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Use and benefits of tools for project risk management

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Abstract

Risk management is one of the key project management processes. Numerous tools are available to support the various phases of the risk management process. We present the results of a study designed to identify the tools that are most widely used and those that are associated with successful project management in general, and with effective project risk management in particular. The study is based on a questionnaire administered to a sample of project managers from the software and high-tech industries. The response data was analyzed in order to find which tools are more likely to be used in those organizations that report better project management performance and in those that value the contribution of risk management processes. © 2000 Elsevier Science Ltd and IPMA. All rights reserved.

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1. Introduction

The management of risk in projects is currently one of the main topics of interest for researchers and practitioners working in the area of project management. A recent survey of research on the topic by Williams [1] includes 241 references. Risk management has been designated as one of the eight main areas of the Project Management Body of Knowledge (PMBOK) by the Project Management Institute, which is the largest professional organization dedicated to the project management field. Further, most training programs for project managers include a course on risk management. Within the currently accepted view of project management as a life cycle process, project risk management (PRM) is also seen as a process that accompanies the project from its definition through its planning, execution and control phases up to its completion and closure.

A number of variations of the PRM process have been proposed. Boehm [2] suggested a process consisting of two main phases: risk assessment, which includes identification, analysis and prioritization, and risk control, which includes risk management planning, risk resolution and risk monitoring planning, tracking and corrective action. Fairley [3] talks about seven steps: (1) Identify risk factors; (2) Assess risk probabilities and effects; (3) Develop strategies to mitigate identified risks; (4) Monitor risk factors; (5) Invoke a contingency plan; (6) Manage the crisis; (7) Recover from the crisis.

The Software Engineering Institute [4], a leading source of methodologies for managing software development projects, looks at project risk management as consisting of five distinct phases (identification; analysis; response planning; tracking and control) linked by an ongoing risk communications effort. In its Guide to the Project Management Body of Knowledge, the Project Management Institute [5] presents four phases of the PRM process: identification; quantification; response development and control.

Kliem and Ludin [6] describe a four-phase process (identification, analysis, control and reporting) that parallels Deming's four steps for quality management (plan, do, check and act). Chapman and Ward [7] outline a generic PRM process consisting of nine phases: define the key aspects of the project; focus on a strategic approach to risk management; identify where risks might arise; structure the information about risk

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assumptions and relationships; assign ownership of risks and responses; estimate the extent of uncertainty; evaluate the relative magnitude of the various risks; plan responses and manage by monitoring and controlling execution. It is evident from this brief review of representative PRM processes that there is general agreement regarding what is included in the process, with the differences depending on variations in the level of detail and on the assignment of activities to steps and phases.

Of course, any PRM process requires tools for its implementation. The adoption of analysis, planning, control, or management tools involves a certain investment, which in certain cases may be quite significant. This cost represents the effort required, both at a personal and at the organizational level, to understand and to learn how to use the tool, and to acquire the necessary infrastructure (technical expertise, computing aids, databases, operating procedures, etc.). A question of major relevance to any individual or organization considering the adoption or improvement of a PRM process is: which tools can provide the greatest benefits?

In this paper we present the results of a study designed to answer this question. The approach taken consisted of surveying a sample of project managers in order to find out which tools are widely used, which tools are associated with successful project management in general, and with effective project risk management in particular. In this context, the term 'tool' is given a wide meaning, including not only special purpose tools, but also practices and processes that are likely to contribute to the management of risks in projects.

In the next section we describe the methodology of the survey, including the selection of the sample and the design of the questionnaire. This is followed by a statistical analysis of the results, and by a discussion of the practical implications of the results. We conclude with some observations regarding the way the research was carried out.

2. Methodology

The data for this study was obtained by means of a questionnaire. The questionnaire, which was written in Hebrew, was distributed either personally or via e-mail to a random sample of about 400 project managers from the software and high-tech sectors in Israel during April through June 1998. At the end of the survey period there were 84 usable completed questionnaires.

The questionnaire consisted of three main sections, each containing a number of brief questions to be answered on a 0–5 scale. The first section dealt with the extent of the contribution of individual PRM tools to the project success in general. The objective here was to identify the tools that were perceived as being the most valuable by the respondents.

The second section of the questionnaire dealt with the effectiveness and efficiency of the manner in which projects are managed in the respondent's organization. With these questions we sought to investigate whether there is a relationship between the use of PRM tools and the level of performance of the project management process.

The third section addressed the contribution of a risk management process to overall project success. In particular, we wished to learn about the differences in PRM tool usage between those project managers who believe that risk management is a valuable process, and those who do not. The specific questions that were included in each of the three sections along with analysis of the responses are presented next.

3. Individual tool contribution

This section of the questionnaire consisted of a list of 38 tools and practices mentioned in the literature as contributing to project risk management. The list was developed as follows. First, an initial compilation of over 100 tools was drawn from the literature. This list was presented to a panel of five individuals who had responsibility for PRM in their organizations: three major software development companies, a company engaged in the development and manufacture of communications hardware, and a manufacturer of chemical products. These five individuals eliminated from the lists duplicated tools, combined related tools into a single one, eliminated tools that were not applied in practice and added related tools that were missing from the list, yielding the final list of 38 tools. It is interesting to note that certain tools that are normally associated with risk management, such as decision trees, fault tree analysis and influence diagrams, were reported to be seldom or not used at all, and consequently are not included in the final list.

The tools were grouped according to the five stages of the Software Engineering Institute Risk Management process [4]. We added a sixth group for tools, processes and practices of a general nature. The tools in this group, which we called 'Background', are likely to affect the manner in which risks are managed without being specifically related to one of the five stages in the PRM cycle.

The respondents were asked to rate the contribution of each tool to the project risk management process by indicating a value between 0 (no contribution at all) to 5 (critical contribution). The results for the 38 tools, divided into the six groups, appear in Table 1, along with the mean and standard deviation of the responses. Bibliographical references mentioning the tools in the risk

management context are noted next to each tool description. The tools without references were added to the list based on suggestions from the panel. The rightmost column shows the ranking of the tools sorted in descending order of their mean score.

It is interesting to note that out of the ten tools that received the highest mean score, five belong to the 'Background' group, and that all the tools in this group received scores above the overall average of 2.72. This finding indicates that risk management is tightly related to other management practices, such as requirements management, subcontractor management, configuration control, and that the contribution of these types of organization-wide processes to effective project management is well recognized. Also, it appears that simulation and prototyping are development practices that are associated with risk management.

The tools in the risk control group are perceived as low contributors. There are two possible explanations for this finding. One is that currently there are no effective tools for risk control, and that the tools offered in the literature are not perceived to be adequate. The other explanation is related to management culture. Project managers might be willing to invest time and effort in the earlier phases of risk management, which are carried out in conjunction with other project planning activities. However, during the execution of the project they become busier and are subject to mounting resource and time pressures, and are likely to neglect the risk control phase. Consequently, risk control tools are

Table 1
Descriptive statistics for the PRM tools

Tool	Description	Group	Mean	Standard deviation	Ranking
T1	Checklists[8]	Identification	2.20	0.98	36
T2	Brainstorming[9,10]	Identification	3.74	0.79	8
T3	Risk documentation form[4]	Identification	2.65	0.94	29
T4	Periodic risk reporting[4]	Identification	2.88	1.12	24
T5	Risk probability assessment[2,11,4,8,12]	Analysis	3.57	1.01	14
T6	Risk impact assessment[2,11,4,8,12]	Analysis	3.86	0.68	3
T7	Risk time frame assessment[4]	Analysis	2.58	1.25	30
T8	Risk classification[13,4,14,15]	Analysis	2.38	1.17	33
T9	Ranking of risks[2,11,4,8,12]	Analysis	3.29	0.91	17
T10	Graphic presentation of risk information	Analysis	1.82	1.24	38
T11	Responsibility assignment[4]	Planning	3.99	0.84	2
T12	Planning for risk mitigation[4,14]	Planning	3.61	0.99	12
T13	Time-limited action-item lists	Planning	3.70	0.82	9
T14	Cost-benefit assessment during risk planning[10,16]	Planning	2.69	1.08	26
T15	Cause and effect analysis during risk planning[9,10,17]	Planning	2.33	1.14	34
T16	Project replanning for risk mitigation[4]	Planning	3.17	1.05	21
T17	Revision of risk assessments[4]	Tracking	3.30	0.77	16
T18	Periodic document reviews[4,8]	Tracking	3.18	1.01	20
T19	Periodic risk status reporting[4]	Tracking	3.20	1.05	19
T20	Periodic reporting of risk mitigation plans[4]	Tracking	2.80	0.93	25
T21	Periodic trend reporting[4]	Tracking	2.58	1.01	31
T22	Critical risk reporting to senior management[4]	Tracking	3.75	0.99	6
T23	Analysis of trends, deviations and exceptions[4]	Control	2.69	0.93	27
T24	Project replanning[4]	Control	2.94	1.02	23
T25	Procedure for closing risks[4]	Control	2.20	1.27	37
T26	Contingency plans for risk mitigation failure[4]	Control	2.43	1.14	32
T27	Cost-benefit analysis during risk control[10,16]	Control	2.68	1.10	28
T28	Cause and effect analysis during risk control[9,10,17]	Control	2.27	0.99	35
T29	Prototyping	Background	3.75	1.03	7
T30	Simulation	Background	4.00	0.85	1
T31	Benchmarking	Background	3.58	0.87	13
T32	Requirements management[18]	Background	3.69	0.89	10
T33	Subcontractor management[18]	Background	3.77	0.96	5
T34	Configuration control[18]	Background	3.81	0.70	4
T35	Quality control[18]	Background	3.69	0.76	11
T36	Quality management[18]	Background	3.39	0.76	15
T37	Training programs[18]	Background	3.11	0.82	22
T38	Customer satisfaction surveys	Background	3.27	0.96	18
	Average across all tools		2.72	0.64	

Table 2
Descriptive statistics for the project management performance questions

Question: To what extent do the projects you manage exhibit the following characteristics?		Mean	Standard deviation
1.	Extent and frequency of plan changes	1.85	1.02
2.	Frequency of emergency meetings	2.85	1.18
3.	Agreement between effort invested and effort required	2.04	0.80
4.	Participant satisfaction	3.30	0.85
5.	Customer satisfaction	3.60	0.75
6.	Number of post-delivery product changes	2.71	1.02
	Project Management Performance (PMP) index	2.72	0.64

used sporadically or not at all, and their contribution is rated as low.

4. Project management performance

This part consisted of six questions designed to represent the manner in which projects were managed at the respondent's organization. We addressed two complementary aspects of project management: efficiency and effectiveness. By efficiency we meant that the project is managed without unnecessary expenditure of effort, which we attempted to measure by considering the extent of project plan changes, emergency meetings and effort invested. By effectiveness we meant meeting the expectations of those involved in the project. Here we asked to rate the satisfaction of the project participants and of the customer, as well as the quality of the project output, as measured by post-delivery rework.

The respondents were asked to indicate the extent to which the projects they manage exhibit the characteristics listed in Table 2, ranging from very low (0) to very high (5). The responses to questions 1, 2, 3 and 6 were recoded so that a higher value indicated a more favorable situation. The mean and standard deviation of the (recoded) questions appear in Table 2. We defined the Project Management Performance (PMP) index as the average of the scores over the six items.

Fig. 1 shows a plot of the PMP index against total tool score. Each observation corresponds to one respondent. In some cases, two or more observations coincided on the chart and appear as a single point. We can see that there is a positive relationship between the extent of tool use and the PMP score. Indeed, the coef-

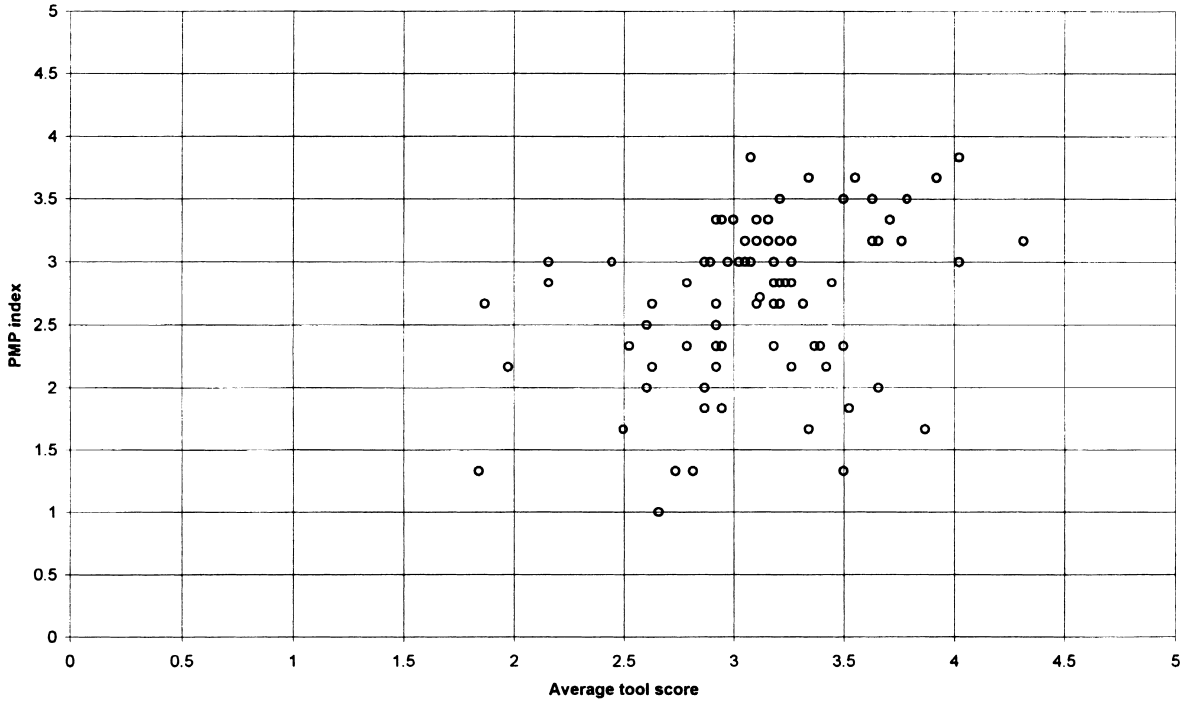

Fig. 1. Project Management Performance index against total tool score.

Table 3
Relationship between tool score and PMP index

	Tool	PMP low ($n=43$)	PMP high ($n=41$)	T-test significance
T1	Checklists	2.28	2.12	0.466
T2	Brainstorming	3.70	3.78	0.635
T3	Risk documentation form	2.51	2.80	0.153
T4	Periodic risk reporting	2.72	3.05	0.185
T5	Risk probability assessment	3.21	3.95	0.001*
T6	Risk impact assessment	3.65	4.07	0.004*
T7	Risk time frame assessment	2.33	2.85	0.053
T8	Risk classification	2.00	2.78	0.002*
T9	Ranking of risks	3.07	3.51	0.026*
T10	Graphic presentation of risk information	1.77	1.88	0.686
T11	Responsibility assignment	3.63	4.37	0.000*
T12	Planning for risk mitigation	3.44	3.78	0.118
T13	Time-limited action-item lists	3.79	3.61	0.301
T14	Cost-benefit analysis during risk planning	2.51	2.88	0.117
T15	Cause and effect analysis during risk planning	2.21	2.46	0.310
T16	Project replanning for risk mitigation	3.12	3.22	0.656
T17	Revision of risk assessments	3.14	3.46	0.054
T18	Periodic document reviews	2.86	3.51	0.003*
T19	Periodic risk status reporting	3.14	3.27	0.578
T20	Periodic reporting of risk mitigation plans	2.60	3.00	0.051
T21	Periodic trend reporting	2.35	2.83	0.029*
T22	Critical risk reporting to senior management	3.72	3.78	0.785
T23	Analysis of trends, deviations and exceptions	2.44	2.95	0.011*
T24	Project replanning	2.93	2.95	0.925
T25	Procedure for closing risks	2.09	2.32	0.421
T26	Contingency plans for risk mitigation failure	2.28	2.59	0.221
T27	Cost-benefit analysis during risk control	2.47	2.90	0.067
T28	Cause and effect analysis during risk control	2.07	2.49	0.051
T29	Prototyping	3.91	3.59	0.156
T30	Simulation	3.74	4.27	0.004*
T31	Benchmarking	3.42	3.76	0.073
T32	Requirements management	3.58	3.80	0.254
T33	Subcontractor management	3.56	4.00	0.035*
T34	Configuration control	3.74	3.88	0.389
T35	Quality control	3.67	3.71	0.844
T36	Quality management	3.21	3.59	0.023*
T37	Training programs	2.86	3.37	0.004*
T38	Customer satisfaction surveys	3.07	3.49	0.045*

ficient of correlation was 0.36 at a level of significance of 0.0008. This suggests that respondents who come from environments conducive to better project management performance are more likely to assign higher scores to project risk management tools.

To further explore the relationship between individual tool scores and the PMP score, we divided the 84 respondents into two sets, based on their PMP index value. The threshold value was 3, resulting in two sets of almost equal size: a LOW set (43 respondents with PMP below 3) and a HIGH set (41 respondents with PMP above 3). Table 3 shows, for each tool, the average score for each of these two sets of respondents. The Student t test was used to test the null hypothesis that the average scores in the populations represented by the two sets of respondents are equal. The rightmost column shows the level of statistical significance. Using 0.05 as the threshold for rejecting the null hypothesis, we highlighted with a star (*) the tools in which there is a statistically significant difference in score between the LOW and the HIGH populations. There were fourteen such tools, and in all cases the average tool score for the HIGH population was higher than for the LOW population.

Six of the fourteen tools belong to the Background group. This finding suggests that there is a link between the organization-wide application of practices such as Simulation (T30) and processes such as Subcontractor Management (T33), Quality Management (T36), Training (T37), Customer Satisfaction Surveys (T38), and an effective and efficient environment for managing projects.

Four tools — Risk Probability Assessment (T5), Risk Impact Assessment (T6), Risk Classification (T8) and

Table 4
Descriptive statistics for the Risk Management Contribution questions

Question: To what extent does the Risk Management process contribute to the following?		Mean	Standard deviation
1.	Overall project success	3.94	0.57
2.	Meeting project schedule	3.76	0.74
3.	Meeting project budget	3.58	0.78
4.	Meeting planned objectives	3.74	0.70
5.	Achieving customer satisfaction	3.36	0.93
6.	Success of other projects in your organization	2.89	0.99
	Risk Management Contribution index	3.55	0.51

Ranking of Risks (T9) — belong to the Analysis group, suggesting that more extensive use of risk analysis tools is associated with better project management practice. The other tools where there was a marked difference between the HIGH and LOW populations are Responsibility Assignment (T11), Periodic Document Reviews (T18), Periodic Trend Reporting (T21), and Analysis of Trends, Deviations and Exceptions (T23). Perhaps the common side of these tools is that they provide some structure and periodic discipline to the risk management effort, and that they can be implemented in an explicit and systematic manner.

It is also interesting to note that there was no significant difference in the scores given to the tools in the Identification group, suggesting that risk identification is carried out in basically the same manner in all organizations. Overall it appears that organizations that manage their projects more efficiently and more effectively tend to attach more value to risk analysis tools, tools that provide structure and discipline, and organization-wide processes associated with quality processes and practices.

5. Contribution of PRM process.

This part of the questionnaire was designed to find out the extent to which the existence of a process for managing risks was perceived to contribute to various aspects of project success. The premise behind this part of the analysis is that those respondents who perceive the contribution of PRM to project success to be higher are more likely to adopt and implement some type of risk management process than those who gave a low score.

One of the reasons we included this part is that we met many project managers who claimed that risk management was an unnecessary activity, and that the

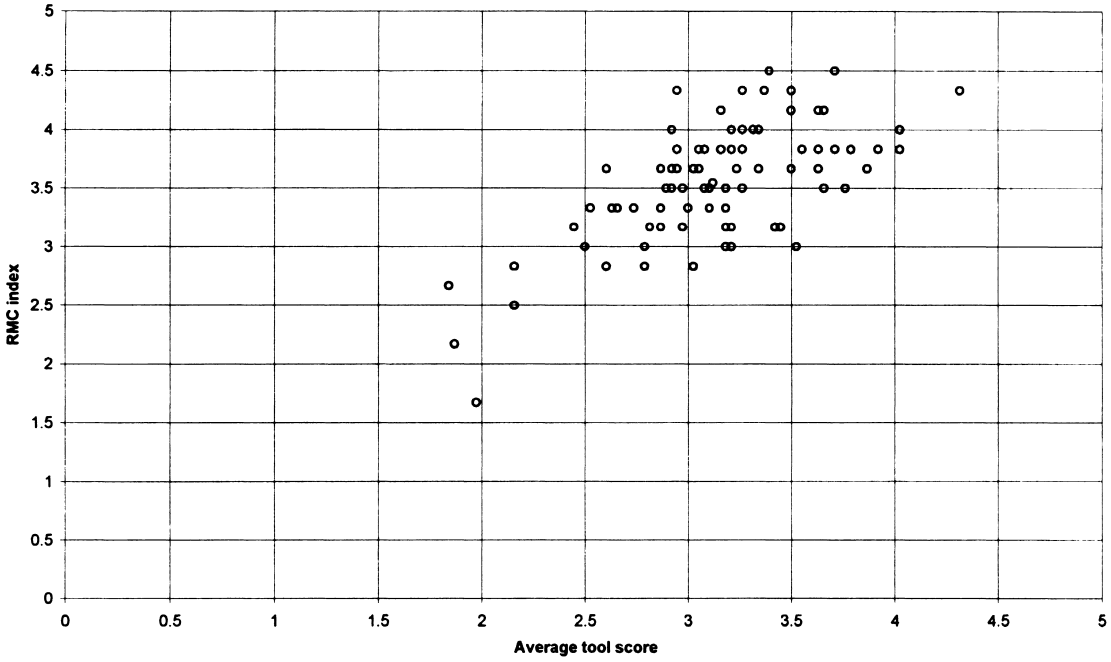

Fig. 2. Risk Management Contribution index against total tool score..

Table 5
Relationship between tool score and RMC index

	Tool	RMC low	RMC high	T-test significance
T1	Checklists	1.83	2.57	0.000*
T2	Brainstorming	3.57	3.90	0.054
T3	Risk documentation form	2.50	2.81	0.131
T4	Periodic risk reporting	2.79	2.98	0.441
T5	Risk probability assessment	3.43	3.71	0.196
T6	Risk impact assessment	3.69	4.02	0.024*
T7	Risk time frame assessment	1.98	3.19	0.000*
T8	Risk classification	1.81	2.95	0.000*
T9	Ranking of risks	3.05	3.52	0.016*
T10	Graphic presentation of risk information	1.62	2.02	0.137
T11	Responsibility assignment	3.98	4.00	0.898
T12	Planning for risk mitigation	3.52	3.69	0.446
T13	Time-limited action-item lists	3.74	3.67	0.692
T14	Cost-benefit analysis during risk planning	2.26	3.12	0.000*
T15	Cause and effect analysis during risk planning	2.02	2.64	0.012*
T16	Project replanning for risk mitigation	2.93	3.41	0.037*
T17	Revision of risk assessments	3.12	3.48	0.033*
T18	Periodic document reviews	2.81	3.55	0.001*
T19	Periodic risk status reporting	3.02	3.38	0.120
T20	Periodic reporting of risk mitigation plans	2.57	3.02	0.025*
T21	Periodic trend reporting	2.31	2.86	0.012*
T22	Critical risk reporting to senior management	3.50	4.00	0.020*
T23	Analysis of trends, deviations and exceptions	2.17	3.21	0.000*
T24	Project replanning	2.71	3.17	0.042*
T25	Procedure for closing risks	1.74	2.67	0.001*
T26	Contingency plans for risk mitigation failure	2.12	2.74	0.012*
T27	Cost-benefit analysis during risk control	2.33	3.02	0.003*
T28	Cause and effect analysis during risk control	2.00	2.55	0.010*
T29	Prototyping	3.76	3.74	0.916
T30	Simulation	4.02	3.98	0.799
T31	Benchmarking	3.43	3.74	0.102
T32	Requirements management	3.60	3.79	0.331
T33	Subcontractor management	3.45	4.10	0.002*
T34	Configuration control	3.64	3.98	0.029*
T35	Quality control	3.52	3.86	0.044*
T36	Quality management	3.19	3.60	0.014*
T37	Training programs	2.81	3.40	0.001*
T38	Customer satisfaction surveys	3.00	3.55	0.008*

resources it required could be put to better use elsewhere in the project. The questions in this part included, in addition to the four commonly accepted project success criteria (schedule, budget, objectives and customer satisfaction), two general items: overall project success and contribution to the success of other projects in the organization. Here we also defined a composite index, Risk Management Contribution (RMC), as the average of the responses to these six questions. The results for this part of the questionnaire appear in Table 4.

Fig. 2 shows a plot of the RMC index against total tool score. Each observation corresponds to one respondent. Here again, some points on the chart represent more than one observation. As anticipated, there is a strong positive relationship, with the coefficient of correlation equal to 0.67 at a level of significance of 0.0001. This means that those respondents who believe in the value of the risk management process as a contributor to overall project success are more likely to apply the tools in the list.

To further explore the relationship between individual tool scores and the perceived contribution of the risk management process, we divided the 84 respondents into two sets, based on their RMC index value. The threshold value was 3.5, resulting in two sets, a LOW and a HIGH set, both of equal size (42). Table 5 shows, for each tool, the average score for each of these two groups of respondents. Here again, the Student t test was used to test, at the 0.05 level of significance, the null hypothesis that the average scores in the populations represented by the two sets are equal. Tools in which there is a difference in score between the LOW and the HIGH populations are highlighted. Statistically significant differences were found in 24 of the 38 tools, and

Table 6
Tools with significantly higher use in the HIGH populations

Tool	Description
	Significantly higher use in RMC = HIGH and in PMP = HIGH
T6	Risk impact assessment
T8	Risk classification
T9	Ranking of risks
T18	Periodic document reviews
T21	Periodic trend reporting
T23	Analysis of trends, deviations and exceptions
T33	Subcontractor management
T36	Quality management
T37	Training programs
T38	Customer satisfaction surveys
	Significantly higher use in PMP = HIGH
T5	Risk probability assessment
T11	Responsibility assignment
T30	Simulation
	Significantly higher use in RMC = HIGH
T1	Checklists
T7	Risk time frame assessment
T14	Cost-benefit analysis during risk planning
T15	Cause and effect analysis during risk planning
T16	Project replanning for risk mitigation
T17	Revision of risk assessments
T20	Periodic reporting of risk mitigation plans
T22	Critical risk reporting to senior management
T24	Project replanning
T25	Procedure for closing risks
T26	Contingency plans for risk mitigation failure
T27	Cost-benefit analysis during risk control
T28	Cause and effect analysis during risk control
T34	Configuration control
T35	Quality control

in all cases the average group for the HIGH contribution population was higher than for the LOW contribution population.

It is worthwhile to note that, similarly to the results reported in the previous section, there were no differences in the use of the tools in the Identification group, with one marked exception — Checklists. However, there were significant differences in four of the six tools in the Analysis group, five of the six tools in the Tracking group and in all six tools of the Control group. This finding is even more striking if we recall that the tools in these groups had the lowest average scores. Our interpretation is as follows.

The use of risk identification tools is about the same, whether a risk management process is in place or not. However, those organizations who believe in a process (and, presumably, have adopted one) are more likely to apply tools that assist them in the weakest areas, namely analysis, tracking and control of risks. In other words, it is relatively easy to identify risks, and you may not need a process for that purpose, but you do need one for the more complicated tasks of to analyzing, tracking and controlling the project risks.

As for the Planning group, we notice that there are significant differences in three of the less commonly used tools: Cost–Benefit Analysis (T14), Cause and Effect Analysis (T15) and Project Replanning for Risk Mitigation (T16). Here again, it seems that project managers who value the contribution of a project risk management process are more likely to apply formal risk planning tools that those who do not. We also note that six of the ten tools in the Background group exhibited significant differences in use between the two populations, including tools T35 through T38, which received a relatively low overall ranking. This finding suggests that the existence of organization-wide processes such as those in this group is associated with a higher rate of adoption of a process approach to risk management.

6. Practical implications

The objective of this study was to identify the tools that have the greatest potential for contribution to a project risk management process. The results of the survey provide important guidance with respect to this issue. First, any one facing the design of a risk management process should first consider the tools that are most commonly used. These are obtained from the ranking in Table 1. Adoption of these tools moves the organization towards the current state of the practice in the field.

Beyond that, in order to strive for some type of competitive advantage, one should adopt the tools that are associated with better performing project management practices (PMP = HIGH), or that are used by practitioners who already have a good risk management process (RMC = HIGH). These tools are listed in Table 6. Obviously, there are costs and lead times associated with the adoption of tools and practices, and these, as well as other factors should be taken into consideration.

These two types of results, the ranking in Table 1 and the selected tools in Table 6, can also serve for diagnostic purposes. By comparing the current practice with these two lists, it is possible to identify areas of insufficient coverage and to devise a course of action that will enhance the project risk management capabilities in the organization.

7. Concluding remarks

The approach taken in this study is similar to the benchmarking methodology developed by Camp [19], Balm [20] and others: we looked at current practice in the more successful organizations and attempted to identify what it is that they do that others do not. This approach can be extended to other aspects of the risk management process, such as assignment of roles and responsibilities, timing and frequency of risk manage-

ment activities, and amount of effort applied. It could also be applied to other processes related to project management, and, as the benchmarking proponents advocate, to many aspects of the organization.

Our specific methodology was based on a questionnaire which required a self-assessment of the efficiency of the project management practices in the organization and of the contribution of the risk management process. Although the possibility of respondent bias exists, we feel that by setting threshold values relative to the sample rather than in absolute terms, we overcome most of this difficulty.

Our survey was limited to the software development and high-tech industrial sectors. This was done because we suspected that in these sectors, which are characterized by very short opportunity windows, high uncertainty, and rapid decision-making, the need for tools and processes to manage risks ought to be greater than in other areas, such as construction, heavy manufacturing or services. Further, our review of the literature revealed that a substantial part of the tools and methodologies used in PRM were developed for these two specific areas.

Another limitation of this research stems from the unique characteristics of Israeli culture, which places a high value on personal initiative, improvisation and on-the-spot problem-solving, while giving less emphasis to disciplined work processes. It will be interesting to see if there are differences across various industrial sectors and different organizational cultures. Our impression, based on personal contacts with numerous project managers in different countries over the last several years, is that indeed this will be the case.

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