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From experience: applying the risk diagnosing methodology

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Abstract

No risk, no reward. Companies must take risks to launch new products speedily and successfully. The ability to diagnose and manage risks is increasingly considered of vital importance in high-risk innovation. This article presents the Risk Diagnosing Methodology (RDM), which aims to identify and evaluate technological, organizational and business risks in product innovation. RDM was initiated, developed and tested within a division of Philips Electronics, a multinational company in the audio, video and lighting industry. On the basis of the results the senior Vice President (R&D) of Philips Lighting decided to include the method in the company's standard innovation procedures. Since then, RDM has been applied on product innovation projects in areas as diverse as automobile tires, ship propellers, printing equipment, landing gear systems and fast-moving consumer goods such as shampoo, margarine and detergents.

In this article we will describe how Unilever, one of the world's leading companies in fast-moving consumer goods, adopted RDM after a major project failure in the midnineties. At Unilever, RDM proved very useful in diagnosing project risks, promoting creative solutions for diagnosed risks and strengthening team ownership of the project as a whole. Our results also show that RDM outcomes can be used to build a knowledge base of potential risks in product innovation projects. © 2002 PDMA. All rights reserved.

1. Introduction

The essence of product innovation is to create or establish something new. Since this process necessarily involves risk, innovating firms require a strategy not of risk avoidance, but of early risk diagnosis and management. Since 1991 the authors have been developing a new method to diagnose and manage risks in innovative projects: the Risk Diagnosing Methodology (RDM). This methodology allows a firm to diagnose thoroughly and systematically the technological, organizational and business risks a project faces, and to formulate and implement suitable risk management strategies. The development of RDM began with an extensive evaluation of one major product innovation project within Philips Glass, from which a first version of a company-specific RDM was developed. This version was tested and improved within Philips Lighting on product innovation projects the company thought important. On the basis of the results the senior Vice President (R&D) of Philips Lighting decided to include RDM in the company's standard product innovation procedures. RDM has since been applied to product innovation projects in various industries in Germany, Italy, Belgium, The Netherlands and the USA.

In the midnineties Unilever, one of the major players in fast-moving consumer goods, suffered a dramatic new-product failure in its detergent division. As a result of this, the Board of Directors, seeking to find out what exactly had gone wrong and how such things could be prevented, decided to try including RDM in their innovation process. In this article we will describe how RDM has been adapted to Unilever. But first we will give some background about Unilever and explain the main characteristics of RDM and its deliverables. At the end we will identify the lessons of Unilever's implementation process of RDM and present an example of what a company might gain from such implementation.

2. Background

Unilever has more than 1000 well-known brands, including Mentadent, Omo, Dove, Sun silk, Magnum Ice, Lipton tea, Organics shampoo and Calve. The consumer goods are divided into two main product groups: Foods, and Home

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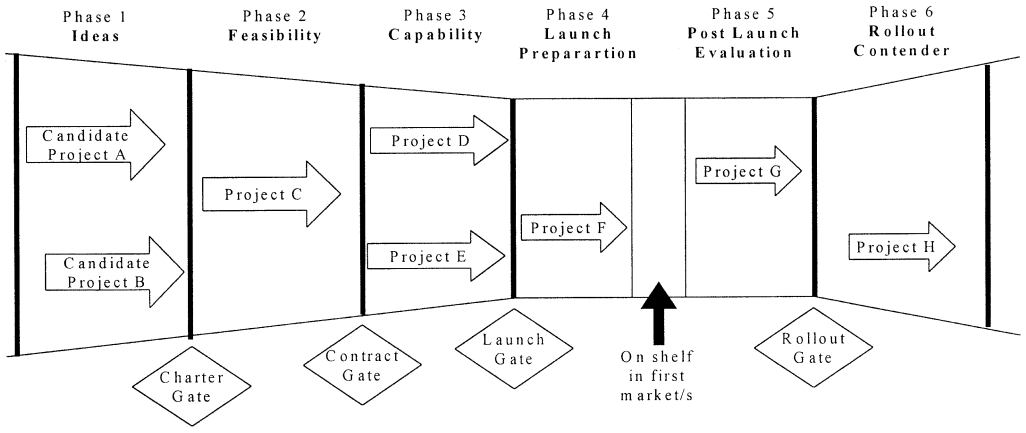

Fig. 1. Unilever innovation funnel.

and Personal Care. These product groups are again divided into 15 Corporate Categories such as Laundry, Functional Foods, Household Care, Oral Care and Prestige Products such as Calvin Klein and Elizabeth Arden. Unilever has more than 8500 people working on research and development, on which it invests over 900 million US dollars each year. In order to manage the project portfolio better, it introduced the "Innovation Funnel" (see Fig. 1) in the early nineties [3]. This approach, based on the model of Wheelwright and Clark [15], has six stages in which projects are defined, followed and evaluated according to a predetermined set of decision criteria.

In 1994 Unilever was struck with a dramatic project failure. It had launched in Europe a detergent based on a new technology, a manganese complex molecule that it claimed would enhance its existing detergent's performance. The *Wall Street Journal* disclosed [12] that in March 1994 Edwin Arzt, chairman of Proctor & Gamble Co., rival to the Anglo-Dutch consumer-goods concern, had turned up at Unilever's headquarters in London, carrying a fearsome message. P&G, he claimed, had scientific evidence that Unilever's new soap damaged clothes, and if Unilever didn't cancel the product's scheduled launch in 11 days, he would tell the world. In June 1994 Unilever admitted that its washing powder damaged clothes "under extreme laboratory conditions." It announced that it would change the product's formula so that it contained less of the contested manganese substance. What was meant to lead to commercial success led to disaster. According to the *Wall Street Journal*, in 1994 Unilever spent $175 million developing the product and another $292 million marketing it [12]. To learn from this experience, Unilever systematically evaluated the process that led to these dramatic and unforeseen consequences. It concluded that to prevent such failures in the future, it should improve its risk management methods and procedures. Comparing different options, a steering committee decided to investigate the potential value of the Risk Diagnosing Methodology.

3. Requirements for an effective assessment of product innovation risks

The true nature of project risk is determined not only by its likelihood and its effects, but also by a firm's ability to influence the risk factors (see e.g. [6,10,13]). Thus a project activity should be labeled "risky" if:

- The likelihood of a bad result is great
- The ability to influence it within the time and resource limits of the project is small
- Its potential consequences are severe

Too often risk analyses are directed exclusively towards either technological, organizational, market or financial factors. The success of product innovation, however, is determined by external influences and internal circumstances in which all these factors interact. To be effective, a risk assessment method therefore needs to help identify potential risks in the following domains:

- *Technology*: product design and platform development, manufacturing technology and intellectual property;
- *Market*: consumer and trade acceptance, public acceptance and the potential actions of competitors;
- *Finance*: commercial viability;
- *Operations*: internal organization, project team, co-development with external parties and supply and distribution.

For all these domains the principal question is this: what is new or different in the knowledge and skills this project requires of the company in general and the project team in particular?

In some approaches (e.g., Failure Mode and Effects Analysis, Potential Problem Analysis) risks are often identified in group sessions. The outcomes of such sessions may be biased by effects introduced through the composition of the group and the process it is using [1,5]. People sometimes hesitate to label factors as risky or not risky if opinion

leaders within the group have a different view. One way to prevent these group effects is to collect potential risk factors individually from each member and then evaluate these factors the same way. The next step is to generate and decide about potential risk management actions. This process, often involving the need for creative solutions or new directions, benefits from the mutually reinforcing impact of the interaction between individual specialists and experts [7].

Many scholars in the last 30 years have identified critical success factors in product innovation (for a review and meta-analysis, see [9]). An effective risk assessment procedure should draw on this knowledge. However, to identify the risks in a particular product innovation project, one must go beyond these generic factors and identify also context-specific ones. Many companies have their own shortlist of critical mishaps that management hopes future projects will escape. The use of a risk reference framework reflecting the company-specific as well as the generic success factors will help lead team members to think of less obvious issues.

The most powerful contribution of risk assessment comes at the end of the feasibility phase of the innovation process, at the contract gate (see also Fig. 1). At this stage, the transition to the actual product development and engineering of a particular product or product range takes place; uncertainty has to be managed taking into account the potential risks relating to all the aspects of manufacturability, marketability, finance, human resources and so forth In this phase of the project, management still has the ability to substantially influence the course of events and make a considerable impact on the eventual outcome [2,15]. However, a periodical reassessment of potential risks in subsequent phases is still required.

In sum, it appears that a comprehensive risk assessment approach would:

- Evaluate each potential risk on its likelihood, its controllability and its relative importance to project performance.
- Take a cross-functional perspective by identifying and evaluating technological, market, and financial as well as operational risks.
- Conduct the risk assessment at the end of the feasibility phase and periodically reassess the project for unforeseen risks and deviations from the risk management plan.
- Identify and evaluate the product innovation risks individually, and generate, evaluate and select alternative solutions in subgroups and plenary sessions.

The Risk Diagnosing methodology RDM was developed to accomplish these aims.

4. The Risk Diagnosing Methodology RDM

The purpose of RDM is to provide strategies that will improve the chance of a project's success by identifying and managing its potential risks. RDM is designed to be applied at the end of the feasibility phase, and should thus address such issues as consumer and trade acceptance, commercial viability, competitive reactions, external influential responses, human resource implications, and manufacturability. RDM has been applied in developing such products as automobile tires, ship propellers, printing equipment, landing gear systems, audio and video equipment, and fast-moving consumer goods like lamps, shampoo, margarine and detergents. In this section we will describe the successive steps (see also Fig. 2) of RDM.

4.1. Step 1: initial briefing

RDM is conducted with the help of a risk facilitator, who may be either a trained internal person who is not a member of the project team and has no direct stake in the project, or an external consultant with state-of-the-art knowledge of product innovation. An outside risk facilitator has the advantage of relative independence and freedom from bias. Project team members will be more likely to confide their worries in such a facilitator. The responsibility for risk management however should stay with the project leader. The first step of RDM is meant to build a full understanding of the conditions to be met at the start of the RDM process and to make the necessary appointments. The initial briefing takes place between risk facilitator and project manager. This initial briefing should cover both general and project-specific topics. Project-specific topics include its objectives and unique characteristics; its stakeholders; the nature of its current phase; and the commitments required from its participants. More general topics include how information about the project will be made available to the risk facilitator; how this information will be kept confidential; who will participate in the RDM process (stakeholder(s), project manager, project team, experts); how participants will be informed of their involvement; when and where the RDM process will take place; and what may be expected from it. In most cases, between 10 and 20 persons participate in the whole RDM process. Special care must be taken to include in the team technological, business and marketing expertise. The output of this initial briefing is twofold: agreements between project manager and risk facilitator on actions to be taken, and invitations to a "kick-off" meeting for participants in the RDM process.

4.2. Step 2: kick-off meeting

The project manager, the risk facilitator and persons invited to contribute in the RDM process should attend the kick-off meeting. The objective of this meeting is to make sure that all participants know what to expect during the RDM process and are willing to cooperate. During the kick-off meeting, the following topics are addressed: objectives of and steps in the RDM process; the expected input, level of involvement, and amount of time from participants;

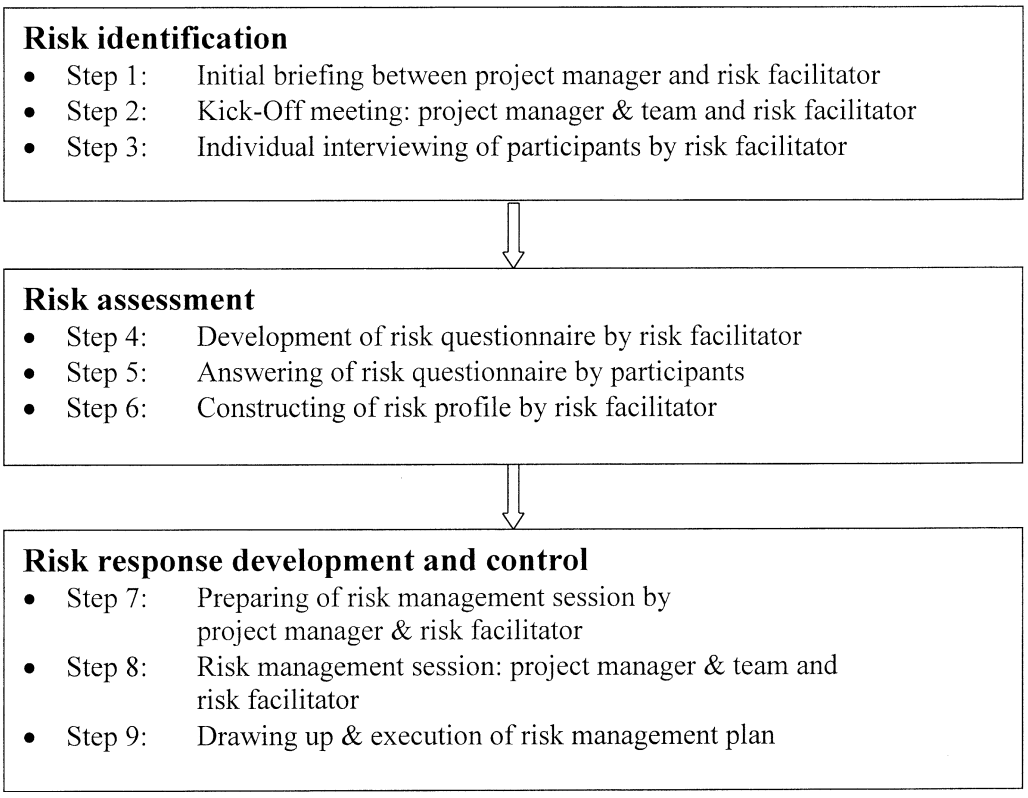

Fig. 2. Outline of risk diagnosing methodology (RDM).

the confidentiality of the interviews and other information provided by participants; the expected output of the RDM process. After the kick-off meeting, agreements are made on the date, time and location of the interviews and on the date, time and location of a plenary risk management session.

4.3. Step 3: individual interviewing of participants

The objective of this step is to develop a comprehensive overview of all critical aspects in the innovation project. To enable participants to describe freely what they see as the riskiest aspects of the project, the risk facilitator interviews all participants individually. Each interview takes about 1.5 hr, during which the participant is led to think carefully on the project and its risks, and on his or her contribution specifically. The most efficient way is to start the interviews with the project manager, who is asked to give a detailed description of the product to be developed and the process of its development. Every participant is asked to study the project innovation charter, the project plan, and the reference list of potential risk issues (see Appendix A). In every new interview, the preceding interviews are taken into account (without mentioning the respondent's name) to test the completeness and correctness of the already gathered data. The protocol for the interviews is as follows:

- A short introduction of both participant and risk facilitator and explanation by the risk facilitator of the objective of the interview
- The interviewee's position in the organization and link to the project
- "Gaps" in the project: "what do you see as gaps in knowledge, skills and experience for this project?" "Can these gaps be bridged within the time and resource constraints of the project?"
- The reference list with potential risks: "what other gaps might be difficult to bridge?"
- Closing the interview: "did we forget something?"
- Next steps: the risk facilitator briefly explains again what the interviewee can expect next, especially the risk questionnaire and the risk management session.

4.4. Step 4: processing the interviews: design of a risk questionnaire

After having interviewed all the participants, the risk facilitator analyzes the interview notes and clusters the critical issues according to the risk categories distinguished in Appendix A (e.g., product technology risk, manufacturing technology risk, project team risk etc.). Then the risk facilitator designs a risk questionnaire, in which the critical issues from the interviews are translated into positive statements of "objectives to be realized." For example, if in one of the interviews a risk team member says, "We will be using a new ingredient in our product solution, and I have read in a journal that this material sometimes causes skin irritations" the statement would be formulated thus: "The

Risk Statements:	What is the *level of certainty* that the statement will be true?					*Ability of team to influence* course of actions within time & resource limits					*Relative importance* of statement for obtaining project success				
	Very Low				Very High	Very Low				Very High	Very High				Very Low
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1. The new product will be safe to use for people with a sensitive skin.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2. With the trade customer clear after sales arrangements have been agreed.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. For localized dye damage we have an appropriate solution.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Fig. 3. Example of part of risk questionnaire.

new product formulation will be safe to use also for people with sensitive skin." Negatively formulated statements, for example, "The new product can cause skin irritations," are avoided because, as we know from Kahneman and Tversky's prospect theory [7,11], negative framing of risks induces more positive perceptions than positive framing. Confronted with negative statements people tend to respond: "It is not that bad." Confronted with positive statements people tend to respond: "They may suppose so, but I am not so sure." Because in risk identification we do not want people to accept risk too easily, we prefer positive statements. After having transformed all potential risk issues into statements, the risk facilitator meets with the project manager. The purpose of this meeting is to verify that all issues were well understood and clearly formulated by the risk facilitator.

4.5. Step 5: answering the risk questionnaire

Respondents are asked individually to score the risk statements developed above on three five-point scales (see Fig. 3):

- The level of certainty that the objective formulated in the risk statement will be realized
- The ability of the team to reach an appropriate solution using the project's allotted time and resources
- The relative importance of the objective to project performance.

Respondents are asked to answer the questionnaire as completely as possible, but not to respond to those issues they have no idea or opinion about. The typical number of risk statements in these questionnaires is 50–60, and it takes 45–60 min to complete.

4.6. Step 6: constructing the risk profile

After the respondents have completed the risk questionnaire, the risk facilitator constructs a risk profile from their scores. Every risk statement is reported with its scoring for the three evaluation parameters (see Fig. 4 for an example).

The risk profile presents both the degrees of risk perceived by the majority of the respondents and the distribution of their perceptions. Although the criterion can be chosen differently, we have chosen to mark with a dot the column in which a support of a minimum of 50% (the average of the scores) is reached. This will give an initial view of the thinking of the majority of the respondents. Next, the risk facilitator classifies the risk statements in two ways. First, every risk statement, is classified along the three parameters into four groups by the following decision rules:

- ("*"): At least 50% of the scores are 1 or 2 on the 5-point scale (1 being "very risky"), and there are no scores of 5 on the 5-point scale.
- ("0"): At least 50% of the scores are 4 or 5 on the 5-point scale, and there are no scores of 1 on the 5-point scale.
- ("m"): At least 50% of the scores are 3 on the 5-point scale, and there are no scores of 1 or 5 on the 5-point scale.
- ("?"): For all remaining cases. There exists a lack of consensus, visible in a wide distribution of opinions. After discussion with the interviewees, the "?" scores may be changed to one of the other three.

Next, the risk facilitator classifies each risk statement into a "risk class" by examining the questionnaire responses. RDM uses five risk classes: S = safe; L = low; M = medium; H = high; F = fatal. For example, a combination of scores "*,*,*" on a given risk statement would result in its classification as so risky that not lessening this risk would be fatal for the project (which would then be assigned a risk class of F), while the combination "0,0,0" would result in a classification as safe (risk class S). The total number of possible combinations of risk scores is 64 (see Appendix B). If there is a distribution of opinions, the risk score can be represented by a range between the lowest and highest risk class that can be reached if the respondents achieve consensus. (For instance: L-M, H-F, and so on). For example, in Fig. 4, the scores indicate a lack of consensus

Risk Statements:		What is the *level of certainty* that the statement will be true? *'C'* Very Low 1	2	3	4	Very High 5	*Ability of team to influence* course of actions within time & resource limits *'A'* Very Low 1	2	3	4	Very High 5	*Relative importance* of statement for obtaining project success *'I'* Very High 1	2	3	4	Very Low 5	Score for each dimension of risk *C*	*A*	*I*	**Risk class**
1. The new product will be	N resp.	0	0	1	3	5	0	0	1	3	5	0	2	5	2	0				
safe to use for people with a	Cum %	0	0	11	44	100	0	0	11	44	100	0	22	78	100	100	0	0	m	**L**
sensitive skin.	□ 50%				●						●			●						
2. With the trade customer	N resp.	3	2	4	0	0	0	2	5	2	0	3	5	1	0	0				
clear after sales arrangements	Cum %	33	56	100	100	100	0	22	78	100	100	33	89	100	100	100	*	m	*	**H**
have been agreed.	□ 50%		●						●				●							
3. For localized dye damage	N resp.	1	3	2	0	2	2	2	0	4	0	4	0	1	1	2				
we have an appropriate	Cum %	13	50	75	75	100	25	50	50	100	100	50	50	63	88	100	?	*	?	**L-F**
solution.	□ 50%		●					●				●								

N resp: Number of team members who scored in certain column
Cum %: Cumulative percentage of team respondents
□ 50%: Column in which at least 50% of team response is first met

'*': At least 50% of the scores are 1 or 2 on the five point scales and there are no scores of 5
'0': At least 50% of the scores are 4 or 5 on the five point scales and there are no scores of 1
'm': At least 50% of the scores are 3 on the five point scales and there are no scores of 1 or 5
'?': Lack of consensus: There is a wide distribution of opinions.

Risk Classes used: **S** = Safe; **L** = Low Risk; **M** = Medium Risk; **H** = High Risk and **F** = Fatal risk.

Fig. 4. Example of a project risk profile.

within the team for risk statement number 3. If, after discussion and clarification, the team as a whole is convinced that "finding an appropriate solution for localized dye damage" is very uncertain and very important to project success, the risk range will change from "L-F" to "F." It should be stressed that this lack of consensus in the risk profile is very valuable information and should not be "swept under the carpet." It has happened more than once that a member of a team had a clearly divergent opinion that appeared, after discussion and clarification, to be right!

4.7. Step 7: preparing a risk management session

In this RDM step the project manager accepts the risk profile and reaches agreement with the risk facilitator on the agenda for the risk management session, the solution-finding and decision-making process to follow. Certain risks will be better tackled in a plenary session, others in subgroups. The choice will depend on the number and difficulty of risks requiring a solution. We use the following criteria to determine what issues should be included in the plenary session:

- Does the problem involve more than one function?
- Can one or a couple of individuals find a solution?
- Is there a need for cross-fertilization?
- How much time is available in the full session, what is the seriousness of the project risk, what is the urgency of a solution?
- What group dynamics can be expected? This depends on the number of participants, their range of experience, their team spirit, the time they have to solve the problem and their organizational culture (open vs. closed).

Experience suggests that a risk management session will require a one-day meeting where the team can work in plenary as well as syndicate (subgroup) meetings.

4.8. Step 8: risk management session

The objective of the risk management session is to achieve consensus on action plans for dealing with the high risks and on procedures for dealing with the medium and lower risks. In addition to the project manager and the risk facilitator, all persons who participated in the RDM process are invited to this session, which the project manager usually leads. A typical agenda for a risk management session is presented in Fig. 5. This agenda includes an introduction to the objectives of the meeting, the program and some "rules of conduct."

Our experience has shown that observing these rules of conduct (see Fig. 6) helps to increase the effectiveness of the process and to foster breakthroughs in problem solving. Not only do these rules enforce the requirements generally agreed on for brainstorming [4], they also limit as far as possible the potential negative effects of group dynamics discussed in the previous section. After the introduction and an agreement to follow the rules of conduct, the risk facilitator presents the risk profile: What are the high risks everyone agrees on? What are the risks about which opinions differ but that could potentially turn out to be high? The risk facilitator also shows how certain issues are related to each other.

The first part of the risk management session is designed to create a common understanding of the risks and to generate ideas for managing them. In the second part of the risk management session, the group is split up into subgroups,

10.00 h.	Opening, Objectives for today Rules of engagement
10.15h.	Presentation of risk profile for project Jumbo
10.45h.	Plenary discussion about scenario's: - Worries - Possible solutions - Selection between scenario's Plenary discussion on other (potential) H-F issues: - Worries - Possible solutions How to handle remaining issues
12.30h.	Lunch
14.00h.	Subgroups Cluster 1: Consumer acceptance & commercial viability Cluster 2: Packaging and supply Cluster 3: Formulation Cluster 4: Patents
15.30h.	Plenary feedback and discussion
17.00h.	Plenary discussion on organizational issues
17.30h.	Next steps and conclusions

Fig. 5. Example of an agenda for a risk management session.

which are asked to work further on the suggested ideas and to formulate action plans specifying what needs to be done, by whom and when. Appendix C presents some trigger questions that might help the subgroups design these plans. In the third part of the session the subgroups present the outcomes of their respective discussions. After further clarification and discussion, the project team decides on which follow-up actions should be taken to manage the diagnosed risks, and on how to present the results to senior management.

- Every one's viewpoint is valid!
- No holding back – Say what's worrying you!
- No management hierarchy
- The things we don't like to hear are probably the key issues
- Explain from your area of expertise

Fig. 6. Rules of engagement for a risk management session.

Project: Golden Eagle	**Risk issue #:** T07
Project number: 01A2552	**Project Leader**: Tom Jefferson
Risk Issue: Deformation of the product due to overexposure	
Date of assessment: 13 June 2001	**Action Responsible**: Marc Erlich
Risk Type: Manufacturing Technology	**Start Date**: 18 June 2001
Risk Class: F **H** M L S	**Due Date**: 3 Sept 2001
Clarification of risk issue: During production an uneven cooling down of the product surface causes instability in product surface structure	
Actions Agreed on: 1. Investigate alternative mould options 2. Investigate how GE has solved this problem	
Follow-Up agreements: 1. Report results and present proposal in project review session of 14 September 2001 2. In case of satisfying new mould option make supplementary work package proposal 3. In case GE-solution is applicable and alternative mould options don't work out, develop cross-over proposal to negotiate with GE	
Mitigation plan status: PT-meeting 6/25: Drafts for mould options a/b/c/d are ready PT meeting 7/23: Prototypes for mould options a/b/c/d casted PT meeting 8/7: Prototypes a/b/c/d tested, prototype c seems satisfactory PT meeting 8/21: PT meeting 9/3:	

Fig. 7. Example of a risk tracking form.

4.9. Step 9: drawing up & execution of a risk management plan

The risks and corresponding action plans are brought together in a risk management plan. In addition to documenting the risk assessment results and the outcome of the risk management session, the risk management plan states who is responsible for each of the diagnosed risks, how much time and resources are needed to deal with these risks, and how progress will be monitored and reported. This plan enables management to decide upon the feasibility of the project and make a "go/no go" decision. The action plans drawn up by the subgroups are documented in risk tracking forms (see Fig. 7). These provide a framework for recording information about the status and progress of each diagnosed risk. To guarantee follow up, besides regular monitoring and control of the project risks in project team meetings, senior management should also require formal approval of the risk management plan and verify the progress of the risk actions plans in all subsequent gate reviews.

It may be necessary to repeat the RDM for some product innovation projects. In particular, in cases where the project newness and complexity are great, modifications and unforeseen issues are almost certain to arise; this might demand reassessment of the overall risks at later stages of the project. Senior management in consultation with the project team therefore should reconsider at each stage whether to repeat the RDM process or simply to have the project team update the existing risk management plan.

4.10. Time commitment for conducting a full RDM

Project teams and senior management should understand how much time a full RDM requires. Our experience suggests that with a team of about 10–20 persons RDM requires 1.5 days for project team members, invited stakeholders and experts; about 2.5 days for the project manager, who also provides the RDM facilitator with detailed information on the project content and process, and co-ordinates activities; and about 6–8 working days for the RDM facilitator, who conducts interviews, develops the risk questionnaire, processes the risk profile, and so forth An RDM can be conducted within 1–2 weeks. Before deciding to apply RDM, firms should consider whether this time investment is in proportion to the complexity, innovativeness or importance of the project. Normally time dedicated to RDM is an investment that will pay off. The results from the application of RDM in many firms suggest that RDM reduces both time-to-market and overall project cost.

5. Adoption of RDM within Unilever

Unilever's objective was to test whether RDM would improve their way of assessing and managing product in-

novation risks. For this purpose, a special Steering Committee was formed of key innovation managers and potential users from the main product categories. The chairman of this committee was disengaged from most of his regular tasks to give maximum support to the process of tailoring the risk-diagnosing methodology to the specific needs of Unilever and to embed the method, if it proved successful, within the whole company. He reported to the CEO for R&D, providing a direct link between the committee and the Board of Directors. Because of their experience with RDM, the authors were invited to participate directly in the RDM adoption project. The project was split into four main steps:

1. *Familiarizing with the Unilever business and innovation practice*

Step one for us was to build up an understanding of the nature of the business and its innovation practice and procedures, and to explore the requirements that must be fulfilled to realize an effective, efficient and accepted version of RDM for Unilever. For this purpose we interviewed about 24 senior managers with responsibility in areas such as new business development, R&D, marketing and manufacturing as well as in product innovation. The interviews made clear that the characteristics of the existing RDM approach fulfilled some key functions brought forward during the interviews:

- It prevented reinforcement of risk-avoidance tendencies

After the OMO-Power incident Unilever management was interpreted as wishing to avoid risk at all costs. The firm therefore wanted new methods that would not encourage this tendency. The RDM approach fits with this requirement since it emphasizes consciously taking risks, not avoiding them.

- It fit with the existing innovation process

Project managers warned that any new method would fail if this method did not fit naturally with the innovation management procedure that had recently been implemented. The requirement within this procedure for a detailed risk assessment in the feasibility phase of development matched very well with the RDM approach.

- It was supportive of the project team's work

Unilever officials wanted to provide project teams with a tool for identifying and assessing risks and then creating, implementing and managing plans to minimize or eliminate them. The opportunity RDM provides for the expression of personal views during risk identification and for team discussion about solutions has been shown in the past to strengthen team ownership of the whole project. The project team becomes much more aware how to organize for the project's success and team members will consciously commit themselves to its challenges.

- It led to no negative group dynamics

Post OMO-Power analyses had shown that group decision-making about product development projects led to wishful interpretation rather than objectivity. The firm wanted teams to have a full picture of the risks of their projects, and to respect the integrity of data. RDM provides a means to this through its requirement of individual risk identification followed by structured team discussion about creative solutions under the guidance of an independent facilitator.

- It led to a cross functionality perspective on the level of change

Unilever management noticed that the level of change a project brings to the business and specifically to the brand(s) linked to it was easily underestimated. They wanted a risk approach that could address the level of change from all possible facets of the project: technical, marketing, supply chain and so forth RDM provides a multifunctional perspective and focuses on the level of change.

2. *Developing a Unilever specific RDM*

RDM was first adapted to identify new risks. Because Unilever is a fast-moving consumer goods firm, our original reference list of technological, organizational and business risk issues was extended to include such issues as brand positioning, supply chain and safety. In view of the time a risk facilitator needs (approximately 60 hr) to conduct an RDM, Unilever decided to focus RDM on breakthrough projects and projects with a potentially significant impact on their business.

3. *Pilot Testing of RDM within Unilever*

Unilever selected a number of representative projects that could serve as pilot case studies for the application of RDM, based in part on the willingness of project leaders to volunteer. The results of the pilot studies were twofold. First, they tested the suitability of RDM in the empirical setting of Unilever. Second, they delivered for each project a full risk diagnosis and management plan so the project team could benefit immediately from the process. From the feedback sessions at the end of the case studies it became clear that participants thought RDM highly useful for risk assessment and risk action decision-making. It was described as "a very powerful and robust process," " . . . that helped a lot to overcome the critical issues in the project," " . . . allows you to confront the risks, to address the risks, and decide what they are and how to manage them", " . . . has done a lot for strengthening team ownership for the whole project," and " . . . helped the team to do their job more effectively." On the basis of the results of a formal evaluation questionnaire and the documented personal feedback from participating project leaders and project team members, the CEO responsible for R&D projects decided to incorporate the Unilever-adapted version of RDM into the company's innovation operating procedures. RDM is now

obligatory for all product innovation projects of strategic importance for Unilever. The firm's experiences with RDM also suggested that it contributes most powerfully when conducted at the end of the feasibility stage (see also Fig. 1). At this stage, the transition to the actual development and engineering of one particular product or product range takes place; uncertainty has to be managed, taking into account the potential risks relating to manufacturability, marketability, finance, human resources etc.

4. *Roll out of RDM within Unilever*

To diffuse RDM successfully within Unilever, the steering committee devised a roll out plan, prescribing the following actions:

- *Awareness creation*

During the development and testing phase, employees working on innovation projects were kept informed on progress. The steering committee seized the opportunity of a yearly 'Lock Away Day' to brief project leaders about RDM. A special risk video was made for this purpose, in which project leaders, project team members and also senior management were interviewed about their experiences with RDM, and the steps and main principles of RDM were explained. In addition to these briefings, Unilever embedded discussion of RDM formally in workshops required at the start of an innovation project. These steps helped stimulate discussion of the opportunities provided by a habit of thorough risk diagnosis and management.

- *Risk facilitator training*

Four RDM training sessions were organized for Unilever. The 35 participants, all professionals with seniority in the domain of product innovation, were selected from each of Unilever's main product groups by a senior manager. Risk facilitation was to be 70% of their role. They followed a 1.5-day training course in RDM techniques, organized as a "real life" simulation of all RDM process steps, and involving discussion of future cooperation between risk consultants. One of the risk consultants was designated a coordinator to be consulted in the diffusion of new developments in risk techniques and software, and to organize the exchange of experiences between risk consultants.

6. Lessons learned from the Unilever RDM experience

The RDM experience at Unilever yielded valuable information about the value of RDM for product innovation projects within Unilever and also about risk management learning across projects.

6.1. Added value of RDM

Results from the RDM adoption process at Unilever suggest that professionals participating in the area of product innovation are very satisfied with the way RDM allows them to identify, confront and manage risks in their projects. Three distinct evaluation studies confirmed this satisfaction.

First, in the implementation phase, the authors asked participants in pilot projects to complete a short evaluation questionnaire, addressing ten questions on the use of RDM. On 5-point scales participants were asked to judge:

- The added value of RDM in identifying and evaluating the project risks (Mean = 4.30);
- The contribution of RDM in making decisions on the management of risks (M = 4.33);
- The usefulness of RDM for product innovation projects (M = 4.45);
- The added value of the risk reference list (M = 3.99);
- The transformation of potential risk issues into statements in the risk questionnaire (M = 4.12);
- The representation of the results of the risk questionnaire in the risk profile (M = 4.11);
- The effectiveness of the risk management session (M = 4.25);
- The contribution of the risk facilitators during the whole process (M = 4.46);
- The time efficiency of the RDM process (M = 4.47);
- Whether they would recommend RDM for other innovation projects (M = 4.41).

Second, one year after the implementation and roll-out phase of RDM at Unilever, an internal evaluation study was carried out to check whether assessment and management of risk had improved. Two staff members from Unilever's department of Organization & Efficiency interviewed some 20 persons about their experiences so far with RDM. The results were unanimously positive. Participants felt that the individual interviews were very useful in getting issues on the table, and that the list of potential risks and their scoring were very helpful in focusing and clarifying team thinking. One manager said: "It allowed a lot of issues that were festering under the surface to be raised in a constructive manner."

The one-day plenary risk management session held at the end of each RDM—step 8 of the RDM procedure—proved one of the most valued parts of the RDM process. Some of the participants felt it enabled them: "to clear all misunderstandings and varying interpretations about the risks." Most participants were very happy with the outcome: they felt that they were: "either reassured on critical issues or at least confident that what they had decided was the right way to tackle it," and that: "it was quite clear at the risk management session that the RDM process had pulled out some key issues and actions which they thought would not have been addressed otherwise." "We always did risk management, but we did it in an ad-hoc way. This RDM approach has given us a much better framework."

Regarding the rule that risk facilitators should in no way be involved in the tasks of that team, participants offered similar observations: "Independent facilitators are essential;

What is the added value of the RDM? • One of the most useful experiences we have had. A tool for focusing project team's minds and communicating risks in an effective manner (Katherine Thompson) • RDM is a very powerful and robust process. With RDM the principles are more important than the tools. RDM has helped us to manage risks as a team, this has proven to be extremely useful. (Richard Hill). • RDM helps to get team ownership of project risks and faces project risks in a holistic way (Andy Chapple). • RDM helped us to convince the business to test on consumer perceivable difference. That test was necessary (David Taylor)
Did RDM change your thoughts on the project? • Yes, It resulted in some risk issues that were not foreseen. It is worthwhile to have quite a few people involved (David Taylor). • Yes, it made everything clearer. It is a good way to come up with an action plan (Martin Astley) • Yes, it helped to keep the focus and efforts on the key issues (Kevin Povey)
What is the added value of the risk reference list? • The risk reference list forces you to look beyond your own area of expertise (Phil Waterfield) • The reference list stimulated the team to think more in detail about the project, and to identify risks the team hadn't thought of before (David Taylor) • It forces you to think beyond the area you are familiar with. It makes sure that you ask all the awkward questions (Andy Chapple).
What is the added value of the Risk Management Session? • Extremely useful to have because it dragged out a lot of new information from the project team. Input from lone voices: information or lack of information from lone voices became known (Kevin Povey). • The risk management session helped to get everybody on board with the action plan (Martin Ashley). • It highlighted the need for good communication between the different functions on the project (Kate Gransden).
Would you use RDM again? • Yes, because RDM allows you to get a look at risks from everybody's point of view equally. Choosing the right people is then the key to success (Andy Chapple). • Yes, because it makes it difficult for problems to be ignored. It does bring out the problems and gives everybody an equal say (Martin Astley). • Yes, because RDM allows people to express their deepest fears. It provides a framework, which is useful to discuss the risks with the business (Katherine Thompson).

Fig. 8. Project manager's visions on RDM: some quotes.

they can ask questions unbiased by status, politics and what happened in earlier projects," and: "I firmly believe that impartial facilitators are absolutely essential. It could not work if the project team tried to do this for themselves."

Finally the evaluation study also addressed the timing of RDM. Participants declared that it ideally should take place at the end of the feasibility phase of the project. Some also suggested that it should be done: "immediately prior to major decisions being taken."

Recently, as part of a research project on risk management, ten project managers at Unilever were interviewed about their experiences with RDM [14]. All these project managers praised RDM and declared that they will use it again in future projects. Fig. 8 presents some quotations taken from the project managers who participated in this last evaluation study.

RDM has led in some of the cases to the termination of a project. This happened when those responsible for it did not see a feasible way to manage the risks. We argue that such timely termination is among the important advantages of RDM. RDM appears also to help in choosing between alternatives. In one of the pilot projects, for instance, the team had to decide between various raw materials. RDM helped to clarify and compare the development scenarios for these materials, each of which involved a series of risk issues that had to be combined before a well-considered decision could be made.

6.2. Learning from experience

In addition to our evaluation study of RDM, we analyzed and compared in more detail the projects that served as pilot studies, in order to move beyond project-specific issues to

those that are inherent or structural in a substantial number of innovation projects. From this analysis, we compiled data useful for future project teams, for instance as an important input for a newly appointed project team in their project-start-up session, or as reference material for the risk facilitator, to be used in the risk identification phase of RDM. The eight projects that we analyzed yielded a total of 653 diagnosed project risks. For this analysis we followed a procedure recommended by Kassarjian [8]. This allowed us to standardize the outcomes of the various project teams and relate these to our reference list of risk issues. After the analysis we drafted a new version of this list, including 12 main risk categories and 142 corresponding potential critical innovation issues (see Appendix A).

Some of the issues included in Appendix A were extracted from articles about critical success factors in product innovation projects. Others were extracted from the RDM studies that we conducted in the last decade in various industrial firms. If a company wants to develop its own risk reference list, Appendix A might serve as a good starting point. We recommend a systematic evaluation of the relevance of the risk categories and related risk issues to the specific innovation context of the company, on the basis of which the reference list might be modified and extended.

6.3. Avoiding potential pitfalls

Our experiences with RDM suggest a number of pitfalls that might interfere with implementation. Skilled facilitators should be able to avoid most of these, by the following means:

- Take enough time for each of the individual interviews because this certainly will pay off at the end. Participants will feel they are taken seriously and will come up with what is really worrying them. For the risk facilitator it will also result a more complete sense of the manner in which a potential risk is perceived within the team.
- Don't turn the plenary part of the risk management session (step 8 of the RDM process) into a full brainstorming to try to solve all problems on the spot. Let the plenary session focus specifically on making plans for solving the identified problems.
- Don't flip through the risks saying, "a team is working on it, we have a plan," since the objective is also to assess those plans, although it can get tough if it is a very technical matter.
- Remember that the results are primarily for internal use. The team is the primary stakeholder for an RDM-process, and should decide what should be reported to whom.
- Follow-up must be guaranteed. Plans made during the plenary session should be worked out and the results should be reported to all participants.

7. Conclusion

An RDM conducted for a specific project generates proactive, cross-functional solutions for managing specific project risks effectively. A company might also use RDM outcomes to search for structural weaknesses in their innovation process. This will yield the necessary data to accelerate learning, to increase a company's innovation capabilities and by this its innovation success.

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Appendix A
Reference list with potential risk issues in the innovation process

I	**Product Family & Brand Positioning risks**
1.	New product helps to achieve business strategy
2.	Project is important for project portfolio
3.	New product contributes to brand name position
4.	Project includes global roll out potential and schedule
5.	New product fits within existing brand
6.	New product fits with brand image
7.	New product enhances potential of product family development
8.	New product provides opportunities for platform deployment
9.	New product supports company reputation
10.	New product has brand recovery potential
11.	New product has brand development potential
12.	New product's platform will be accepted by consumers
II.	**Product technology risks**
1.	New product's intended functions are known and specified
2.	New product fulfils intended functions
3.	In-use conditions are known and specified
4.	Interactions of product in-use with sustaining materials, tools etc. are understood
5.	Components' properties, function and behavior are known
6.	Correct balance between product components is established
7.	Assembled product meets safety and technical requirements
8.	Alternatives to realize intended product functions available
9.	New product shows parity in performance compared to other products
10.	New product shows stability while in storage (factory, shop/warehouse, transportation, at home)
11.	New Product format meets functional requirements
III.	**Manufacturing Technology Risks**
1.	Raw materials available that meet technical requirements
2.	Process steps to realize the new product are known and specified
3.	Conditions (temperature, energy, safety, etc.) to guarantee processing of good product quality known and specified
4.	Production means (equipment and tools) necessary to guarantee good product quality are available
5.	Scale up potential is possible according to production yield standards
6.	Production system requirements (quality & safety standards, training of human resources, facilities etc.) will be met
7.	Product packaging implications are known and specified
8.	Manufacturing efficiency standards will be met
9.	Alternative approaches to process the intended product will be available
10.	Adequate production capacity available
11.	Adequate Production Start Up assured
12.	Reusability of rejects in production foreseen

Appendix A (continued)
Reference list with potential risk issues in the innovation process

IV. Intellectual property Risks

1. Original know-how will be protected
2. Required external licenses or know how known and available
3. Relation to legal and patent rights of competitors known and arranged
4. Relevant patent issues are understood
5. Patent crossing potential known and arranged
6. Trade mark registration potential known and arranged

V. Supply chain & Sourcing risks

1. Suppliers will meet required quality
2. Capacity available to meet peak demands
3. Appropriate after sales services available
4. Contingency options available for each of the selected suppliers
5. Financial position of each supplier is sound
6. Past experiences with each of the suppliers are positive
7. Suppliers are ready to accept modifications if required
8. Supply contracts can be canceled
9. Each supplier will be reliable in delivering according to requirements
10. Required quantities will be produced against acceptable prices
11. Appropriate contract arrangements with suppliers will be settled

VI. Consumer Acceptance Risks

1. Product specifications meeting consumer standards and demands
2. New product fits consumer habits and/or user conditions
3. New product offers unique features or attributes to the consumer
4. Consumers will be convinced that they get value for money, compared to competitive products
5. New product appeals to generally accepted values (e.g. health, safety, nature, environment)
6. New product offers additional enjoyment, compared to competitive products
7. New product will reduce consumer's costs, compared to competitive products
8. Non-intended product use by consumers is adequately anticipated
9. Target consumer's attitudes will remain stable during the development period
10. New product will be communicated successfully with target consumers
11. New product will provide easy-in-use advantages, compared to competitive products
12. Primary consumer requirements are known
13. Target consumers will accept the new product's key product ingredients
14. Niche marketing capabilities available if required
15. Communication about new product is based on realistic product claim
16. Advertising will be effective
17. Product claims will stimulate target consumers to buy
18. New product has repeat sales potential

Appendix A (continued)
Reference list with potential risk issues in the innovation process

VII. Trade Customer Risks

1. Product specifications will meet trade customer standards and demands
2. Trade customers will welcome the new product from the perspective of potential sales
3. Trade customers will welcome the new product from the perspective of profit margin
4. Trade customers will welcome the new product given required surface and volume on shelf and storage facilities
5. Trade customer's attitude will remain stable during the development period
6. New product will be communicated successfully to trade customers
7. Right distribution channels will be used
8. Trade will give new product proper care
9. Trade supporting persons will endorse the new product
10. Stock demands will be met

VIII. Competitor Risks

1. Product will provide clear competitive advantages
2. Introduction of new product will change existing market share positions
3. Introduction of the new product will have impact on market prices
4. New product will be launched before competitors launch comparable product
5. Response actions towards public and media expected from competitors will be anticipated
6. New product enables the creation of potential barriers for competitors
7. Implications of being technology leader or follower for this project have been identified
8. Competitor's actions will be monitored and followed with adequate response
9. Competitor's challenges will be monitored adequately

IX. Commercial Viability Risks

1. The market target is clearly defined and agreed
2. Market targets are selected based on convincing research data
3. Capital cost projection for new product is feasible
4. Delays in product launch will leave the commercial viability of the new product untouched
5. Sales projections for new product are realistic
6. Estimated profit margin are based on convincing research data
7. Profit margin will meet the company's standards
8. The estimated return on investment will meet the company's standards
9. Volume estimates are based on clear and reliable estimates
10. Product viability will be supported by repeat sales
11. Supplier will get attractive purchasing agreements
12. Knowledge of pricing sensitivity is available
13. Adequate investments to secure safety in production will be made
14. Long term market potential is to be expected
15. Financing of capital investment is secured
16. Fall back to prior product concept is feasible
17. New product is commercially viable in case of market restrictions

Appendix A (continued)
Reference list with potential risk issues in the innovation process

X.	**Organizational & Project Management Risks**
1.	Internal political climate is in favor of this project
2.	Top management actively supports project
3.	Project goals and objectives are feasible
4.	Project team is sufficiently authorized and qualified for the project
5.	Project team will effectively utilize the knowledge and experience of (internal) experts
6.	Roles, tasks and responsibilities of all team members are defined and appropriate
7.	Decision making process in project is effective
8.	Communication between members in the project team is effective
9.	Required money, time and (human) resources estimations are reliable and feasible
10.	Required money, time and (human) resources will be available when required
11.	Project team will be informed in time about project progress
12.	External development partners will deliver in time, conform budget and technical specifications
13.	Sound alternatives are available to external development partners
14.	Collaboration within the project team is effective
15.	Sponsor's interest for the project is secured
16.	Project will effectively be organized and managed
17.	Collaboration with external parties is effective
18.	Collaboration between project team and the parent organization is effective
19.	Project team is highly motivated and committed
20.	Project team is paying attention to the right issues
21.	Project has an effective planning and contingency planning
22.	Project team is learning from past experiences
XI.	**Public Acceptance Risks**
1.	It is clearly understood who is responsible for PR of the project
2.	The key opinion formers for the new product are known
3.	Support of key opinion formers will be assured
4.	Legal and political restrictions will be adequately anticipated
5.	Environmental issues will be adequately anticipated
6.	Safety issues will be adequately anticipated
7.	Possible negative external reactions will be effectively anticipated
8.	In case of new technology prior (external) experience will be consulted
XII.	**Screening & Appraisal**
1.	New product performance targets will be tested and measured adequately
2.	Trade customer appreciation will be tested and measured adequately
3.	Consumer appreciation will be tested and measured adequately
4.	Adverse properties as a consequence of the technological change will be tested and measured adequately
5.	Credibility of the (internal) measures to external agencies is warranted
6.	Tests will provide reliable evidence

Appendix B
Decision rules for classification into risk classes

Score:
- * = At least 50% of the scores is found in 1st and/or 2nd column and none in 5th column;
- 0 = At least 50% of the scores is found in 4th and/or 5th column and none in de 1st column;
- M = At least 50% of the scores is found in 3rd column;
- ? = For all the remaining cases (wide distribution in opinions or remarkably deviating opinions). This score may eventually lead to a '*', '0' or 'm', after examinations and discussions between members in the risk team.

SCORE			RISK CLASS	SCORE			RISK CLASS
Certainty	Ability of team to influence course of action	Relative importance to project success		Certainty	Ability of team to influence course of action	Relative importance to project success	
*	*	*	F	*	*	?	M-F
*	*	0	L	*	?	*	H-F
*	0	*	M	?	*	*	M-F
0	*	*	H	*	?	?	L-F
0	0	*	L	?	*	?	L-F
0	*	0	L	?	?	*	L-F
*	0	0	L	?	?	?	S-F
0	0	0	S	?	0	0	L
*	*	m	H	0	?	0	L
*	m	*	H	0	0	?	L
m	*	*	H	?	?	0	S-M
*	m	m	M	?	0	?	S-H
m	*	m	M	0	?	?	S-M
m	m	*	M	*	?	0	L-M
m	m	m	M	*	0	?	L-H
0	*	m	M	0	*	?	L-M
*	0	m	M	0	?	*	L-M
0	m	*	M	?	0	*	L-H
*	m	0	M	?	*	0	L-M
m	*	0	M	*	?	m	M-H
m	0	*	M	*	m	?	M-H
0	0	m	L	m	?	*	M-H
0	m	0	L	m	*	?	M-H
m	0	0	L	?	m	*	M-H
0	m	m	M	?	*	m	M-H
m	m	0	M	m	?	0	L-M
m	0	m	M	m	0	?	L-M
				0	?	m	L-M
				0	m	?	L-M
				?	0	m	L-M
				?	m	0	L-M
				?	m	m	L-M
				m	?	m	M
				m	m	?	M
				?	?	m	L-H
				?	m	?	L-H
				m	?	?	L-H

mean of the risk classification:

- F = Fatal risk;
- H = High risk;
- M = Medium risk;
- L = Low risk;
- S = Safe, no risk.

A combination of classes means that the risk team should work out whether the disagreement can be resolved and hence a single risk classification can be achieved. If consensus can't be achieved the worst possible case should be assumed.

Appendix C. Trigger questions to assist the process of developing solutions for project risks

1. *Problem description*:
   - What is the problem?
   - Where does it occur?
   - When does it occur?
   - What damages can be attributed to the problem?
2. *Problem causes*:
   - What is the origin of the problem?
   - Why does it occur?
3. *Probability of the causes*:
   - How probable are the distinguished causes?
   - How can be verified that these are the causes?
4. *Selection of solution direction*:
   - Is action necessary?
   - If action will be taken: what is an attractive option: to reduce; to transfer the risk to another party; or to reject?
   - If action is not chosen: which precautionary measures should be taken?
5. *Specifying the solution direction*:
   - In case of risk reduction: what are the options?
     Possibilities are among others:
     * Selecting a different (technical) solution:
       - Use a more reliable or known solution;
       - Altering the demands and specifications;
     * Selecting the same solution, but:
       - Take more time and funds for research and testing, like simulation; take these tests as soon as possible;
       - Take a more time-phased approach; time-phase the specified production quantities or, incorporate quit options;
       - Incorporate back up;
       - Execution in cooperation with experts;
       - Opt for a different team composition, mode of cooperation, control, location of execution etc.
       - Altering the project structure.
   - In case of risk transfer to another party: what are the options?
     Possibilities are among others:
     * Outsource entirely to an organization with more experience, knowledge or skill in the respective area;
     * Development in cooperation with one or more allies.
   - In case of risk rejection: what does that mean for the project?
     * Does rejection lead to a complete stop in project execution or can the project still be adapted?
     * If adaptation is chosen: what are the options for redefining or restructuring the project?
   - If no action is chosen, how can possible effects of a risk, if these occur, be coped with?
     * Do nothing, but monitoring carefully to still take (precautionary) measures;
     * Take precautionary actions through a contingency plan and/or incorporate sufficient slack (in time, capacity and funds) to cope with the effects.
6. *Action planning*:
   What action should be taken to actually execute the found solution: who is responsible/ how to achieve/ when-to- start/ when-to-complete/ resources needed/ progress reporting and steering possibilities/ etc.?

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