Guidelines for Managing Bias in Project Risk Assessment

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Abstract

Risk management is often seen as a project manager's job. However, the information and knowledge required to make a realistic assessment of project risks is often dispersed among people in and around the project. Also people will tend to focus their attention on different aspects and as a consequence on different risks because their different roles with regard to the project.

Our assumption is that it is wise to have a team of relevant people making a joint risk assessment, based on knowledge and information dispersed in, but not necessarily shared by, the team. The team corrects the filters and biases of individuals in their specialized roles and positions and creates both a richer "knowledge base" and increased variety in interpretations.

To test these assumptions, we formulated design requirements for a risk management method on the basis of the theory of human group and individual decision-making and information processing. Based on these requirements a risk management method was developed and used in eight IT projects. The results confirmed the assumption that lack of information and bias are relevant issues in risk assessment. The proposed guidelines resulted in a method capable of handling these issues.

1. Introduction

ICT projects are regularly confronted with problems that result in budget and delivery time overruns and in insufficient quality (e.g. (Reel, 1999)). Risk management (RM) is an approach to handle such problems. RM is directed at finding and analysing risks and at taking actions in order to reduce the probability that a risk leads to a problem as well as its impact (Boehm, 1991).

RM in practice is generally seen as part of the project manager's job. One may ask, however, whether this is an effective and efficient approach. Look for instance at Ropponen and Lyytinen (2000) who report on a survey in which 83 project managers were asked to provide software project risk factors. Principle component analysis was used to group these into six mainly (software) technological categories. Surprisingly this grouping excluded organisational oriented issues such as user acceptation. Our data (see table 4) however show, confirmed by the risk management literature (Procaccino et al, 2002) that these issues are extremely relevant. Ropponen and Lyytinen's findings can be construed as an indication of bias on the part of the project manager preventing them to 'see' certain types of risk.

The information and knowledge required to make a realistic assessment of project risks are often dispersed among people in and around the project. It is realistic to assume that a project RM carried out by a *group* of project stakeholders should be expected to offer a more complete and reliable picture of project risk. This paper presents a research project based on this assumption, which may be expressed as two linked premises:

- One person single handed is not able to identify relevant risks because of:
    - lack of information
    - role induced bias
- If certain conditions with regard to effective information processing are met, a group of persons performs better than an individual in identifying relevant risks.

The outline of the paper is as follows. Section 2 gives a brief explanation of risks and RM. In section 3, important aspects of group problem solving and decision-making are discussed and design requirements for a RM method are formulated. In section 4 a RM method developed on the basis of these requirements will be presented. In section 5, we deal with the empirical application of the RM method and the testing of the premises.

2. Risks and risk management: an overview

IT projects tend to be characterized by uncertainty, defined as the discrepancy between the information required to carry out a task and the information that is actually available (Galbraith, 1973). Risk management is an approach aiming at managing the inherent

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uncertainties of IT development and can therefore be seen as a human information processing activity. In the remainder of this paper this point of view will be taken.

We define risk as the likelihood that a certain event will taking place during project execution will have a (usually negative) impact on project progress or outcome (Boehm, 1991). The definition centres on the elements of likelihood and impact. When discussing risk, we will need to distinguish between these two elements and their four possible combinations .

If an event is likely to happen and will have large consequences, it should be a main target for project management. Project management is usually able to identify and handle this type of potential problems.

The other situations tend to be more problematic. Risks with a small likelihood of occurrence are often not noticed or dismissed as irrelevant. On the other hand risks that are more likely to occur are often overemphasized even though the associated impact is relatively slight (Davis, 1982). Therefore likelihood and impact should be looked at in conjunction. This can be depicted by the notion of risk exposure (RE) that is defined as RE = likelihood of occurrence * impact.

Next to the notion of 'risk' we should look at the notion of 'measure' or 'action' (Charette et al.,1997). In this context this refers to an action that:

- either diminishes the likelihood of the event occurring
- or reduces the impact the event causes if it occurs,
- or enables the organization to compensate for the impact if the event occurs
- or transfers the risk to another party.

When selecting an action or set of actions, one should take care that the costs of the action are in line with the potential benefits. This can be envisaged by using the concept of risk reduction leverage (RRL) that can be defined as RRL = {RE(before) - RE(after)} / {costs of the actions}

RM is defined here as (DOD, 1996; Williams, 1997; Charette, 1989) identification of, dealing with, and elimination of risks before they cause either a threat to successful project completion or important additional effort and lead-time.

In literature many RM methods can be identified, e.g. the Software Engineering Institute method (Higuera and Haimes, 1996; Hall, 1998). When looking at existing approaches we find that the following RM elements can usually be identified:

- Risk Identification: finding all risks that might influence the current project.
- Risk Analysis: determining the importance of all identified risks.
- Risk Prioritisation: choosing the most important risks to form a subset of manageable proportions.
- Risk reduction: defining actions that can reduce the probability and/or impact of risks as well as allocating the responsibility for these actions
- Risk monitoring: assessing at regular intervals if the proper risks have been identified, probability and impact are correctly estimated, the right actions have been agreed upon, been executed, and resulted in the expected results.
- Risk evaluation: summarising the lessons learned from applying RM to the project for future projects and for enhancing the RM method.

The research described in the paper concentrates on the first three elements of RM that is also called risk assessment. Risk assessment can be seen as a special case of a general decision-making model. The early stages of identification, analysis and prioritisation are information-processing tasks, which precede the actual deciding on what actions to take.

In literature the subject of human information processing has been discussed extensively in social psychology, organization theory and the theory of group decision support. Relevant issues are:

- What do we mean by individual filtering and bias?
- How can we link this to a general model of perception?
- How can biases and filtering be explained in the context of organizations and projects?
- What are the conditions for groups to be effective and efficient decision-makers or problem-solvers?

If we then look at existing RM methods, we can notice that this aspect of human information processing is either ignored or lacks theoretical substantiation. In the following section we will look at state-of the art in human information processing literature to identify relevant concepts applicable to the process of risk assessment.

3. Risk management: a human information-processing activity

3.1. Introduction

The central theme of this publication is the added value of using teams to carry out this complex decision-making task. A team is supposed to have more wisdom at its disposal than an individual project manager. Risk assessment should therefore be carried out by a team rather than by the individual manager.

This assumption will be elaborated on further in this section, by using a general model of information-processing from social psychology, showing some major limitations on individual information processing, arguing that teams or groups may remedy such limitations, presenting some agreed-upon conditions for group effectiveness and efficiency for carrying out such a task, and translating such conditions into specifications for the practical design of instruments and procedures to be used in risk management.

3.2. Individual information processing: perception

An individual who assesses the risks in a project, forms a *judgment* on the basis of what he sees, in combination with what he (or she) knows, or rather: he combines that which he thinks he sees with what he thinks he knows. By this we mean that 'seeing a risk' is not a simple observation, but the outcome of a perception process, which goes through a number of stages. Figure 1 depicts such a model as described by Janis et al. (1999).

What people actually use of those interpretations they have constructed on the bases of their selective attention to stimuli depends on what they selectively store and retrieve from their memories. *Selective memory* and selective forgetting in organizations is again dependent on positions, tasks and roles.

Selective memory feeds back into selective attention to stimuli and differential interpretation. This self-reinforcing character of selective processes, also known as the primacy effect or anchoring (Davis, 1982) makes human perception very vulnerable to bias. Stimuli that are not attended to will not lead to interpretive schemata and will not create memories which help to see such stimuli in the future! Blindness tends to be self-perpetuating in individual perception (Weick (1979)).

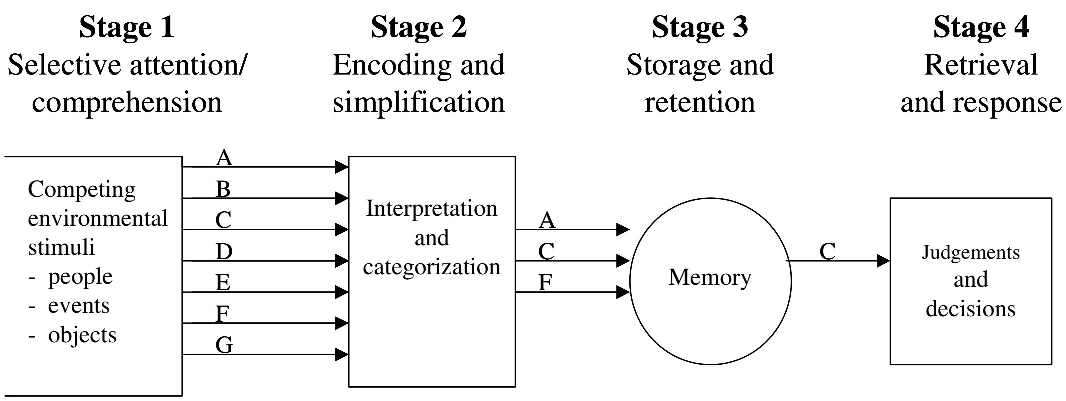

Figure 1: The perception model of Janis et al. (1999)

This model implies that two observers of the same project are likely to form different judgments with regard to project risks, due to:

- selective attention to people, events and objects
- the interpretation of what is perceived
- selective memory: that which is retained in memory.

People *attend selectively* to stimuli, which are congruent with their needs, and these depend in turn on position, role and tasks. People in different functions or on different levels in the hierarchy can select different stimuli that could later be interpreted as 'risky'.

People have different *schemata* to order the stimuli that they selectively attend to, influenced by personality and prior socialisation (education, training, group membership). By hiring people from specific backgrounds and organising them in groups, the organization reinforces differential *interpretation* of risks by different members.

With regard to perceiving risks, people tend to underestimate their existence and magnitude and therefore tend to make 'bold forecasts' based on narrowly framed definition of decision situations, focusing on concrete and specific information from an 'inside view' of the situation (Kahneman & Lovallo, 1993; Davis, 1982) at hand and ignoring statistical data which would be available in a broader framing of the problem . Pressures on the project manager to report positively reinforce this tendency towards unwarranted optimism in projects (Schmidt et al., 1999, Snow, 2002).

Such limits to individual perception make the responsibility of an individual project manager for the total risk management problematic. How can we assure that this manager is unbiased with regard to the risks surrounding his project? This would require access to a very wide range of stimuli, openness towards different interpretational schemata and a very strong memory.

3.3. Risk assessment as a group task

It seems more reasonable therefore, to define risk management, especially the information-processing tasks we are dealing with here, as a group task. A group of individuals with sufficient diversity of disciplinary backgrounds, position, roles and tasks, will counterbalance the perceptual one-sidedness of individuals. A group can improve the risk assessment by:

- paying attention to a larger range of potentially relevant stimuli, experienced by people in diverse positions with various backgrounds and different tasks
- employing a larger collection of interpretative schemata to the available pool of stimuli, enabling a broader framing of the situation and thereby diminishing unwarranted optimism (neglect of risk)
- retaining a broader whole of interpretations in a (collective, shared) memory.

What we are suggesting here, is one of the core ideas in *knowledge management*: we can use the group to create superior knowledge through the interaction of specialized individuals who share their knowledge, by turning private in to public and tacit into explicit knowledge (Nonaka and Takeuchi, 1995). This also applies to risk management, but that doesn't make risk management an easy task for a group. In order for groups to outperform individuals, we must be able to use the advantages of groups, by creating the necessary conditions for effectiveness and efficiency of group performance for the specific type of task.

3.4. Conditions for group effectiveness and efficiency in risk assessment

The effectiveness of a group can only be measured in terms of a specified task. In our case this task consists of the identification, analysis and prioritisation of risks in a project. What kind of task is this? It is certainly not a task in which the outcome consists of the only 'correct answers'. Neither is it a political task in which resolving conflicts of interests between the actors is central to the process. The task does involve the resolution of substantive conflicts, however, needed to integrate knowledge from different backgrounds and reconciliation different frames of actors: it has characteristics of a so-called 'cognitive conflict task' (McGrath, 1984).

The *effectiveness* of a group carrying out such a task can be judged in terms of:

- the degree to which the cognitive input of participants has been used
- the degree of integration of this knowledge as a result of group discussion.

We call a group *efficient* if it is effective with relatively few resources in terms of participant time and effort.

A general model of group functioning (adapted from Zanten, 1996) connects group results with group processes and input (figure 2).

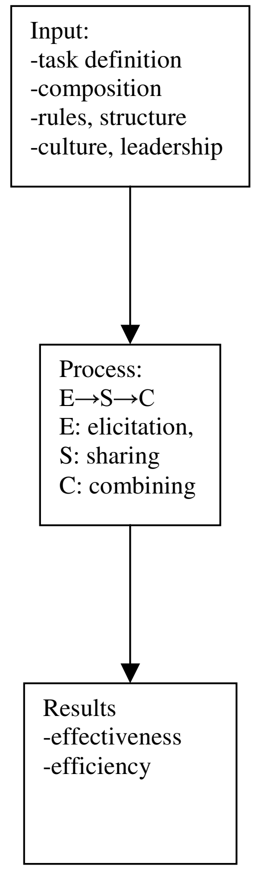

Figure 2: a general model of group functioning (Zanten, 1996).

Input

First of all, the task definition must be clear at the very start for all involved. This may involve a formal task assignment, briefing of new group members etc. The composition of the group must be in line with this task. In our case, the variety of backgrounds and the representation of all relevant knowledge must be warranted. The structure and rules of the team must support the task. In our case, where the task asks for a free flow of information and open communication, there should be no hierarchical structure. The group culture should support the requirements of the task. One decision about the group structure is leadership, possibly as the design of a facilitator role, which will be dealt with later. Group size is also a variable. In our case diversity calls for relatively large groups, but this should be balanced against efficiency: each new member makes communication more complex.

Process

The central processes in this type of group involve:

- Eliciting individual (private, maybe tacit) knowledge from participants
- Sharing this knowledge by communication in the group
- Combining, integrating this knowledge by group discussion.

These processes can be promoted by adequate *procedures* and techniques:

- procedures to 'tap' knowledge from participants prior to meetings
- techniques to summarize and present shared knowledge to support group discussion
- procedures to ensure the quality of group discussion.

An effective procedure aims at broadening the frames in which risks are perceived as well as sharing the role-specific knowledge of the participants. This requires effective elicitation of local, i.e. organization-specific knowledge in terms of locally relevant themes and using participants' frames of reference.

Procedures should be designed so as to counteract the natural tendency of groups toward inefficiency. Groups tend to block the production of ideas by individuals, for example; this can be a reason to combine group work with individual work.

The nature of the task demands that procedures favour diversity, in information as well as interpretations.

Actual group dynamics may negatively impinge on group effectiveness and efficiency. One frequently mentioned problem is formed by processes that destroy the necessary (cognitive) variety in the group, also known as *groupthink* (Janis et al, 1999). Anxiety and pressures on individuals to conform lead to inferior reasoning in groups in difficult situations. Patterns of defensive reasoning may hinder the necessary learning processes in groups dealing with difficult cognitive tasks (Argyris, 1983; 1990). Win-lose dynamics and unilateral control patterns must therefore be corrected in such groups.

Applying procedures can decrease the likelihood for such negative group dynamics to arise and discussion rules that favour criticism and debate, like the devil's advocate and the dialectical method (Janis et al, 1999).

A facilitator, i.e. a person with the specialized role of enabling the processes that lead to desired group outcomes, may be essential for maintaining procedures for effective group work, and correcting possible negative group dynamics that may arise. Facilitators should correct defensive patterns and win-lose dynamics in groups, ensure the equal participation of all group members and deal with emotional problems if they should block effective functioning.

4. The BAP risk management method

4.1. Method description

Based on the conditions for optimising risk judgements as formulated in the former section, the so-called BAP RM method has been developed (The abbreviation BAP stands for Controlling IT projects (in Dutch). The method (Heemstra and Kusters, 1996) contains the following steps.

Step 1: Selection of participants of the Risk Management team (RMt).

The goal of the first step is the composition of a RMt. An important issue here is insuring representation of each stakeholder group and knowledge area involved in the project by a minimum of one agent.

Step 2: Explanation of the method and planning 'risk activities'.

The goal of step 2 is twofold. First of all it is important to inform all stakeholders about the work procedure. Secondly it is necessary to acquire commitment.

Step 3: Identification of risks.

Each member of the RMt identifies the risks during an interview with the facilitator using a checklist, adapted to the local circumstances.

Step 4: Pre-selection of identified risks.

The interview results are analysed and the most relevant risks are summarized.

Step 5: Collaborative risk identification and selection.

The objective of this step is to confront (during a so-called RMt meeting) the team members with each other's perception of potential risks, to start a discussion on risk probabilities and effects, and finally to agree upon the most relevant risks and risk reducing actions.

Step 6: Risk monitoring, (repeat steps 4 and 5).

Monitoring is carried out regularly and is directed at checking if the agreed actions have been carried out, analysing the current status of the identified relevant risks and checking if any new relevant risks have cropped up since the last risk meeting.

Step 7: Compiling a Risk Management evaluation report.

The risk management evaluation report summarizes the identified risks and risk actions, aimed at identifying 'lessons learned' for future projects, and thus enables a learning process.

4.2. From conditions to method

When designing the RM method, care was taken to adhere to the conditions as identified in section 3. A number of specific design decisions were taken to achieve these conditions or requirements. These can be summarised as:

- use of an independent facilitator,
- use of interviews to collect information,
- use of a group discussion to process the information.

Table 1 shows how the requirements were used during designing the method.

Table 1: How design requirements are used in designing the risk management method.

Input requirements
Task definition • Clear design of the method coupled with (in step 2) explicit explanation of tasks and responsibilities.
Group composition • Selection of participants aimed at covering all major roles and knowledge areas.
Rules, structure • Use of an independent facilitator with no political ties to the project. • Individual interview between participants and facilitator as basis for group discussion to promote open communication. • Group size to be kept reasonable low so as to facilitate an efficient group meeting.
Culture, leadership • Use of an independent facilitator with no political ties to the project.
Process requirements
Elicitation • Individual interviews as the basis for further discussion to prevent blocking and groupthink. • Use of a project type specific checklist to promote motivation of participants by exhibiting relevance. • Use of a checklist based on organization specific jargon to promote efficiency by staying within the participants' frame of reference, thus furthering understanding.
Sharing • All interview results are made available to all participants. • Interview results are used anonymously to prevent pressures to conform. • The facilitator also summarizes interview results in order to provide a list of potential project specific risks for discussion.
Combining • Use of an independent facilitator to chair the meeting in order to correct defensive patterns and win-lose dynamics, ensure equal participation en deal with emotional problems that block effective functioning.

5. Evaluation

5.1. Approach

The RM method described in the previous section was used in practice. In this section we will use results obtained during use to evaluate the basic premises:

- an individual is not able to identify all relevant risks
- if certain conditions with regard to effective information-processing are met, a group of persons performs better than an individual in identifying relevant risks.

Such an evaluation should ideally be based on information on the 'real' risks that should have been identified during risk assessment. However, this information cannot be made available. Remember that risk refers to events that might happen. Furthermore the likelihood of an event occurring is impacted by actions taken, actions that may or may not be prompted by the risk assessment approach used. We can see that risks identified during the assessment:

- need not occur anyhow
- did not occur due to actions taken
- did occur (possibly with a lower impact because of actions taken).

Similarly risks that were not identified in the assessment:

- need not occur anyhow
- did not occur because of actions taken outside of the risk management effort
- did occur (but need not necessarily be identified by other means).

Thus, no factual information regarding the reality of risks in a project is available and information regarding risks that actually occurred during the project can be misleading.

It was therefore decided to base the evaluation on a reference that is available in each project, i.e. the set of risks resulting from the original group assessment. Given that this set is the result of a consensus decision, reached with the explicit agreement of all persons involved we felt that it could serve as a proxy for evaluation.

This has consequences, however, for the type of conclusion that can be drawn. This reference does not permit the conclusion that a group performs better than an individual. All we can see are differences, which arise between individual and group assessment. Given that all individuals in the end agreed to take the group result as the basis for further action, we have chosen to interpret these differences as a shift in a positive direction. Of course, another interpretation could be that people conformed to the group result because of group pressure. We feel this not to be the case from our own experiences in chairing these meetings where frank and open discussion was encountered. Also Hofstede's results

(Hofstede, 2001) where the Dutch society is characterised as having a low power distance index and a low score on masculinity as well as having a high score on individualism seem to confirm this.

5.2. Data

The evaluation is based on data from eight projects in several different organisations where the risk assessment method was used. These projects were innovative, fairly large and / or complex and therefore non-trivial. Participants in the risk assessment were selected from those involved so as to provide input from different roles. The number of participants varied from 6 to 16 per project. In total 83 persons participated in the assessments. In line with the requirements, each assessment was based on a checklist that was specifically adapted to each project. To facilitate comparison of data across projects, all participants were classified according to the role they held in the project. Furthermore, since each project used a different checklist, all risks identified were classified in one of nine risk domains. Table 4 shows both classifications used.

5.3. Evaluation results

The first premise relates to the capabilities of individuals. If we compare the results of the individual assessments to the results of the group assessments, we can identify risks that were identified by the group, but missed by the individual (1st category error) and risks that were identified by the individual but not confirmed by the group (2nd category error). Table 2 shows these results.

Table 2: Individual bias: overview

	Total	**1st category error**	**2nd category error**	**Total error**
#	322	59	51	110
%	100	19	17	36

Table 2 shows that a sizeable difference exists between individual and group assessments. One might assume that the project manager, having an overall view of the project, is in a unique position and is therefore better able to identify relevant risks. Table 3 shows this to be only partially true. Project managers do perform slightly better than other participants, but in our view such difference seems hardly convincing. An interesting result is the poor performance of both sponsors and outside consultants. Intimate knowledge of the project in its setting seems to be required for an adequate risk assessment.

Table 3: Individual bias per role

Role	**1st category error**	**2nd category error**	**Total error**
Project manager	13%	18%	31%
Sponsor	18%	24%	42%
User	22%	12%	35%
Subject expert	26%	7%	33%
Project staff	16%	18%	34%
Consultant	30%	18%	48%

We also examined the effect of roles on the type of risk that is likely to be identified. This information is presented in table 4 that shows the allocation of all risks mentioned by participants in a specific role over different risk domains. A percentage is presented in bold script if it falls outside the interval [mean +/- standard deviation] as calculated per risk domain. From the data we can conclude that a definite role-linked bias exists for all roles except the external consultants. Project managers for instance tend to over emphasise planning and user related risks while paying less attention to specification risks.

The combined tables 2 to 4 confirm that an individual is not likely to correctly identify all relevant project risks. On average 19% of relevant risks are missed and 17 % of the risks targeted by individuals should not have be been taken into account. Project managers (with 13% relevant risks missed) perform slightly better than the other participants, but this does not justify allocating this task to them solely.

Table 4: Links between role and bias

Role / **Risk domain**	Supplier	Realisability	Specification	Use / maintenance	Developer	Sponsor	Planning	User	Resources	
Sponsor	3,80%	12,80%	16,60%	8,50%	11,80%	11,40%	14,70%	**16,60%**	3,80%	100%
Project manager	3,30%	19,10%	**8,10%**	9,30%	10,60%	11,40%	**19,50%**	**16,70%**	2,00%	100%
User	1,20%	**21,90%**	20,60%	**15,00%**	**7,30%**	**8,10%**	11,70%	11,70%	2,40%	100%
Expert	1,30%	11,60%	**26,20%**	10,20%	10,70%	11,10%	13,30%	11,60%	4,00%	100%
Project staff	**11,00%**	13,60%	19,70%	10,10%	11,80%	**7,50%**	**7,50%**	**9,20%**	**9,60%**	100%
Consultant	2,70%	16,40%	17,30%	13,20%	10,50%	9,50%	14,10%	14,50%	1,80%	100%

Roles as a source of bias is confirmed by table 4, supporting the notion of a group-based risk assessment approach in which representative of the various roles are included.

The second premise indicates a well-designed group will provide better (as compared to individuals) results. Given that all projects in this sample used the same method this premise is difficult to support quantitatively. Again the problem of a correct reference against which results can be assessed crops up. Table 5 shows how the risks as identified by individuals are allocated over the various risk domains. This information is set off against the allocation of the risks as identified by the groups. A marked difference between the two can be observed indicating that the group result is more then just a summary of individual results. Also the existence of 2nd category errors (tables 2 and 3) would point in the direction that the group meeting was a contributing factor in the assessment process.

Table 5: effects of adding a group discussion

Risks	Individual	After meeting	Difference
Supplier	13,3%	6,0%	-7,3
Realisability	12,6%	19,0%	6,4
Specification	13,5%	16,0%	2,5
Use / maintenance	9,0%	9,0%	0,0
Developer	21,8%	20,0%	-1,8
Sponsor	12,0%	14,0%	2,0
Planning	13,6%	7,5%	-6,1
User	1,1%	1,5%	0,4
Resources	3,0%	7,5%	4,5
	100,0%	100,0%	

In addition to this, some qualitative evidence can be shown. One of the projects was concluded with a formal evaluation of the method used. All respondents (N=6) agreed that the method, the checklist as well as the meeting were considered useful and that they felt that application of the method had given them more grip on the project. The group meetings were unanimously positively appreciated. Not only did the discussions about risks, risk reduction etc. appear to be useful but also the side effects namely communication about goals, expectations, responsibilities etc. were found helpful. Some weaker points were:

- the description of the risks was sometimes abstract;
- the method was time intensive;
- the relation with project management was not clear.

Some further qualitative evidence can be derived from the fact that the method was accepted for use in two large organizations as shown by

- inclusion in the standard project approach,
- introduction of a risk management support desk, and
- training of approximately 120 persons in usage of the method.

Altogether this supports the second premise that a well-designed group-based assessment will be able to provide good results.

6. Conclusions

In this paper we looked at the area of risk management, and more in particular risk assessment, from a human information processing point of view. Based on literature from this field we came to the conclusion that lack of data and presence of role related bias will negatively impact the ability of an individual (e.a. a project manager) to carry out a comprehensive risk assessment and that this activity should not be carried out by individuals but by a group of people representing the different roles that are involved in the project. Furthermore a number of guidelines for developing a risk management approach were derived. Based on these notions a method for risk management was designed. The method was used in practice and date collected during use support the basic premises behind its design. We feel that in developing a risk management method should take into account the guidelines provided here.

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