ATTENTION SHAPING IN RISK ASSESSMENT PROCESSES: AN ACTION RESEARCH STUDY

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Abstract. This paper present an action research study conducted at Smurfit Kappa Kraftliner, in which a risk assessment method was used to identify risks related to their use of IT in the production. The aim of the paper is to create a better understanding of the risk management methods needed in addressing the complexities of today's plant information systems. The result of the study is an adaption of the risk assessment method used to allow for identification of more complex, socio-technical risks. Document layout

Introduction

IT infrastructures are increasingly used in all areas of our society. While the use of IT infrastructures in organisations grows, the complexity and the diversity of its application domains increases as well. In the context of the process industry, the successful integration between business systems, workflow systems, manufacturing execution systems and shop-floor process control systems remains a key issue for facilitating the deployment of plant IT infrastructures. Increasing flexibility and plant efficiency has been a key challenge for modern process industries since long.

However, the rapidly increasing complexity of each component does not help ensuring coherent relationships between all components involved.

In fact, due to the inherent autonomy and heterogeneity of each component, a fundamental problem concerns the correct and reliable execution processes in today's industrial plants. To this end, risk management has emerged as a key issue for process industries, in particular issues related to the ongoing adaptation of IT infrastructure components. Addressing these risks cannot be achieved simply by connecting components to the overall plant IT infrastructure while attending to technical risks. In fact, much evidence has pointed at the limitations of existing risk management methods in addressing the complexities involved in contemporary risks (see e.g. Lyytinen et al 1998)). In particular, a promising approach has been articulated by Hanseth (Hanseth & Braa 2000) in addressing risks from a perspective grounded in theories on the risk society (Beck 1994; 1999). This paper builds on these efforts and seeks to extend existing literature by building on the results of a case study in the process industry addressing risks as a socio-technical phenomena

While risk management has attracted the attention of IT management and organization scholars, a key question seems to be whether or not mainstream risk management methods are effective. Our research question is: how does the implementation of, and work with, risk management methods influence corporate risk? To address this question we draw our inspiration from writings within Actor-Network Theory (ANT), especially its "and after" dimensions (see Callon, 1998, 1999; Law, 2004; Law & Mol, 2002). In such a perspective a risk management method becomes an intermediary in a *heterogeneous materiality*, travelling due to a wide range of translations, and with a capacity of bending socio-technical space.

The overall aim of this paper is to create a better understanding of the risk management methods needed in addressing the complexities of today's plant information systems. In doing this we apply a risk management method from the computer consultancy firm Sogeti to a risk management case at Smurfit Kappa Kraftliner, Piteå, Sweden. Based on the case study, and the ways in which the method shaped the attention for risk managers to some issues while ignoring others, we revise the method to better suit the particularities of plant information systems.

The rest of the paper is structured as follows: The next section deals with IT risk management methods seen as heterogeneous materiality. In section three we present the case, which is later analyzed in section four. We conclude with a discussion and lessons learned for both researchers and practitioners.

Related Research

Risk, risk management and risk management methods

Lyytinen, Mathiassen and Ropponen (1998) have developed a framework for software risk management to address what they see as three fundamental weaknesses of contemporary approaches.

1. The contemporary approaches rely on simplistic environmental models and make no distinction between different types of risk-generating contexts.
2. Action is guided through ad hoc lists of risk resolution techniques and thus provide a weak understanding of the nature of risk management behaviour.
3. The attention of risk managers is shaped through specialized/narrowly focused lists of risk factors.

They build on the idea that risk management needs to take into account how managers act in uncertain situations and complex organizational settings. The use of risk management methods can help shape the attention of risk managers at all levels of an organization, and as such can be used to not only identify technological risks and current risk handling processes but also socio-technical risks not commonly included in risk management methods. This can be achieved by broadening the focus and topics of what can be regarded as a risk, thus following the suggestion by Lyytinen et al (1998) to examine risk management as an instance of organizational uncertainty absorption and management.

Risk management as heterogeneous materiality

A key concern in ANT is how *ontology* is approached. Lee and Hassard (1999: 393) write that "contemporary research strategy takes recourse increasingly to trajectories that are empirically relativist and ontologically realist. In contrast, for us, the research strategies of ANT largely invert this position". Callon and Latour (1981: 286) also suggest that an actor is: "Any element which bends space around itself, makes other elements dependent upon itself, and translates their will into a language of its own". These capabilities are typically reserved as a property of human beings.

When actors - nonhumans and humans - are translated they are also black boxed. According to Callon & Latour (1981: 284-285), such a box "contains that which no longer needs to be reconsidered, those things whose contents have become a matter of indifference. The more elements one can place in black boxes – modes of thoughts, habits, forces and objects – the broader the construction one can raise." As more and more black boxes are closed, the actor-network expands to larger proportions. Our reading is that this does *not* mean that scallops (Callon, 1986), Pasteur's microbes (Latour, 1988), a spreadsheet (Law, 2002), or a risk management method, all have the ontological status of a human actor. However, we do posit that it

would be a mistake to impose our categories prior to action. Instead, human and nonhuman "are treated as effects or outcomes, rather than explanatory resources" (Law, 2004: 157). It is thus only after the network has been assembled, or performed, that we can say something about different elements' role and significance (Callon, 1991).

Sharing epistemological space with nonhumans is an empirically realist and epistemologically relativist position in which humans and nonhumans have, at least potentially, similar capabilities. Both are essential to the construct of epistemological possibilities. In such a way "things" are organized and moulded by humans with worldviews and intentions, at the same time as nonhumans cause network-effects (Law, 2002) that configure human epistemology and ontology (Callon, 1999). To this end risk management methods are not only neutral tools, or carriers of information, but have the capability to construct and organize the very things (humans and nonhumans) that they describe (cf. Callon, 1998).

Case

Research method

As one of the weaknesses identified by Lyytinen et al (1998) was that many contemporary approaches to risk management rely on simplistic environmental models and do not differentiate between different types of risk-generating contexts, we chose to approach this study by basically conducting two different types of risk management studies. A risk management consultant from Sogeti conducted a risk analysis using the Sogeti risk management method (described in more detail below), while we conducted a risk management analysis focusing on risk as socio-technical phenomenon and risk management as an intermediary in a heterogeneous materiality.

Understanding risk in such a fashion, we founded our study on an interpretive epistemology (see e.g. Walsham, 1995). The qualitative approach was chosen because of our idea that relevant knowledge needed to reach our aim (and guided by our choise of theoretical underpinnings), reside primarily with the people actually working in the context in question. Since we aim to pinpoint and identify risk issues of more complex and contextual nature, we opted for observations and semi-structured interviews as a means to collaboratively generate data.

It can be argued that the linchpin in our methodological design (given our aim) is the selection strategy for the interviews. In order to be better prepared for that, as well as the content of the interview structure, we started out by conducting a four hour observation of the mill, spending time in the different parts of the mill (e.g. the control rooms of the operators). The selection strategy for the interview then aimed at including as many different perspectives as possible. In a discussion with the IT

manager we identified operators, technicians, maintenance personnel and project managers as key categories of employees. Furthermore the IT manager, the Process IT manager and the manager for Maintenance and Projects were interviewed, as well as a representative from their main IT-vendor. All together 12 interviews were conducted over a three day period. After transcribing, we analyzed the data by categorizing the risk issues raised. This allowed us to also discuss and highlight risks of more aggregated, overarching character.

After categorizing the identified risks we conducted a work shop with representatives from Smurfit Kappa Kraftliner and their main IT-vendor ABB in order to prioritize the risks. The senior risk analyst from Sogeti presented risk categories from his use of the method at several different organizations in the process industry, and we presented the result of our categorization efforts. These were then discussed and prioritized. The work shop lasted for approximately two hours and the discussion converged more and more toward the socio-technical issues identified in our study.

The research design of this study can be characterized as action research (Susman & Evered, 1978; Kemmis & McTaggart, 1998; Baskerville & Wood-Harper, 1996; Checkland, 1991; Baskerville & Myers, 2004), where the basic epistemological idea is that interventions (by the researcher) makes things visible that are otherwise tacit. In our case we based our intervention on two things. One is the systematic collection of risk issues from the different perspectives of people working at the plant and managing risks of different kind every day. The other is the result of our own perspectives and analytical skills, in identifying risks of aggregated, overarching or tacit nature.

The Sogeti Method

The Sogeti Method for risk management basically follows the process described by Chapman & Ward (3) although simplified from their six steps to four and run in iterations

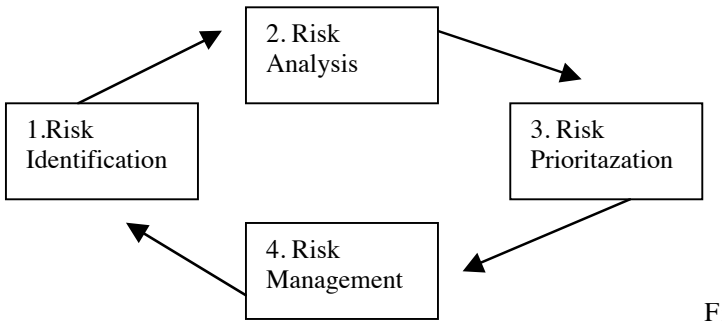

Figure 1: Sogeti's risk assessment method

The senior risk analyst at Sogeti is by and large responsible conducting all steps of the process. His expertise and experience dictates the output of the risk management process. The main focus is on hardware, software and environmental issues. When completed, the process has generated a process IT strategy, a maintenance strategy, a project model suggestion and a security policy.

The Kappa Experience

Smurfit Kappa Kraftliner in Piteå, Sweden is Europe's biggest kraftliner producer, annually producing 700 000 tonnes of kraftliner used for production of high quality corrugated packaging. Currently some 600 people are employed at the mill and in the R&D department, of whom approximately 200 are shiftworkers.

The use of information technology in production processes has increased every year, and today it's presence is as good as ubiquitous. The responsibility for IT issues at the mill is divided between the IT department and the Process IT department. A rough description of the areas of responsibility shows that the Process IT department focus on IT use in the actual mill, including control systems, process stations, field units, sensors etc, and the IT department focus on administrative systems such as business systems.

The information infrastructure at Smurfit Kappa is becoming increasingly integrated and complex, which means that the borders between the two departments are not clear cut or closed.

Categorizing is at best a tricky endeavor, as the world seldom fits neatly within strictly defined and clearly separated categories. Still, there are benefits to such an activity and form of presentation. Below we present the result of our study, ordered in the main risk source categories we chose to use.

Organizational risks encompass risk issues related to the organizational structure and roles, and to the installed base of technology currently in use at Smurfit Kappa. Personnel related risks is used to describe risk issues connected to the work force, both as a whole and on a more individual basis. Under management related risks we have sorted sources of risk more closely connected to the decision making processes regarding IT use and direction. Finally, vendor related risks encompass risks associated with the relationship between Smurfit Kappa Kraftliner and their IT-vendors.

Other categorizations are of course possible, and would paint a slightly different picture, but the main risk sources would be the same and we believe our way sheds light on some interesting things. We have also chosen to include sources of risks that today are successfully handled by Smurfit Kappa Kraftliner and their employees, in order to make explicit what facilitates this success.

Organizational risks

Systems longevity and spare parts. The life span of systems used in the factory differs, and for the systems with a long life span getting hold of spare parts are

today problematic. Smurfit Kappa has a about 60 Contronic P process stations in use today, constituting an important part of regulating the production process. The process stations has been in place since the late 80's and work well. A big problem is however that spare parts to Contronic P no longer are manufactured, and Smurfit's own stock of spare parts are rapidly dwindling. The process stations are being replaced by more modern ones, but at a moderate pace, currently six stations a year, due to the high cost and in order not to disrupt production. When a station is replaced Smurfit Kappa will salvage as many parts as possible in order to boost their supply.

This does not solve the problem of spare parts shortage, as there is no way of telling if the part will actually work in another process station, especially after a year or to on a shelf. Regularly testing the spare parts is not an option used by Smurfit as the risks, and required effort, are too high. There is no way of telling when the spare parts will run out, but the situation today is described by the Projects and Maintanance manager as precarious.

Maintenance is another type of organizational risk. Continuous production is paramount to Smurfit Kappa as the cost of halting production is very high. This means minimizing stoppage time is an essential aim for the organization. This poses a challenge for conducting maintenance processes. Every year there is a five day planned production stop (and each month there is a short maintenance stop) during which larger maintenance tasks can take place. The tasks and activities that take place during this week are carefully planned for long in advance in order to make full use of the stop.

The window of opportunity to perform maintenance that requires testing of vital parts of the production process is then rather narrow, and only occurs once a year. During the rest of the year maintenance activities primarily focus on making sure the production process doesn't stop, fixing things that break down, solving problems as they crop up. This is a source for risk as a lot of things identified as "things we should do something about" seldom gets done, things that are not important enough to warrant a place on the five day stop list, and at the same time are not a direct threat to the production.

A third kind of organizational risk is the heterogeneity of the infrastructure. The information systems infrastructure at Smurfit Kappa Kraftliner is heterogeneous and at the same time it becomes more and more integrated. This means that when replacing a part or installing a new system, the task of integrating the new with the old is as important as it is difficult. With the high degree of systems integration even simple tasks like indexing becomes difficult by the sheer number of items to be indexed. Furthermore, every new part must be configured so that it is compatible with what is already there.

This means that even standardized products are challenging to implement. The importance of continuous production makes it important to configure the new part to

resemble the one being replaced, no matter what new functionality the new part may offer.

Collaboration is another risk associated with the organization. When solving a problem, or detecting a potential problem and pro-actively taking appropriate measures, collaboration between different parts of the work force at Smurfit Kappa is essential. The production process is interconnected which means that problems in one part of the process has consequences for the other parts. Having to restart the process after a complete halt is much more difficult than speeding up after going at half speed.

This is one reason why operators in different parts of the process keep in touch with each other when something happens. To make adjustments along the process line so that it never has to stop. If the boiler is malfunctioning, then the operators at the paper machine can slow the pace of the machine in order to make the pulp currently available last as long as possible – giving the pulp boiler crew as much time as possible to fix the problem.

The collaboration between operators and technicians and maintenance personnel also help significantly shorten the time to locate and solve problems that arise. This is greatly due to the fact that knowledge about the process and process related technology is shared throughout the work force. Paper machine operators have enough knowledge about the technology in their environment to greatly reduce trouble shooting for the maintenance personnel.

Technicians work in small, often ambulating, work groups and make a point of checking in with their fellow employees while moving about, in order to stay updated and maintain the social bonds that helps facilitate the important collaboration. To some extent the collaboration is supported by the information systems, e.g. the intranet, however much is accomplished through the use of telephones and face to face meetings.

Finally, knowledge (management) is recognized as an organizational risk issue. An important challenge for Smurfit Kappa Kraftliner is to be found in how they successfully will be able to manage the knowledge base within their organization. The main part of the work force has worked at the mill for a long time and are very experienced. This experience, and knowledge, constitutes a key factor for handling many of the everyday problems and risks at the mill. Smurfit Kappa runs the risk of losing valuable knowledge if the experience and knowledge acquired over the years is not secured.

In order to do so Smurfit needs to find ways to recognize relevant knowledge amongst their employees, and then devise ways of either formalizing it or make it transferable in another way (e.g. through trainee programs). Some of the knowledge is tacit, making it difficult to spot, let alone formalize. To get on overview of the relevant knowledge presently to be found at Smurfit Kappa is important in other ways as well. It can increase Smurfit's ability to coordinate and put together work groups, and act swiftly if unforeseen events occur.

Personnel related risks

Significant for Smurfit Kappa Kraftliner today is the homogeneity of their workforce. A large part of the work force at the mill has over twenty years of experience. They know each other well and work together well, which in many ways is beneficial for Smurfit Kappa. However, it also hampers change to some degree. Relationships, attitudes and practices are cemented, often shared and deeply rooted. New perspectives and ideas that challenges the equilibrium can be difficult to implement. When new technology is proposed and implemented there is a tendency to use it the same way as the previous technology.

A changing of the guards is also looming for the paper mill. The turnover of personnel at the mill has been relatively low, and a majority of the work force has been there for over twenty years. Within the next decade many of today's employees will enter retirement, leaving the organization deprived of their knowledge and experience. Replacing them will be quite challenging for Smurfit Kappa. To handle this risk the organization needs to start in time, addressing the problem of defining and securing relevant knowledge (explicit as well as tacit).

Another risk issue related to personnel is the current dependency on key individuals. The production of kraftliner at the mill has doubled since the mid-eighties, at the same time the number of employees has been reduced by approximately 30 %. The demands and responsibilities on operators, technicians etc. grow as middle management are being removed. The foremen were removed from the mill in the nineties, now (in the spring of 2007) the production planners will disappear.

The infrastructure is very complex through it's heterogeneity, integration and continuous technical development. This means that replacing people, who for some reason are unavailable, becomes increasingly difficult, and the demands on those who are available are raised. This certainly narrows Smurfit Kappa's room to maneuver, and should be considered a risk.

"For instance, just before coming here I spoke to the manager of another division here at Smurfit. One of my guys has put in for a transfer within the organization, with better hours and less time on call. So, this other manager, under whom my guy will work, asked me when I'm willing to let the transfer go through. If I were to answer truthfully I'd say "in about two years", because that's how long I reckon it will before we have a fully trained replacement for this guy….If he leaves in three months, then we have to cancel a major maintenance project, because we can't replace him."(Process IT manager)

Knowledge (requirements) is also a difficult and important challenge. As indicated above Smurfit Kappa needs to systematically manage relevant knowledge. In addition to the reasons already discussed, this is an important step towards being able to formulate required knowledge for new employees. Doing this is by no means an easy task. Some of the relevant knowledge today is tacit, making it difficult to formulate requirements.

When looking at the work being performed by operators, technicians and maintenance personnel it is clear that they perform complex, demanding tasks that basically corresponds to descriptions of work typically performed by engineers. Recruiting people with the desired skill and not too high demands on wages will be difficult

The final risk issue we have identified and categorized as personnel related is data representation. As automation of the mill increases and new control systems are implemented, the operators interactions with the machines rely more and more on digitalized representations. It is important that these representations adequately translate relevant information about what is happening at the mill.

Today, the operators use the control systems to monitor the performance of the machines. They work extensively with graphs depicting trends, e.g. temperature. By continuously monitoring these graphs they get an overview of the state of affairs in their part of the mill, which allows them to take pro-active measures. Built into the control systems there are a large number of alarms, to help the operators recognize a problematic situation.

Operators act in a very information rich environment, and it is important that the data representation is reliable and relevant. If something unforeseen happens, time is often of the essence. Therefore the feedback from the control system needs to be quick and obvious. Not every relevant aspect can be represented in the control system, sometimes depending on the lack of ability to measure or quantify. Therefore operators make use of other technologies to trouble shoot. TV-cameras are strategically placed in places where things sometimes go wrong, places which are hard to inspect otherwise.

When something goes wrong, operators also often make use of their senses to help them locate the problem. Smell, sound, touch are regularly used by experienced operators to detect and fix problems. Experience and knowledge like this is hard to represent successfully in a control system, yet they constitute important tools for accomplished operators.

Management related risks

The increased dependency on other actors is evident in this case. Smurfit Kappa can be described as an IT dependant organization. IT permeates the organization and constitutes an increasingly complex, integrated installed base, affecting how things are done and where to go from here.

"There are CPUs in everything these days, soon our hammers and cutting pliers are fitted with processing power" (Process IT manager)

This has resulted in an increased dependency on others in order to keep the mill running. The dependency on information technology and the complexity and character of their installed base, has made Smurfit Kappa increasingly dependant on their IT vendors for upgrades, support, trouble shooting and advise. This is problematic because it is not obvious that Smurfit Kappa and their vendors share the

same goals all the time. The IT-vendors want to sell products and services to make a profit, and this aim may well collide with Smurfit Kappa's.

Securing continuous production is paramount at Smurfit Kappa, so they strive for control and equilibrium. IT-vendors and the information technology industry develop new tools and systems at an increasing rate, products they want to sell. Spare parts go out of production and stock, education and support are hard to come by if you use old systems and technologies.

The tactics employed so far at Smurfit Kappa aim at upgrading only when necessary, and making a huge effort in integrating the new part as seamlessly as possible. This often means that functionality offered by the new part, or system, is not put to use.

Time to implementation is becoming a risk issue more than before. The cost of investing in new systems or conducting major maintenance projects is usually high and, given the timeframe offered by the narrow windows of opportunity to implement the changes, time consuming because they need to be planned out in great detail. The IT or Process IT departments plan for these changes, and then apply for project funding. If the requested funds are granted, planning and preparation are conducted within the departments in order to as rigorously as possible make sure the changes won't hamper production.

The time frame from initial plan to implementation is often in the region of twelve to eighteen months. A trend in recent years has been that the point in time for the decision to grant the funds needed is moving closer and closer to the suggested implementation date, making time for testing and preparation shorter. This is considered a risk as the time and resources needed to properly prepare for integrating new entities in the infrastructure grow in step with the increased complexity of the installed base. This way, Smurfit Kappa becomes even more dependant on the few people available who have the knowledge required to successfully carry out such projects.

The way in which management view IT-related issues is also important. Developing and maintaining the information technology at the mill is, because of it's complexity and ubiquity, an expensive and continuous activity. How IT investments in IT and maintenance needs are viewed by the people deciding how to allocate resources, is important. Unless they can see a good reason for investing heavily in e.g. a new control system, the resources making it possible would in all likelihood not be made available.

This certainly is a challenge for actors at different levels at Smurfit Kappa, to express their need in a way that leads to adequate funding. This can at times be difficult, especially when they themselves have no wish of changing or replacing a functioning part, but feel forced to do so because the supply of spare parts are all but emptied. As the manager for Maintenance and Projects puts it:

"It's really difficult to ask for money to replace something that works fine…I mean, how do you explain to someone that we have to make huge investments in something that will, if we are lucky and work hard, work exactly the same as our current system.

When you speak to the vendors they agree that the new product probably won't add any value to our process, but that there of course are new possibilities. In other words, we cannot really say we ever will have a return of investment, our production will not get better, the quality will not improve. Our only argument is safety reasons, risks. But, of course, there are no models for determining what the risks are for the system, at best someone has looked at a component. The only thing we know about new systems is that they take quite a while to break in so to speak, there are a lot of problems. How do you explain this to the management?"

Vendor related risks

When and how to choose direction in IT-related issues is a major concern for the organization. The rate of technical development is high, and the structure of the market has changed over the last decade or two. When Smurfit Kappa invested in the Contronic P system in the mid-eighties, the vendor Hartmann & Braun was one among many. Like many of the smaller vendors, they were subsequently taken over, and Contronic P merged into ABB's product portfolio.

For some time big vendors like ABB or Siemens built every part of their products themselves and stocked up on spare parts. The increased standardization of information technology parts has facilitated outsourcing of parts of the production and today ABB rely on third-party vendors to supply them with parts to their products. This has had an effect on the rate of development, where new functionality and features are part of the everyday life of e.g. a control system.

New standards emerge frequently and it is very difficult to know when it is time to switch, or what path to choose. Smurfit Kappa are, by earlier choices, tied to ABB's product family, but even within a certain vendors portfolio, bad choices can be made. Three years ago Smurfit decided to invest in a certain control system, sold by ABB, because it was compatible with their Contronic P process stations. After replacing the control system in one operator room, ABB announced that they would focus their efforts at another control system in their portfolio. Soon support became hard to get, ABB technicians skilled at the system Smurfit bought very hard to find – unless you happened to live in Germany.

Had Smurfit Kappa decided on the other control system within the ABB product family, things would have been rather different. Now they are faced with yet again having to seriously consider changing technological direction, at a large cost.

The coordination of knowledge is a vendor related risk. The competence needed to conduct maintenance, go through with replacing components and systems or handling unexpected situations are in part to be found at the IT-vendors. In the case of Smurfit Kappa it is very important that people with the right kind of knowledge are located in the vicinity, because the cost of a stand still is quite high and many problems require that you are present at the mill to be able to handle. Therefore they have opted to as much as possible keep this kind of competence in the organization.

They cannot cover all their bases, so it is important for them to coordinate their efforts with people from their IT-vendors, especially when time is a critical factor. This means that it, besides from knowing where to turn for help in a certain

situation, is important to establish areas of responsibility between Smurfit Kappa and their vendors.

Work Shop

After categorizing the identified risks we conducted a work shop with representatives from Smurfit Kappa Kraftliner and their main IT-vendor ABB in order to prioritize the risks. The senior risk analyst from Sogeti presented risk categories from his use of the method at several different organizations in the process industry, and we presented the result of our categorization efforts. These were then discussed and prioritized. The work shop lasted for approximately two hours and the discussion converged more and more toward the socio-technical issues identified in our study. It became clear that the technical and environmental risks highlighted by Sogeti were considered very important, but at the same time the managers from Smurfit Kappa felt that they knew how to handle and approach them. The risks of more over-arching and socio-technical character were considered even more important, because of their complexity and difficulty to manage with resources from within the organization alone. Risks such as discontinued production of spare parts, knowing how and when to choose technological paths and standards, how to secure access to personnel with relevant technological and organizational knowledge etc were considered vitally important in the long term, and something that Smurfit Kappa today do not know how to handle.

Discussion

For something to travel, human or nonhuman, it *has to be simplified* (Callon & Latour, 1981; Latour, 1986). When something travels it does so because it has, temporarily, made things a little bit less complicated. As the translation process continues, however, simplifications pile up, resulting in increasing complexity. Despite the fact that that each of the simplifications still make things less complicated, complexity emerge out of the associations between different simplifications. Complexity is thus not used here in its ordinary meaning, i.e. that something is of a complex nature, but rather as something characterized by that *things do not add up*, that escape logic and order (Law & Mol, 2002).

Our evaluation of the risk issues raised by our study suggest that there were a whole set of issues not covered, or identified, by Sogeti's method. These risks were considered vitally important for Smurfit Kappa Kraftliner to find ways to handle successfully, and we suggest that an important first step is to articulate them. Since these risks were not identified by Sogeti's method we suggest the following adaption of the method.

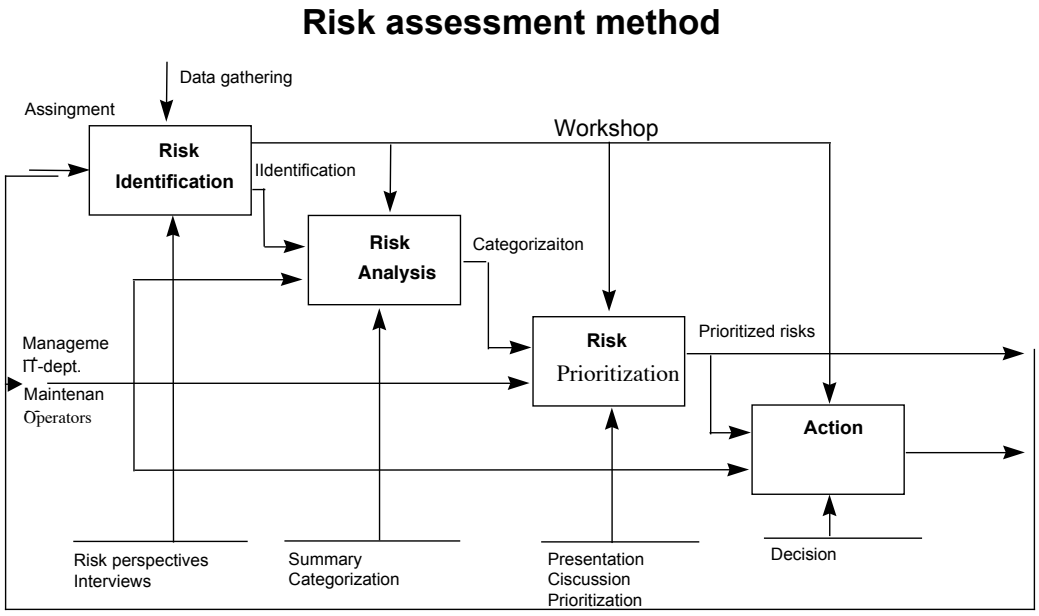

Figure 2: New Risk Assessment Method

The most important aspect of the change has to do with the actors involved in the process. By involving managers and employees actively in the process by e.g. workshops different kinds of risks are articulated and different ideas of solutions can emerge. By widening the scope to include e.g. vendors, customers or suppliers the knowledge and perspectives increase even more, opening up for innovative ways to handle complex risk issues.

By outlining the travel of risk assessments in a heterogeneous materiality and the translation process therein, we have begun to sketch the outlines of an alternative methodological approach to risk management. Humans and nonhumans are, in our revised method, not considered as passive receivers that do not change what is diffused, hence the assumption of homogeneity and that ideas, routines, management principles, blueprints etc. are copied rather than changed (cf. Latour, 1986). This stands in contrast to the results of the risk management approaches discussed in Lyytinen et al (1998).

Conclusion

What we have explored in this paper is the implications that a heterogeneous materiality might bring to risk management in theory and practice. By doing so, we have sketched the outlines of an approach to the study of risk and risk management. Our alternative extends earlier frameworks in the field from being characterized by an objectified, passive and neutral view of risk management methods, to an approach in which the risk manager has to be open to that the method has a potential of playing a more active part in the networks assembled. It is our contention that empirical studies based on the risk management approach outlined here might

render in more full descriptions of how risk processes take shape in practice, and thereby also help shape more realistic expectations about risk management efforts.

Attention is shaped by the risk management method and we have in this study shown the importance to enlarge the attention to also include "soft issues". To exclude them on the merits that they are too complex for a risk management method to deal with would be a costly mistake to make in a process industry organization where continuous production is vital and margins for error are slim.

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