

Software Risk Management Barriers: an Empirical Study

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Abstract

This paper reports results from a survey of experienced project managers on their perception of software risk management. From a sample of 18 experienced project managers, we have found good awareness of risk management, but low tool usage. We offer evidence that the main barriers to performing risk management are related to its perceived high cost and comparative low value. Psychological issues are also important, but less so. Risk identification and monitoring, in particular, are perceived as effort intensive and costly. The perception is that risk management is not prioritised highly enough. Our conclusion is that more must be done to visibly prove the value : cost ratio for risk management activities.

1. Introduction

Despite at least two decades of software risk management research, including some extensive research programmes [8], software project failure remains alarmingly frequent, with a recent global survey reporting failure rates of up to 15.5% [10]. Here, we pose the following question. “What hinders companies from doing software risk management?”

2. Background

Boehm’s [3] six phases (*Risk Identification, Risk Analysis, Risk Prioritization, Risk-Management Planning, Risk Resolution and Risk Monitoring*) are now well known and have been incorporated into the software development process. An example approach is ‘RiskMan’ [4] which advances Boehm’s steps with a process for risk management, closely linked to historical data, and a project management tool. Gotterbarn and Rogerson [12] introduced a risk management approach called ‘SoDIS’. Their study discussed the issue of how to address risk analysis, identification of stakeholders and the need for qualitative approaches to risk. Freimut et al. [11] presented results from a case study using the ‘RISKIT’ method in a large telecommunication company and

claim a systematic approach which emphasises the goals of stakeholders. Dey et al. [6] presents a single case study for an integrated framework for managing risks from the software developers’ perspective.

As more and more studies are done, it is evident that these have similar scope, building on methods of Boehm [3] and Charette [5]. However, some claim that risk management should be looked at from a different perspective and new methods should be introduced.

Hence, many have introduced new methods and tools for software risk management and have provided varying degrees of evidence for their efficacy. At the same time others have reported problems:

- handling risks is difficult due to complexity [14];
- risks are not well understood [20];
- there are too many risks to manage within resource limitations [16]; and
- a lack of motivation among developers to perform risk management [17].

3. Motivation and Research Methods

Based on the available literature, despite many well documented approaches, a conclusion can be made that the extent of human effort associated with risk management presents a difficulty. Referring to Boehm’s tutorial [3] on risk management there is potentially a lot of costly and monotonous work to be done, since his six phases have many associated candidate activities. Moreover, the problem is confounded by psychological and motivational issues and some of these contribute to over-optimistic behaviour and ignorance of risk [1].

3.1 Research Methodology

Easterbrook et al. [9] provide five classes of research method for software engineering, of which a survey is useful if data is to be sought from a large number of companies. Pfleeger and Kitchenham [19] provide a definition of a survey: “It is a comprehensive system for collecting information to describe, compare or explain knowledge, attitudes and behavior”. Our

survey, using an online questionnaire [18], was unsupervised, simply for the practical reason of the predicted effort otherwise, had all invited participated.

The survey targeted current practices and perceptions of risk management, but in this paper we specifically investigate the perception of experienced project managers on the barriers to software risk management. The population was software development companies with offices in Northern Ireland and built using a combination of contact lists from the regional government economic development agency and from the local ICT trade association. To avoid dormant companies and those still in start up, the list of contacts was screened to exclude companies with a total number of employees less than 10, so avoiding companies that were immature, and by implication less likely to have fully established or stabilised software processes. The total final population consisted of 89 companies and 18 of these responded. The responding companies were all software development companies, involved in the commercial production of software.

Since we were examining the perception of experienced software project managers, we defined this initially as those with at least 2 years of experience in that role.

4. Results

Within our sample, 12 companies reported having a defined risk management process. When asked about the frequency of risk identification in their projects 4 project managers stated “Every” project, 5 stated “Almost All” and 3 stated “Some” projects.

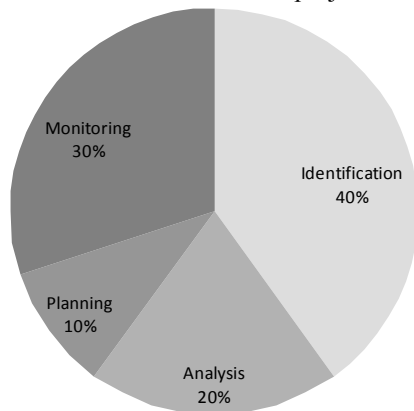


Figure 1. Effort for Risk Management Activities

The survey asked about the effort required for individual risk phases. 40% agreed that Risk Identification was the most effort-intensive practice (Figure 1), with 30% selecting Risk Monitoring.

Respondents were also asked to comment directly about the most complicated risk management step or process. While not generalizable globally, we summarise them here as a useful insight.

- Risk Monitoring can be difficult, where it involves tracking risks across large projects/ multiple teams.
- Risk Management is difficult if treated as a separate activity.
- The discipline required to continually review and manage risks is challenging.
- Project pressures put the focus on schedule, quality and budgetary control rather than risk management.
- Risk calculations are highly subjective.
- Reaching a consensus about risks is difficult.

The survey attempted to assess the barriers to applying risk management as described by Dedolph [7] (Figure 2). Respondents were asked to rank the barriers from 1 (most agreed) to 9 (least agreed). The final percentage score for each barrier was derived using the calculation $(100 / t) \sum s_i$, where s_i is the score from each respondent ($s_i = 9 - \text{rank} + 1$), and t is the total of all scores.

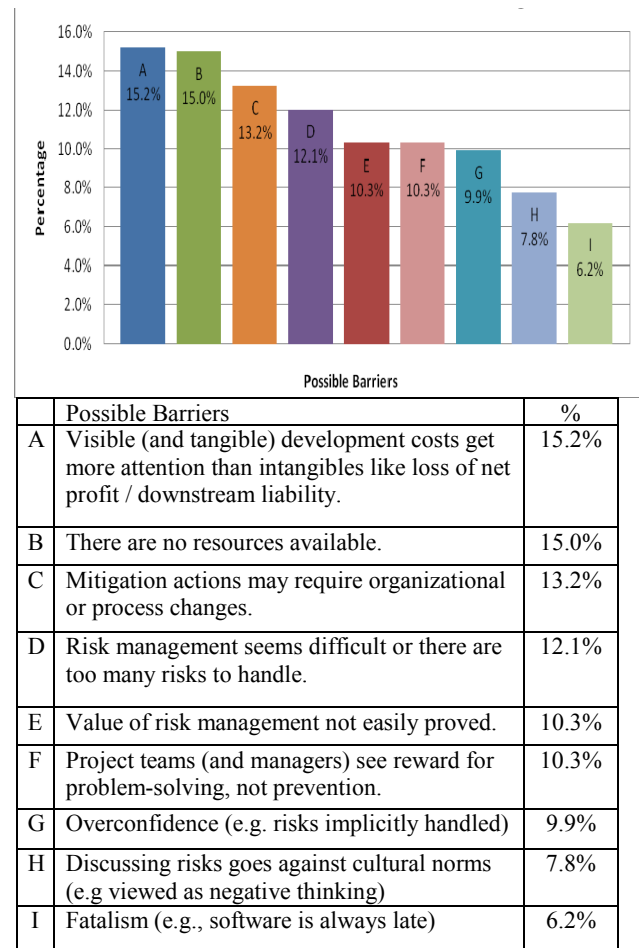


Figure 2. Perceived Barriers

Project managers were asked if they used a tool to manage risk. Only one company responded positively, corresponding to an organisation with more than 4000 software developers, the 3rd largest in our sample.

5. DISCUSSION

Our survey revealed good awareness of risk management among the sampled project managers. It also discovered that formal risk identification is common. Nonetheless, our survey offers evidence that the barriers to the application of risk management are mostly due to its perception as not being as valuable as other activities. The indications are that psychological factors are also at play, but less important as a barrier.

5.1 Study Validity

External Validity: Questionnaires are known for low response rates and our return of 18/89 means that our evidence is not conclusive, but indicative. The sample is also related to a single geographical territory so that there is the possibility of a cultural bias. The sample was, however, mixed in terms of indigenous and foreign owned companies. The company sizes ranged from 16 to 100,000 employees.

Construct Validity: In maximizing the time given to answering the questionnaire, we did not attempt to test respondent knowledge, but based on their stated experience levels assumed that the respondent understood the terms being used. The survey followed on from another survey on early project planning [13]. Thus the threat of the questions being the wrong ones to ask was mitigated. Each question left space for elaboration, and when asked for comment on the questionnaire, only favorable responses were received.

Internal Validity: The authors used generic contact lists and the emails provided therein. We specified that the questionnaires should be passed on to an experienced project manager, and assume that this was carried out faithfully. As a check, we asked specifically about job role and experience and received responses of either “project manager” or “project leader”. The mean number of years experience they had in this role was 8.8 years, and the range was 2 to 20 years. 12 of the respondents had more than 5 years experience in a project managing role and 8 had more than 10 years.

Conclusion Validity: The research provides a mixture of quantitative and qualitative data. Given that it is a small sample and from one region of the United Kingdom, the results cannot be assumed to be generically applicable. Our sample is of experienced project managers; the appropriateness of extending the conclusions to others is left to the reader.

5.2 Discussion of Findings

Our response on asking which risk management activity is the most effort intensive showed that most considered risk identification as the most problematic. Since this is the most basic activity and the one on which all others depend on, it offers evidence of problems in the whole risk management process.

However, we wished to find out what experienced project managers perceived as the largest barriers to performing risk management. The categories ranked in the legend in Figure 2 indicate that the biggest barriers are related to the perceived value (or lack of value) in performing risk management. Items A-F can all be explained in terms of value. Item A refers to other activities taking priority, implying that those activities are of higher value and that risk management can be sacrificed for them. Item B also implies that risk management is not worth the effort. Item C implies an unacceptable cost to management in implementing risk management process. Item D indicates a perception that not enough resources can be assigned, or in other words that there is not a good enough economic argument for employing them. Item E is self explanatory and relates closely with Items A-D. Item F further illustrates the perceived value in other activities over risk management. If management are rewarding other activities or outcomes and ignoring risk management, then it is less likely to be performed. While, the six highest scored barriers can all be related to a consideration of the value of risk management activities compared to the cost of carrying them out, the lowest ranked (items G to I) are concerned with attitudes and human behaviour [17]. Overall the value:cost ratio seems most important. Given that there are many publications providing evidence for the value of risk management, it justifies efforts in future to try to reduce the cost of risk management. Only one of our sample reported using a tool, implying that conventional tools have not seen as the solution. Equally, it could be that the benefits of risk management have not been communicated sufficiently. This point is emphasised by Bannerman [2], who argues that one of the challenges faced in organizations is that they are driven by demonstrable outcomes, usually performance. Hence, when the project is successful, it is difficult to show any part of the outcome pertaining to risk management.

The last three items in the table, the least important barriers all relate to psychological and human factors. These were all ranked lowly by the project managers but indicate an attitude to risk management that influences negatively. Given that they were uniformly ranked as less important, we cannot conclude that these

are as big a problem as the economic perception of risk management.

The results generally show motivation concerns among stakeholders. Future work will relate this to Expectancy Theory [21] which argues that motivation is achieved by explicitly linking effort, performance and outcome. Thus, there is a need to demonstrate that an increased effort in risk management will lead to increased performance and valuable outcomes.

5.3 Conclusions

We have concluded that, in our sample at least, there is good awareness of Software Risk Management. Nonetheless, we have confirmed barriers that prevent or reduce its application, the main ones being related to the extent of human effort required or the perceived value of that effort. Despite this, none of our sample used dedicated risk management tools. Hence, as future research we are investigating how routine risk management actions can be carried out by tools, preferably autonomically. Software agents [15] may help because, unlike conventional software components such as objects, they are not passive, and so can act on behalf of people to achieve goals. In this scenario, agents will initiate actions based on their assigned goals and rules, and therefore help in making intelligent judgments and decisions regarding risks. This may involve routine decision making or timely and tailored decision support for humans.

In future, we plan further empirical studies to confirm our findings, or otherwise. Nonetheless, we believe that the results from this survey are useful, be that in improving risk management processes or informing better risk management practices. Ultimately, we seek to improve the situation by developing an agency approach, where the risk management process is better supported or in part automated. At the same time any new approaches to risk management should be backed up with empirical evidence of their value and applicability.

6. REFERENCES

- [1] Bandyopadhyay, K., Mykytyn, P. P., Mykytyn, K., A., 1999, A Framework for Integrated Risk Management in Information Technology, *Management Decision* 37/5 pp. 437-444.
- [2] Bannerman, P. L., 2008, Risk and risk management in software projects: A reassessment, *J. Systems and Software*, Volume 81, Issue 12, (Dec.), pp. 2118-2133
- [3] Boehm, B. W., 1989, *Software Risk Management*, IEEE Computer Society Press, Washington D.C.
- [4] Carter, B., Hancock, T., Morin, J., Robins, N., 1994, *Introducing Riskman Methodology*, NCC Blackwell.
- [5] Charette, R.N., 1989, *Software Engineering Risk Analysis and Management*, McGraw-Hill, NY.
- [6] Dey, P. K., Kinch, J., Ogunlana, S. O., 2007, Managing Risk in Software Developments Projects: A Case Study, *Emerald IMDS*, Volume 107, No. 2, 284-303.
- [7] Dedolph, F.M., 2003, "The neglected management activity: Software risk management", *Bell Labs Technical Journal*, Volume 8 Issue 3, (Dec), 91 – 95.
- [8] Dorofee, A., Walker, J., Alberts, C.J., Higuera, R.P., Murphy, R.L. and Williams, R.C., 1996, "Continuous Risk Management Guidebook", *Software Engineering Institute*, Carnegie Mellon University.
- [9] Easterbrook, S. Singer, J., Storey, M., Damian, D., 2008, *Selecting Empirical Methods for Software Engineering Research*, *Guide to Advanced Empirical Software Engineering*, pp. 285-311.
- [10] El Emam, K., Koru, A. G., 2008, A Replicated Survey of IT Software Project Failures, *IEEE Software*, 25(5), pp. 84-90.
- [11] Freimut, B., Hartkopf, S., Kaiser, P., Kontio, J., Kobitzsch, W., 2001, An Industrial Case Study of Implementing Software Risk Management, *ACM, ESEC/FSE 2001*, Vienna Austria, 277 - 287.
- [12] Gotterbarn, D. and Rogerson, S., 2005, Responsible Risk Analysis for Software Development: Creating the software development impact statement, *Communications of the Association for Information Systems*, 15, article 40.
- [13] Greer, D. and Conradi, R., An Empirical Study of Software Project Initiation and Planning, to appear *IET Software*, 2009.
- [14] Higuera R. P., Haimes, Y. Y., 1996, Technical Report CMU/SEI-96-TR-012 ESC-TR-96-012 *Software Risk Management*, Software Engineering Institute Carnegie Mellon University Pittsburgh, Pennsylvania 15213.
- [15] Jennings, N. R. 2000, On agent-based software engineering. *Artificial Intelligence*, 117:277–296.
- [16] Keshlaf, A.A., Hashim, K., 2000, A Model and Prototype Tool to Manage Software Risks, *Proc. 1st Asia-Pacific Conference on Quality Software* 297 – 305.
- [17] Kwak, Y.H., Stoddard, J., 2004, *Project Risk Management: Lessons Learned from Software Development Environment*, ScienceDirect, *Technovation*, Volume 24, Issue 11, Nov, pp. 915-920.
- [18] Odzaly, E.E., Greer, D., "Questionnaire on Software Risk Management", August 2009. [Online]. Available: <http://www.cs.qub.ac.uk/~Des.Greer/riskquestionnaire2009.doc> [Accessed: Aug. 18, 2009].
- [19] Pfleeger, S.L., and Kitchenham, B.A., 'Principles of Survey Research Part 1 - Turning Lemons into Lemonade', *ACM SIGSOFT Software Engineering Notes*, 2002, 26(6), pp. 16-18.
- [20] Ropponen, J., Lyytinen, K., 2000, Components of Software Development Risk: How to Address Them? A Project Manager Survey, *IEEE Transactions on Software Engineering*, 26(2), pp. 98-112.
- [21] Vroom, V.H., 1964, *Work and Motivation*, John Wiley and Sons, New York, NY.