Intra-Organizational Model of Communicaton on Serious Risks

Mira Kajko-Mattsson

***Abstract*—Organizations must be more forthright in their communication about risks. This is however not easy on an organization-wide basis where many different processes and roles are involved. In this paper, we evaluate a model of an intra-organizational risk management communication within 57 software organizations. Our results show that our model is mainly applicable within large companies.**

***Index Terms*—business level, engineering level, risk manager, risk management forum, communication channels, risk-driveness.**

I. Introduction

Some serious risks need to be properly and efficiently communicated within the whole organization [1, 12, 14]. It is only in this way one may make informed and proactive decisions about their management. This is however not easy bearing in mind the fact that many different processes and roles are involved in risk communication.

To facilitate an intra-organizational communication, we have outlined a model in [2]. This model was developed for an agile context. However, we believe that it is applicable in any development context, agile or non-agile.

In this paper, we present a model of an intra-organizational communication about risk management and evaluate it within 57 organizations. Our goal is to identify types of risk management information and its flow when being communicated within a whole organization.

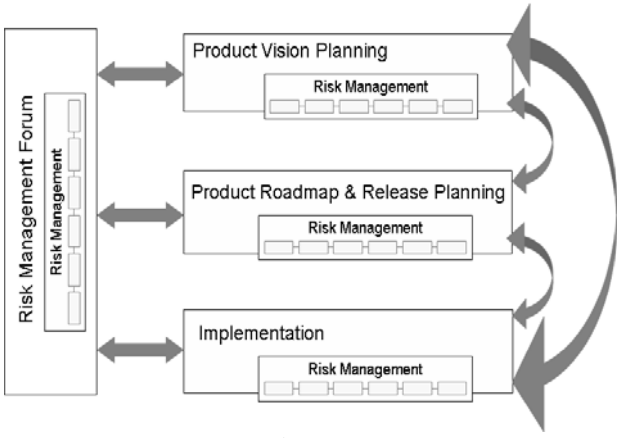

Fig. 1. Overview of a risk communication model

Manuscript received January 20, 2010.
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The remainder of this paper is as follows. Section II briefly presents the intra-organizational risk communication model. Section III describes our research method. Section IV evaluates the risk communication model within 57 companies. Finally, Section V makes conclusions and suggestions for future work.

II. Preliminary Version of Intra-Organizational Risk Communication Model

The model manages all risks encountered on an organization-wide basis. As depicted in Figure 1, it covers three main phase levels, *Product Vision Planning* corresponding to the business strategic level, *Product Roadmap and Release Planning* corresponding to the operational strategic level, and *Implementation* corresponding to the operational level [3, 4].

Most of the risks undergo a complete risk management process within one level. The ones that are not or cannot be mitigated within one level may be transferred to the next level, and/or get reported to the *Risk Management Forum (RMF)*.

The *Risk Management Forum* is a function for coordinating risk management across the organization. It manages serious risks that have to be promptly disseminated, for instance, risks concerning several teams. It consists of a cross-functional group represented by the roles responsible for or concerned with or capable of managing these kinds of serious organizations-wide risks.

Below, we provide a brief overview of the model in the following order: (1) *Process Phases and Organizational Levels,* (2) *Roles and Responsibilities,* and (3) *Communication Channels*.

A. Organizational Levels and Process Phases

Risks should always be considered in some context and the goal that is desired in this context. The context on an organization-wide basis is always an outcome of a specific business cycle [9]. The intra-organizational communication model covers the entire development process including the *Business* and *Engineering* levels [3, 4].

As depicted in Figure 2, the *Business Level* consists of the *Product Vision Planning* phase. The *Engineering Level* consists of *Product Roadmap, Release Planning* and *Implementation*.

Product Vision Planning phase involves creating a product vision plan guiding the work carried out in subsequent planning, decision making, and development [13]. Risk management within this phase mainly concerns the

ISBN: 978-988-17012-8-2
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

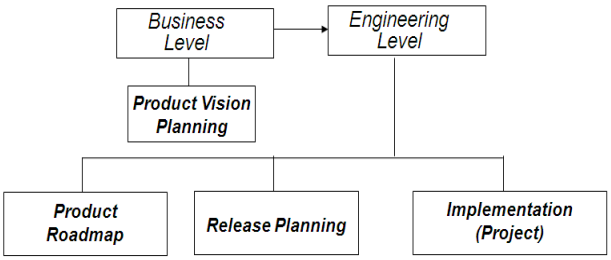

Fig. 2. Organizational levels and main process phases

identification and analysis of business related risks, such as budget and resource risks.

During the *Product Roadmap* and *Release Planning* phase, one first creates a high-level roadmap plan for the product releases which one then regularly revisits before the start of each new release. Risk management in the *Product Roadmap* and *Release Planning* phase comprises risk identification, analysis and action planning. It involves both business and technical risks.

In the *Implementation* phase, the team, product management and other stakeholders plan the work to be conducted in the coming iteration. The plan is then executed to deliver an increment of working product functionality. Risk management in this phase primarily covers the monitoring and controlling of the project risks that are continuously identified, analyzed and planned for during this phase. Risks are mainly of a technical character in this phase. Also, risks identified in the previous development phases are monitored and controlled during this phase.

B. Roles and Responsibilities

In our model, we have identified several roles having various responsibilities with respect to risk management and its communication. Generally, however, risks are owned by the roles in the phase where the risk is originally identified. The roles and responsibilities are:

- *RMF Members*: *RMF members* own all the organization-wide serious risks. Their main task is to supervise and coordinate all the major and most serious risks and make decisions on them. However, they may delegate their management to other roles either within the *Business* or *Engineering* levels or both. Just as within emergency problem management, the constellation of the *RMF* depends on the risks to be managed. *RMF* may consist of permanent roles and temporary roles [7]. The permanent roles are the upper management roles that are responsible for making final decisions on risks and their management. The temporary roles, on the other hand, are the roles that have encountered risks, such as for instance, team leaders or the roles that are affected by the risks, such as for instance customers. The temporary roles assist the permanent roles in mitigating risks.
- *Business Manager: Business Manager* is responsible for managing risks at the *Business Level*. This role owns all the risks relevant for this level. However, he may delegate their management to the roles in the *Product Roadmap and Release Planning* or *Implementation* phase. The choice of risks to be delegated depends on the character of the risk and where in the organization it is most adequately managed. Still however, *Business Manager* keeps the risk ownership till the delegated risks get mitigated.
- *Product Manager: Product Manager* is responsible for all the risks managed in the *Product Roadmap and Release Planning* phase. This role owns all the risks relevant for this level. However, in the same vein as the *Business Manager*, *Product Manager* may delegate their management to other roles in the organization, if needed. He still keeps the risk ownership till the risks get mitigated.
- *Team Leader* and *Team Members: Team Leader and Team Members* are responsible for managing risks within the *Implementation* phase. The team leader supervises the risk management. Usually, team members own the risks that concern the development tasks assigned to them. However, the team may also decide to delegate the risks to others in the organization depending on the risk and its management needs.

C. Communication Channels

An effective management of organization-wide risks rests on how risks are communicated within an organization. To warrant effective information flow throughout the whole business cycle, one needs define communication channels. As depicted by the double-edged arrows in Figure 1, our model identifies six *Communication Channels.* They are: (1) *Product Vision Planning* ↔ *RMF,* (2) *Product Vision Planning* ↔ *Product Roadmap and Release Planning,* (3) *Product Roadmap and Release Planning* ↔ *RMF,* (4) *Product Roadmap and Release Planning* ↔ *Implementation*, (5) *Product Vision Planning* ↔ *Implementation,* and (6) *Implementation* ↔ *RMF.* Each communication channel involves different roles who act as the main senders and receivers of risk information.

III. Research Method

In this section, we present our research method. We first describe the research steps taken in this study in Section III.A. We then present the questionnaire used in Section III.B. Finally, in Section III.C, we motivate the sampling method used when choosing the organizations for this study.

A. Research Steps

Our work consisted of several consecutive steps. We first outlined a roadmap designating business and engineering levels, their inherent processes and communication channels among them. This roadmap was created in our former study [2]. It is illustrated in Figure 2. On purpose, due to former direction of our research, the roadmap was created for the agile development context.

In our former study [2], the model was considered to fulfill its purpose as a reference model. It was regarded useful for anybody interested in comparing their risk management practice. Some concerns, however, were raised involving the function of *Risk Management Forum* and the roles in the model. Although they were considered appropriate to traditional heavyweight methods, they were regarded to conflict with agile principles. For this reason, we have decided to continue evaluating it, this time however, in all types of development contexts, agile and non-agile.

ISBN: 978-988-17012-8-2
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

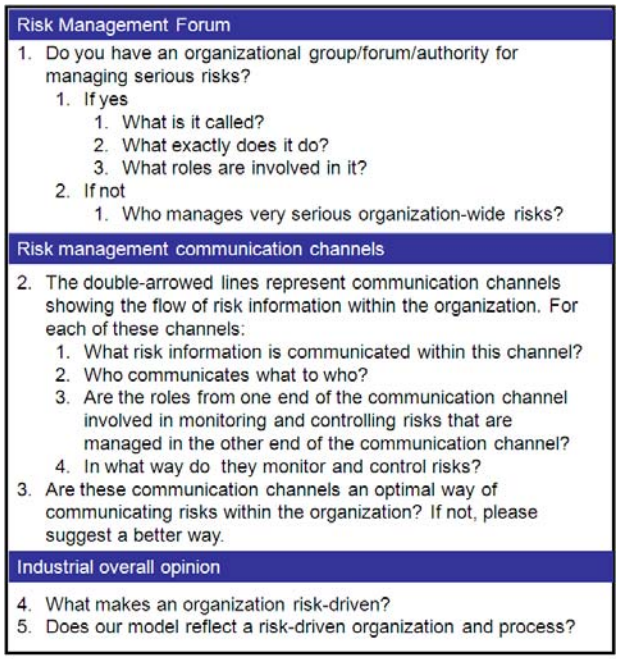

Fig. 3. Our questionnaire

As a second step, we designed a questionnaire in which we inquired about the communication channels in our model and the appropriateness of *Risk Management Forum.* In addition, we collected suggestions for how to make organizations more risk-driven on an organizational-wide basis. Our questionnaire is presented in Figure 2 and described in more detail in Section III.B.

In the third step, the interviews were made with 57 representatives from different 57 companies. The interviews were conducted by our students. The process of interviewing and evaluating our results is presented in Section III.C.

In the fourth and final step, we analyzed the results delivered by the students and checked their credibility, if needed. It is these results that constitute a basis for evaluating and extending our intra-organizational risk communication model.

B. Questionnaire

Our questionnaire consisted of three groups of questions. As shown in Figure 3, these are the following:

- *Questions inquiring about Risk Management Forum*: Here, we asked whether the organizations had some organizational authority for managing serious organization-wide risks, how this authority was called, what exactly it did and what roles were involved in it. The goal was to find out how major serious risks were managed within the organizations today.
- *Questions concerning the communication channels:* For each of the communication channels, we found out what risk information was communicated within the channel, who communicated it to who, and how the risks were monitored and controlled by the parties involved. Finally, we asked our interviewees for the opinion about the communication channels.
- *Questions regarding the industrial overall opinion about managing risks*: We first asked the interviewees to list the features of a risk-driven organization. We then requested them to express their opinion about the risk-driveness of our model.

C. Sampling Method and Validation

The interviews were conducted by our students who attended an advanced international software engineering course. The data sampling method was convenience sampling [15]. The students were free to choose any software organization. The only requirement was that the organizations had a risk management process in place.

The organizations chosen by the students represent the countries of China, Colombia, Denmark, Finland, Germany, Iran, Mexico, Bangladesh, Pakistan, Thailand, USA, Spain, and Sweden. They range from small IT consultancies developing business applications to large multinational organizations developing complex software for the medical, defense or space industry. The roles interviewed vary from software developers to CEOs. Due to confidentiality reasons, we neither name the organizations nor the interviewees.

The data sampling method chosen for this study does not allow us to generalize our results. It still however provides a valuable feedback for evaluating and extending our model.

IV. Interview Results

In this section, we present the interview results. When doing it, we follow the order of the questionnaire.

A. Risk Management Forum

Out of 57 organizations studied, only 22 of them had established an authority corresponding to *Risk Management Forum*. The naming of this authority varies. Examples are *Executive Committee, Steering Group, Executive Board, CORE 3, Project Manager Office, IT Architecture and Governance Unit, Operation Onboard Core Team Meeting, Engagement Risk Management, Corporate Risk Management,* and *Safety Managers*.

Out of the remaining 35 organizations, 16 of them manage all their risks locally within projects. Regarding the remaining organizations (19 out of 35), all their serious risks are managed by a group of roles created on an as-needed basis. Hence, we may conclude that they have an authority corresponding to *Risk Management Forum*.

The constellation of roles involved in *Risk Management Forum* varies depending on the risks to be managed. Just as in our model, some roles belong to this authority on a permanent basis whereas others are only involved temporarily. As shown in Figure 4, the flora of role names is very wide ranging from *Developers* to *Project Managers* to the *Presidents of the Company*.

Regarding the companies that do not practice decision making in form of *Risk Management Forum*, they claim that most of their risks are handled locally within the projects. Usually, it is a project manager together with developers who are responsible for risk management.

Risk Management Forum manages risks in form of meetings. According to the companies practicing *Risk Management Forum*, such a role is a must to assure proper

ISBN: 978-988-17012-8-2
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

- Chief Technical Officer
- Business Manager
- Technical Consultant
- Project Manager
- Team leaders
- QA Managers
- Lead Developer
- Upper Management
- Product Manager (Product Owner)
- CEO
- CTO
- System Architect
- Business Analyst
- Development Area Director
- Sales Manager
- Team of Experts
- Risk manager
- Development team
- Senior analyst
- Executive Steering Committee
- Client Sponsor
- Client Project Manager
- Project Manager
- Quality Manager
- Marketing Manager,
- SVP (Senior Vice President)
- System Analyst
- Developer
- Tester
- Release manager
- President
- Sales and Marketing Manager
- Research and Development Manager

Fig. 4. Roles possessing an authority corresponding to *Risk Management Forum*

management of serious organization-wide risks. Their fora are arranged on either a continuous or on an as-needed basis.

Two of the organizations have mentioned that they have created a common tool in which they record all risks. This tool supports an organization-wide risk management. Anybody within the organization has access to it and the RMF is automatically notified about the risks by this tool.

Risk Management Forum is responsible for defining the organization-wide risk management policy. It starts being active already in the sales and proposal stage of a business cycle/project and ends upon its completion and delivery of its outcome. It begins by setting a risk management strategy for a specific goal. This strategy is usually agreed upon with the client. It corresponds to an action plan of how risks will be addressed throughout the business cycle [9].

Risk Management Forum is active throughout the whole business cycle. It assists in identifying and assessing risks and their dependencies, in co-ordinating and reviewing risk management, in monitoring and controlling risks, in suggesting action plans and solutions, and in following-up risk management actions.

Risk Management Forum is most active at the beginning of the business cycle. This is because risks identified at this stage are determinants whether the business/project should start. Depending on the company and its risk management strategy, it then follows the business cycle/project either on a continuous or on an as-needed basis. [9]

- ❑ Delivery risk
- ❑ Project implementation risk
- ❑ Time and work estimates risk
- ❑ Schedule risk
- ❑ Performance risk
- ❑ Environment change risk
- ❑ Feature feasibility risk
- ❑ Test plan risk
- ❑ Cost and budget control risk
- ❑ Release delay risk
- ❑ "Adding/dropping items from release" risk
- ❑ Product expectation risk
- ❑ Technology risk
- ❑ Slack burn,
- ❑ Human capital risk (demotivations, etc.)
- ❑ Defective release risk
- ❑ Requirements misinterpretation risk
- ❑ Project milestones and deadlines risk
- ❑ Fraud risk
- ❑ "Non-compliance of specifications and schedule with customer requriements" risk
- ❑ "Customer resistance to features" risk
- ❑ Technical risks
- ❑ Quality risks
- ❑ Hardware risks
- ❑ Consumer reaction risk
- ❑ "Unnecessary customer requirements" risk
- ❑ Unrealistic deadline risk
- ❑ Additional customer requirements risk
- ❑ Deployment risk
- ❑ "Impact on other releases" risk

Fig. 5. Risks managed within the *Product Roadmap and Release Planning ↔ Implementation channel*

B. Communication Channels

In this section, we describe the practice of communicating risk information within an organization. Sections II.B.1-6 describe the communication channels within the organizations studied. Section II.B.7 presents the opinion about the optimality of our communication channels.

1) Channel: Product Roadmap and Release Planning ↔ Implementation

In the *Product Roadmap and Release Planning ↔ Implementation* channel, one communicates risks between implementation (projects) and product and release planning phases. As shown in Figure 5, these risks are mainly related to projects and release problems. They range from risks for defective releases, to delivery delays, to human resource risks. The roles involved in communicating the risks are team leaders, project managers, product owners, developers, customers, customer proxies, release managers, testers, and architects.

The majority of the organizations conduct some form of risk monitoring and controlling activities. These activities take the following forms:

- Continuous control that the product functions/features agree with customer requirements.
- Continuous monitoring and control that the activities are performed according to the project plan as agreed upon with the customer.
- Monitoring of risks coming from previous projects, plus monitoring of risks identified within the current project.
- Continuous review of the implementation plan.
- Preparation of a contingency plan for all potential risks.
- Regular tracking of project status and resource availability.
- Schedule and task progress monitoring.
- Putting extra resources and training the team.
- Considering additional expectations of the customers and increasing the required resources to fulfill the expectations.
- Correcting customer expectations either by making compromises with the customer or by inducing more resources to meet the customer expectations.
- Creating test cases for most uncertain parts.

- ❑ Project implementation risk
- ❑ New technology risk
- ❑ New customer requirement risk
- ❑ Market risk
- ❑ Business risk
- ❑ "Changes to product vision planning" risk
- ❑ "Changes in external environment" risk
- ❑ "Impact on several releases" risk
- ❑ "Development direction violation" risk
- ❑ Delivery risk
- ❑ Competitor risk
- ❑ "Slippage of schedules "risk
- ❑ Revenue risk
- ❑ Project change risk
- ❑ "Customer willingness to co-operate" risk
- ❑ Business know-how risk
- ❑ Technical know-how risk
- ❑ Product user-unfriendliness risk
- ❑ Unattractive product risk
- ❑ "Under and over budgeted resource" risk
- ❑ Low competiveness risk
- ❑ Business volatality risk
- ❑ Product quality risk
- ❑ Initial product vision risk
- ❑ Public opinion risk
- ❑ Sensitive release date risk
- ❑ Media risk

Fig. 6. Risks managed within the *Product Vision Planning ↔ Product Roadmap and Release Planning* channel

ISBN: 978-988-17012-8-2
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

Fig. 7. Risks managed within the *Product Vision Planning* ↔ *Implementation* channel

- Modifying the software so that it can fit riskless environment.
- Agreeing on new release dates with the customer.

Usually, *Product Owner* is involved in monitoring and controlling risks being managed in projects. They monitor them through regular feedback and via reports from *Project Managers* or via various kinds of meetings.

2) Channel: Product Vision Planning ↔ Product Roadmap and Release Planning

In the *Product Vision Planning ↔ Product Roadmap and Release Planning* channel, business management communicates risks with the roles responsible for product and release planning. As shown in Figure 6, one communicates risks ranging from schedule risks to market risks to business volatility risks.

The roles involved in this communication channel are business analysts, business managers, project managers, release managers, product owners, marketing managers, and program managers.

The majority of the organizations studied conduct some form of monitoring and controlling activities at these levels. The activities that have been mentioned by the interviewees are:

- Strict monitoring of the project plan.
- Adding more resources.
- Ensuring that the developed product meets the business requirements.
- Overloading team members with additional tasks or getting more team members.
- Compromising profit/loss against product quality.
- Modifying features that put the product in a risk-zone.
- Deciding on whether to release the product.
- Changing the release date to earlier or later dates.
- Controlling that all deliverables are delivered on time.
- Conducting training, if necessary.
- Conducting a comprehensive product testing.

3) Channel: Product Vision Planning ↔ Implementation

In the *Product Vision Planning ↔ Implementation* channel, business management communicates risks with the roles responsible for the implementation process. As shown in Figure 7, one communicates risks ranging from technology risks to schedule slippage to market risks.

Fig. 8. Risks managed within the *RMF ↔ Implementation* channel

The roles involved in this communication channel are business analysts and project managers. Some of the interviewees pointed out that these two actors do not often communicate with each other. They should communicate indirectly via *Product Roadmap and Release Planning* level. However, following the new communication trend suggesting more intimate contact between business and developer roles, the majority of the organizations studied conduct some form of common monitoring and controlling activities at these levels. The activities that have been mentioned are:

- Strict monitoring of the project plan, its milestones and budget.
- Adding resources to capture the market earlier than the competitors.
- Monitoring that the product is developed according to the customer requirements.
- Continuous monitoring of the progress and status of the project.
- Control that the new product fulfills the customer requirements and competes with other products.
- Deciding on whether to release or not the product version.
- Ensuring the project is implemented on schedule.

4) Channel: Risk Management Forum ↔ Implementation

In the *Risk Management Forum ↔ Implementation* channel, projects communicate with the upper management on mainly very serious risks. As shown in Figure 8, the risks communicated in this channel concern all kinds of serious emergency risks that may jeopardize the company's business opportunities, product quality and the like.

The roles involved in the communication are mainly project managers, team leaders, top management, sales managers and the RMF members that are relevant for the risk at hand.

The monitoring and control taking place between these levels is strongly limited to only very serious risks. It deals with:

- Strict monitoring of the project plan when to deliver a product and its new features.
- Monitoring whether the resources are enough to early capture the market before other competitors.
- Monitoring that the product is developed according to the customer requirements.
- Extending the existing resources.
- Arranging additional training.

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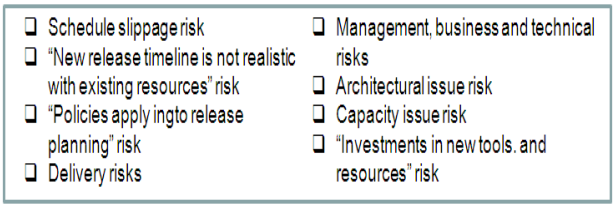

Fig. 9. Risks managed in the *Product Roadmap and Release Planning ↔ RMF* channel

Fig. 10. Risks managed in the *Product Vision Planning ↔ RMF* channel

- Revising the policies and strategies to mitigate the risks.
- Rearranging development tasks.

5) Channel: Product Roadmap and Release Planning ↔ Risk Management Forum

In the *Product Roadmap and Release Planning ↔ Risk Management Forum* channel, one discusses serious implementation risks with the organization's upper management. Examples of such risks are listed in Figure 9. The roles involved in the communication are mainly project managers, team leads, top management, sales managers and the *RMF* members that are relevant for the risk at hand.

Some form of monitoring and control takes place in this channel. It deals with:

- Monitoring and control that project releases are delivered on time.
- Monitoring and control that releases meet the customer requirements.
- Controlling that the product gains the market and competes with other products.
- Requesting more funds if necessary or overburdening the team members.

6) Channel: Product Vision Planning ↔ RMF

In the *Product Vision Planning ↔ Risk Management Forum* channel, upper management meets in order to discuss serious risks, mainly of business character. Examples of such risks are listed in Figure 10. The roles involved in this channel are business analysts, business managers, senior members of executive committees, risk managers, CEOs and the like. They commonly analyze the market situation, customer expectations and competitor products, monitor and control whether the product evolves according to the market trends and whether it fulfills the customer requirements. They also identify competition points that might help them introduce new business ideas. They may request modifications to product features and commonly judge whether it is profitable to develop or modify the product.

7) Optimality of Communication Channels

The interviewees were asked to express their opinion whether our communication channels were optimal. They judged them from their organizations' point of view.

Out of 57 organizations, 36 organizations were of the opinion that the designation of the communication channels was optimal on an organization-wide basis. However, some of them have pointed out the following:

- These communication channels are a good way of communicating risks information. However, they are only realistic to implement in large-scale companies, having many employees, running big projects and encountering major risks. Most of the risks are attended to locally within each individual level.
- For small companies, it may be enough to have regular meetings with the attendance of all the company's staff. However, some representatives from even smaller companies still preferred our model. According to them, using it would remove various types of bottlenecks and message overdose when managing serious risks.
- The channels need to be complemented with escalation rules for how and when to escalate risks to the appropriate manager or forum. A clear process should define which risks should be escalated according to what escalation pathway and to what management level.
- The channels need be complemented with tools supporting risk management process. Some of the interviewees have expressed a need for effective tools in which one could constitute a central repository containing all information about risks and their management. This would aid in effective dissemination of risk information.
- The model is very abstract; however, it constitutes a good start for identifying communication channels. In reality, these channels may take a different course due to differences in organizational constellations. For instance, in one organization practicing agile development, one uses developers in *Product Roadmap and Release Planning* phase. In this case, the communication channel between *Product and Release Planning ↔ Implementation* is unnecessary. It would imply that developers report on risks to themselves.
- The model imposes formal communication. According to one interviewee, informal communication is performed more naturally, but is not reliable enough when dealing with very serious risks. To achieve reliability, the communication channels as suggested in our model must be formalized in some way.
- *Risk Management Forum* constituting the highest level of the escalation process should be partly independent of the group handling the risks. In this way, one may guarantee fair and unbiased risk management.

Regarding the remaining organizations, three of them stated that the model was not applicable, eight of them could not provide any answer, and the remaining nine totally disagreed with the model. The organizations in which the model was not applicable were either outsourced or outsourcing or they were small organizations. The organizations that disagreed could not provide any concrete motivation. On further study of their risk management processes, we discovered that most of their risks were managed within projects only.

ISBN: 978-988-17012-8-2
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

C. Risk-Driveness

In this section, we first list features of a risk-driven organization as provided by our interviewees. We then describe their opinion about the risk-driveness of our model.

a) Features of Risk-Driveness

The organizations were asked to list issues that make them risk-driven. Out of 57 interviewees, we received 47 concrete responses. These are presented from four different perspectives: *Process, Organization, Role* and *Product*.

- Process perspective:
  - Risk management should be part of most of the activities. It should be pervasive within most of the processes within the organization. The process that was suggested to be excluded from risk management was front-end support [5, 6, 8].
  - Risk management should be a continuous activity. It should start anywhere and anytime within a business cycle or project. Hence, it should be conducted on a regular basis during which one continuously identifies and eliminates risks.
  - One must assume that risks always exist. Hence, one should have risk management policies, strategies, and processes for managing them.
  - Use of previous experience when identifying and eliminating risks makes the process truly risk-driven.
  - If risks determine the next process steps or influence it in some way, then the organization and its processes are truly risk-driven. This is only applicable if risks block the next process steps. If this is not a case, then risks can be handled at later stages or in parallel with the next process steps.
  - Daily stand-ups, iteration planning meetings, release planning meetings, and retrospective and review meetings should cover risk management. Here, the majority of interviewees stated that these activities should regularly include risk management activities. However, one interviewee pointed out that risk management on the lowest level such as daily stand-up meetings should identify and remove some obstacles for the projects. Hence, it is doubtful whether it can be classified as risk management.
  - Developers write stories and break them down to tasks. In this way, they conduct risk management and avoid unexpected surprises.
  - Risk impact control loop should be implemented. Before any change within any project area is approved and implemented, the effect of the risk on the other areas must be analyzed and considered.
  - The majority of the interviewees claimed that all risk types should be documented. The focus, however, should be on the severe risks having a severe impact. Due to the fact that the same risks appear again and again, their documentation should provide feedback for collecting lessons learned and experience to be used in the future. The documentation should provide the backbone of the risk management communication. To facilitate the documentation process, templates should be created such as, for instance, the one suggested in [5].
- Organizational perspective:
  - Provide visibility about the risks to all the relevant stakeholders and act to get rid of risks or to minimize their impact. Not all risks however should be visible to everybody within the organization. Risks associated with serious business opportunities or those impacting other business parts should be transparent business-wide.
  - Provide an open and positive atmosphere with respect to risk management in the organization. Still, however, many people are embarrassed to point out risks. This only delays and deteriorates risk management process.
- Role perspective:
  - All roles should be involved in risk management. Here, there were divided opinions. Some interviewees claimed that everyone should be involved in risk identification and communication. This is because it is useful to collect many different opinions and perspectives on risks. However, not everyone should be involved in managing risks. The risk management should be conducted by the peopl who have a good overview of the project or business.
  - The mental alertness about risks is crucial for achieving a risk-driven organization. So, it is people and not the processes that contribute to the risk-driven organization.
- Product perspective:
  - For some products such as nuclear plant controllers or on-line products, risk should be considered as an important product feature. Risks here are important in relation to various product qualities such as availability, safety, security and the like. All product related risk information should be explicitly communicated and provide input to the next-coming product releases.

2) Risk-Driveness of our Model

The interviewees were asked to express their opinion about the risk-driveness of our model. Out of 57 organizations, 38 explicitly stated that the model is risk-driven. Only one organization stated the opposite and 18 organizations could not answer this question.

Irrespective of the answers provided, the majority of the respondents claimed that the model is very abstract. It should be however pointed out that in real situations, these levels may be more or less integrated or desegregated with each other. Hence, they may be context-dependent.

The majority of the interviewees claimed that our model constitutes a good beginning for a roadmap designating an intra-organizational risk communication. However, it needs to be complemented with an overall organization-wide risk management process taking place within all these levels with clear specifications of risk management escalation rules.

V. Conclusions and Suggestions for Future Work

In this paper, we have presented a model of an intra-organizational communication about risk management and evaluate it within 57 organizations. Our goal is to

ISBN: 978-988-17012-8-2
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

identify types of risk management information, its communication paths within a whole organization and the roles involved in this communication.

Our results show that our model is realistic and appropriately reflects an intra-organizational flow of risk management information within large companies. In smaller companies, however, many of the channels are felt redundant.

The model only provides a backbone for visualizing an intra-organizational information flow. It needs to be complemented with risk management processes relevant for each of the levels and escalation rules among the levels.

We have already started adding muscle to our model by studying risk management process within a business life cycle at IBM [9] and by studying how various roles are involved in risk management [10, 11]. However, more cases studies need to be investigated in order to enhance our intra-organizational risk communication model.

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ISBN: 978-988-17012-8-2
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)