation, the study's sample size is 64 plants. This size may be considered small for our statistical analysis.

9. Future Research Recommendation

In this paper we studied IT impacts on risk management. In future studies, analysis can be done to measure the impact of IT infrastructure on other areas of project management. The same analysis for individual sectors with selecting higher sample could be carried out and it may help to prove the findings of this research.

Conclusion

In this research we prepare a questionnaire to investigate place of IT and also risk management in some Iran oil companies and studying the IT impacts on risk management process. By collecting data and analyzing them, we understood that IT tools have positive impacts on time rather than cost and performance of risk management process. Although we saw good results in some sections, more satisfied results have been expected. One of the reasons may be improper IT implementation or incomplete risk management execution. So in spite of making progress in Information Technology and Risk Management areas, first we need more focus on proper implementation and management of these fields in Iran.

References

1. Anthony Byrd Terry, H. Thrasher Evelyn, Lang Teresa, W. Davidson Nancy(2006) A process-oriented perspective of IS success: Examining the impact of IS on operational cost, PP 448-466.
2. Assmuth Timo, Hildén Mikael(2008) The significance of information frameworks in integrated risk assessment and management.
3. Bahli Bouchaib, Rivard Suzanne(2005) Validating measures of information technology outsourcing risk factors.
4. Cho Taejun, Kim Tae Soo(2008) Probabilistic risk assessment for the construction phases of bridge construction based on finite element analysis, PP 383-400.
5. Cooper D.R.; Schindler, P.S., 2003. "Business research methods." 8th ed., McGraw Hill, pp. 234-240.
6. Davis Peter, Clay Dibrell C, D. Janz Brian(2002)The impact of time on the strategy performance relationship: Implications for managers.
7. Dikmen, Birgonul M.T., Anac C., Tah J.H.M., G.Aouad(2008) Learning from risks: A tool for post-project risk assessment.
8. Flanger Roger (2007) Management Risk For An Uncertain Future. The University of Reading.<www.bre.polyu.edu.
9. Gerber Mariana, Von Solms Rossouw(2005) Management of risk in the information age. Assmuth Timo, Hildén Mikael(2008) The significance of information frameworks in integrated risk assessment and management.
10. Helland Aasgeir(2009) Dealing with uncertainty and pursuing superior technology options in risk management—The inherency risk analysis, PP 995-1003.
11. Jabbari Gharabagh M, Asilian H, Mortasavi S.B, Zarringhalam Mogaddam A, Hajizadeh E, Khavanin A(2009). Comprehensive risk assessment and management of petrochemical feed and product transportation pipelines.
12. Loudon T.V(2002) Geoscience after IT: Part A. Defining information technology, its significance in geoscience, and the aims of this publication.
13. McGaughey Jr Ronald, A. Snyder Charles, H. Carr Houston(1994) Implementing Information Technology for competitive advantage: Risk Management issues, PP 273-280.
14. Paxton Larry (2007). "Faster, better, and cheaper" at NASA: Lessons learned in managing and accepting risk.
15. Reed Mark(2008) Stakeholder participation for environmental management, PP 2420-2421.
16. Taylor Nicholas(2007) A note on the importance of overnight information in risk management models, PP 161-180.
17. Wang Minhong, Wang Huaqing, Xu Dongming(2005) The design of intelligent workflow monitoring with agent technology, PP 257-266.