Risk management from an organizational psychology perspective: A decision process for managing uncertainties

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Risikomanagement, Management von Unsicherheit, strategische Entscheidungsprozesse, Stabilität, Flexibilität, Gestaltung von Geschäftsprozessen

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Seit einigen Jahren ist Risikomanagement allgegenwärtig. In diesem Artikel wird das Risikomanagement in Organisationen aus der Perspektive des Managements von Unsicherheit diskutiert. Unsicherheit wird als "neutrale" Quelle von Risiko angesehen; entsprechend ist der angemessene Umgang damit eine wesentliche Voraussetzung für effektives Risikomanagement. Anders als in vielen Abhandlungen über Unsicherheit und Risiko werden sowohl die Reduktion als auch der Erhalt oder sogar die Erhöhung von Unsicherheit als potentiell wirkungsvolle Strategien einbezogen. Ein Entscheidungsprozess wird beschrieben, der Entscheidungsträger bei der Wahl zwischen diesen Strategien unterstützt, wobei das übergeordnete Ziel eine adäquate Balance zwischen Stabilität und Flexibilität der Geschäftsprozesse ist. Das Risikomanagement eines Eisenbahnunternehmens dient als Illustration für den gewählten Fokus auf das Management von Unsicherheit. Abschliessend werden einige Schlussfolgerungen zur Rolle von Risikomanagement in Organisationen präsentiert.

In recent years risk management has become omnipresent. In this paper risk management in organizations is discussed from the perspective of managing uncertainty. Uncertainty is considered to be the „neutral" source of risk and its management an important prerequisite for effective risk management. Unlike in other treatments of uncertainty and risk, reducing as well as maintaining or even increasing uncertainty are assumed to be potentially viable strategies. A decision process is outlined that supports decision-makers in choosing among these strategies with the overall aim of achieving an appropriate balance between stability and flexibility in business operations. An example concerning risk management in a railway company is used to illustrate the suggested focus on uncertainty management. Finally, some conclusions are drawn concerning the role of risk management in organizations.

1. Introduction

In the wake of major accidents and crises in various industrial domains over the last decades, awareness has risen for the importance of managing risks in a proactive and systematic fashion (*Power* 2007). Risk management is in itself probably one of the fastest growing business fields. In the most basic sense, risk management entails the identification and evaluation of risks, measures for handling the risks, and risk communication (*Renn* 2008).

Many sophisticated methods have been suggested especially for the identification and evaluation of risks (e.g. *Bedford/Cooke* 2001), while the handling of risks and risk communication are not covered much by formal methods. However, there is an extensive literature on risk communication in the social sciences that helps determine appropriate forms of communicating risks (*Renn* 2008). In this article, I will focus on the decision-making in relation to different options for handling risks, which is the aspect of risk management least comprehensively treated in the literature. I will suggest a systematic process for making decisions on risk, which is based on an organizational psychology approach to managing uncertainty.

The risk management literature usually discusses four ways of handling risk: reduction, retention, avoidance, and transfer (e.g. *Renn* 2008). This leaves out a fifth option, which may be of equal importance, that is, deliberately increasing risk. The significance of increasing risk in order to create business opportunities is particularly obvious in the financial sector (e.g. *MacKenzie* 2006). In the following, the reduction of risk, which in a more general sense also comprises avoidance and transfer of risk, and the retention of risk, which is expanded to also include increasing risk, will be considered.

Furthermore, a shift in perspective is proposed by focusing on uncertainty, not risk. Uncertainty is considered to be the more generic concept, which can easily be linked to risk in its most basic form as an uncertain event or in more specific definitions of risk such as the product of probability and damage. Uncertainty in terms of insufficient or ambiguous knowledge about cause-and-effect relationships can be regarded as the "neutral" source of risk. Uncertainty implies that predictability and transparency as crucial prerequisites of control are reduced, which leads to insufficient means of influence for either avoiding damages or realizing opportunities. *Power* (2007) postulates that uncertainty is transformed into risk when it becomes an object of management. When uncertainties are managed well, a basic prerequisite for good risk management is established. With the proposed focus on uncertainty it also becomes easier to appreciate the relevance of both decreasing and increasing risk. Many business operations capitalize on exploring new territory, which by definition means to increase uncertainty and risk, even though this is often not made explicit due to the generally negative connotations of risk.

In the next section some principles are discussed which are relevant for the proposed decision process. Subsequently, the decision process for handling uncertainty and risk is described and an example given for its application.

2. Principles for decisions on managing uncertainties

In the following, four principles for the process and the content of decision-making regarding the management of uncertainties will be derived. The decision process will be discussed in light of research on the rationality of decision-making and the importance of individual and collective beliefs when making decisions. The decision content will be deliberated upon in terms of finding the middle ground between minimizing of and coping with uncertainty.

2.1 (Ir-)Rationality in decision-making

Decision-making is probably one of the most researched psychological processes. For a long time, research was mainly concerned with contrasting prescriptive mathematically based models of rational decision-making with the actual decision-making behaviour of individuals and groups. Based on the fundamental differences found, the main thrust of the conclu-

sions drawn has been to point to the fallibility of human decision-making and the need to educate and support decision-makers in more rational decision-making (*Mellers et al.* 1998). More recently, some authors have begun to suggest that human decision-making should be studied more from the point of view of its functionality in adapting to personal and situational requirements instead of taking mathematical models as gold standard (*Shafir/LeBoeuf* 2002). A brief outline of the current debate in the decision-making literature is provided in order to subsequently suggest two process-related principles for supporting decision-making on managing uncertainties.

The most pervasive prescriptive conception of decision-making is the maximization of subjective expected utility, which postulates that the alternative with the highest expected payoff gets chosen. In order to use this model, knowledge of probabilities and utilities is needed and certain prerequisites have to be fulfilled like absence of framing effects and of a priori preference for (un)certainty. Research has provided convincing evidence that these requirements are often not met, which substantially reduces the viability of the model (*Mellers et al.* 1998; *Shafir/LeBoeuf* 2002). For instance, certainty is often preferred in decisions on gains, but uncertainty is preferred when losses are to be decided upon (*Kahneman/Tversky* 1979).

Another frequently used formal conception of decision-making is the maximization of multi-attribute utility based on the knowledge of all relevant alternatives and all dimensions and their relative weights for distinguishing among the alternatives. *Simon* (1955) pointed out half a century ago already that people's cognitive capacities are limited, which he termed bounded rationality, leading them to accept "satisficing" choices, for instance based on an alternative's acceptable level on one crucial dimension. In recent years, especially *Gigerenzer* has advocated the view that the use of simple decision heuristics is often fully adequate even if more cognitive resources were available. He postulates that expert intuition is about knowing which information is important and ignoring the rest (*Gigerenzer/Goldstein* 1996; *Gigerenzer* 2007).

The debate whether deviations from the formal prescriptive decision models make human decision-making irrational or whether the formal models are built on a very restricted and possibly even irrelevant understanding of rationality is still on-going (*Weber/Johnson* 2009). The issue becomes even more complex when not only individual decision-making but also groups of decision-makers are considered (*Kerr/Tindale* 2004). Groups may help to overcome individual biases and faulty heuristics, but they may also exacerbate individual inadequacies by, for instance, group pressures or diffusion of responsibility. Both for group and individual decision-making recent research has stressed adaptive functioning as the ultimate criterion for good decision-making instead of some normative one best way (*Kerr/Tindale* 2004; *Kahneman/Klein* 2009). This has been advocated in particular by researchers following the so-called naturalistic decision-making approach, which focuses on studying real life decision-making by professional groups instead of conducting laboratory experiments (*Klein* 2008). Most recently, the apparent contradictions between heuristics-based intuitive decision-making and formal rational decision-making have been built into dual-process models (*Evans* 2008). These models assume the parallel functioning of both types of decision-making, sometimes called system 1 and system 2, with more or less emphasis on each, depending on situational requirements. While system 1 refers to intuition and is characterized by implicit, automatic, low effort, holistic, fast, and emotional processes, system 2 entails reasoning with explicit, controlled, high effort, analytic, slow, and cognitive processes.

Research following the paradigm of naturalistic decision-making has also been very influential in demonstrating the importance of basic assumptions and belief systems in decision-making. An example is *Feldman's* (2004) analysis of two major NASA accidents; the explosions of the shuttles Challenger and Columbia. *Feldman* traces some of the faulty decision-making involved in these tragedies back to an over-confidence in quantitative data combined with neglect of non-quantifiable data. As an underlying cause, he sees the culture of objectivity at NASA, a culture he considers typical for an engineering organization. "They (the NASA engineers) were not able to quantitatively prove flight was unsafe, so in this culture it became easy for management to claim it was safe. […] Under conditions of uncertainty, cultures dominated by the belief in […] objectivity must be silent. This silence makes these cultures vulnerable to power and manipulation." (*Feldman* 2004, 708)

For our current purposes, two basic and uncontested principles for decision-making processes can be derived. (1) Decisions are always based on some kind of subjective cost-benefit analysis. (2) Individual and collective assumptions and beliefs about reality are at least as important in decision-making as objectivist rationality.

2.2 Balancing different modes of uncertainty management

As a starting point for making strategic decisions on how an organization should approach uncertainties, minimizing uncertainties versus coping with uncertainties can be contrasted (*Grote* 2009).

Scientific treatment of organization design at the turn of the 20th century (*Taylor* 1911; *Weber* 1947) was built on the assumption that organizations are closed systems, thereby protected from external uncertainties. Internal uncertainties were to be minimized by minute planning and continuous monitoring of the execution of these plans, providing minimal degrees of freedom to the people in charge of carrying out the plans and taking any deviation from the plans as signs for the necessity of even more planning and monitoring (see *Figure 1*). Accordingly, the basic control mode is that of feedforward control. The Fordist production lines are a prime example of the minimizing uncertainties approach. They were tailored to mass production of standard products, that is: Model T in black. With the acknowledgement of the open system nature of organizations the minimizing uncertainties approach continued to be followed and even gained in fervour in order to keep systems under control (*Senge* 1990). *Weitz* and *Shanhav* (2000) have suggested that engineers used their success in handling technical uncertainties to expand their professional domain to include the reduction and elimination of organizational uncertainties as well. As the minimizing uncertainties approach promises maximum control, it is still the favoured approach in many organizations.

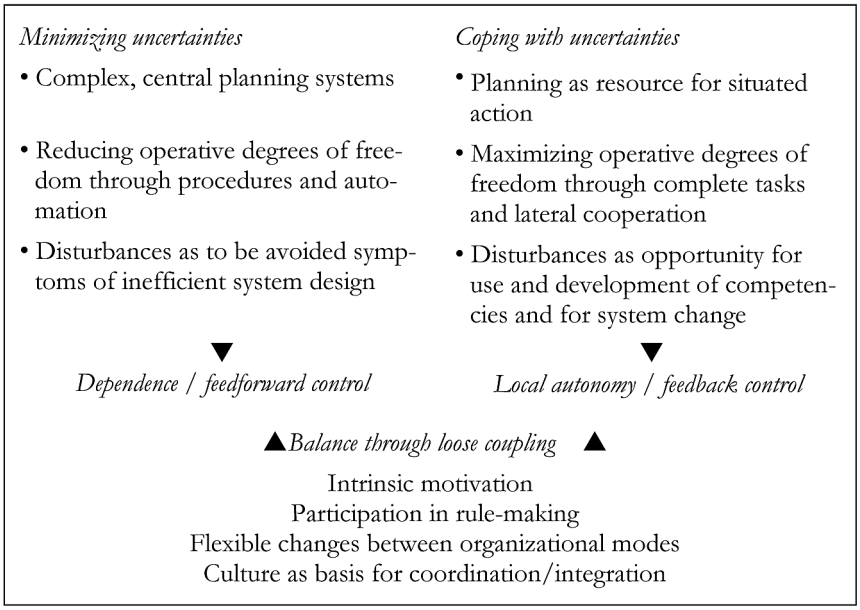

Figure 1: Basic principles of uncertainty management (adapted from Grote 2009)

A fundamentally different approach which has been promoted by organization theorists and work scientists for several decades now is to enable all members of an organization to cope with uncertainties locally and to rely on feedback control (e.g., *Perrow* 1967; *Weick et al.* 1999; see *Figure 1*). From this perspective, planning is understood primarily as a resource for situated action (*Suchman* 1987), not as a blueprint for centrally determined and monitored action. Local actors need to be given as many degrees of freedom as possible, achieving concerted action mainly through lateral, task-induced coordination. Disturbances are regarded as opportunities for use and expansion of individual competencies and for organizational innovation and change. *Cherns'* (1987) principles of socio-technical design provide a good summary of the core ideas of this approach, especially the principles of minimal critical specification for work processes and task allocation, of role breadth to ensure multifunctional expertise, and of controlling variances at their source.

Much of the earlier literature in organization theory was aimed at developing contingency models for deciding between the minimizing and coping with uncertainty approaches in light of the types and amounts of uncertainty a particular organization is faced with (e.g. *Burns/Stalker* 1961; *Thompson* 1967; *Van de Ven et al.* 1976; *Argote* 1982; for a comprehensive review see *Wall et al.* 2002). The most basic understanding of these contingencies is that minimizing uncertainties only works when the overall level of uncertainties an organization is confronted with is low. With higher levels of uncertainties, any attempt to design them out of the system will fail and therefore the system has to be enabled to cope with uncertainties locally.

More recently, research has been concerned with showing the need and also the possibilities for overcoming the dichotomy between minimizing of and coping with uncertainty. In 1976 *Weick* already argued that most organizations aim to achieve what he called loose coupling, that is the concurrence of autonomy and dependence and thereby also a mix of coping with and minimizing uncertainty. Elements of loose coupling are: intrinsic motiva-

tion, which promotes using autonomy in line with superordinate goals; participation in rule-making as a way to allow higher-order autonomy; mechanisms that support swift shifts between the two modes of handling uncertainty; and finally culture as a "soft" form of centralization through values and basic assumptions (see *Figure 1*). Even for high-risk industries, it is now acknowledged that organizations need both the stability created by minimizing uncertainty and the flexibility achieved by coping with uncertainty. The concepts of high-reliability organization (e.g., *Weick et al.* 1999) and of resilience engineering (*Hollnagel et al.* 2006) are promiment examples of this change in thinking.

In 1991 *March* wrote a very influential article, approaching the same issue from the perspective of learning in organizations. He argued that a balance is needed between exploration of new possibilities, concerned with search, variation, experimentation and risk taking, and exploitation of old certainties in terms of refinement, implementation, and efficiency. In strategic management, the organizational capabilities needed for concurrent exploitation and exploration have also been termed ambidexterity (*Tushman/O'Reilly* 1996). In the competition for scarce resources in organizations, exploitation tends to win because benefits are more visible and short-term (*Benner/Tushman* 2003). As an example, *March* (1991) discusses the socialization of newcomers into organizations, pointing to the attempts in organizations to ensure fast learning of organizational routines in order to quickly reach efficient performance at the expense of the organization learning from the different viewpoints and prior experience of the new employee. *March's* work has motivated much research into achieving a balance between exploitation and exploration and thereby also between stability and flexibility in organizations. Especially the duality of flexibility and rigidity at different levels of an organization has received much attention (*Gupta et al.* 2006), which exemplifies a basic tension in part-whole relationships described by organization theorists (*Astley/Van de Ven* 1983). Autonomy at one system level is always linked to constraints at another system level, and vice versa. Particular members of an organization can only act autonomously if people at higher levels of the organization are prepared to restrict their autonomy and delegate it to them.

From the preceding discussion, two further principles for decisions on managing uncertainty can be derived: (1) Requirements of concurrent stability and flexibility need to be fulfilled. (2) Instead of choosing between a minimizing uncertainty versus coping with uncertainty approach, a detailed consideration of reducing, maintaining and increasing uncertainty in different business units and at different organizational levels is necessary.

3. Deciding on the management of uncertainty: A four-step process

We start with the fundamental premise that the overall objective in individual and organizational decision-making is to gain and maintain control in order to achieve desired goals. Because for decision-makers in organizations uncertainty may itself induce strong perceptions of threat beyond the actual threats of economic loss (*Argote et al.* 1989), the usual first reaction to uncertainties is to try to reduce them. The decision process described here aims to achieve a more balanced assessment of ways of handling uncertainty by systematically considering advantages and disadvantages of reducing, maintaining and increasing uncertainty.

Four steps are proposed (for more detail see *Grote* 2009), which should be carried out by a team that includes the organization's experts of the domains to be covered (for instance, planners when suppy chain management is the focus of the decisions to be taken, or process engineers when a new automation concept is to be developed), representatives of

the people affected by the decisions (for instance, operational personnel), and the actual decision-makers (for instance, the top management team or one representative from that team). Depending on how broad the chosen content domain is and how much documentation already exists on the work processes related to that domain, the four steps can be discussed within a few hours, or they might form the basis of a project running weeks or even months. If, for instance, the degree of standardization for the operative processes in one subunit of the organization is the focus, this can be evaluated within a day or two. If the general philosophy of the organization is at stake in an attempt to turn it into an ambidextrous organization, the necessary assessments of current practice and changes needed may easily take several months.

In preparation for the suggested decision process, an uncertainty landscape needs to be drawn up that contains as many of the relevant internal and external uncertainties as possible. Starting from the basic definition of uncertainty as lack of information required to perform a task, three variations of this lack of information should be considered: incomplete information, ambiguous information, and unclear response alternatives (*Lipshitz/Strauss* 1997). These different kinds of lack of information may concern the organization's and the environment's current or future states and cause-effect relationships related to different states and responses. Causes for uncertainties may lie within the organization, for instance, they can be related to technologies and materials used and the interdependencies between tasks, or they may be external to the organization, such as changing customer demands or emerging competitors.

Subsequently, a systematic assessment is performed regarding the costs and benefits involved in reducing, maintaining or increasing the identified uncertainties. This assessment is complemented by a reflection of belief systems and their impact on cost-benefit assumptions for the different ways of handling uncertainty. Beliefs about central controllability of production processes, for instance, may easily produce an overly optimistic view on opportunities for minimizing uncertainty. Finally, the discussion on costs and benefits of different management approaches will be summarized for all uncertainties concerned and decisions taken on the most appropriate approach. The overall aim is to achieve a balance of stability and flexibility fitted to the particular needs of the organization. The suggested steps in the decision process are the following:

1. Analyze costs and benefits of reducing uncertainty;
2. Analyze costs and benefits of maintaining or increasing uncertainty;
3. Explore belief systems in the organization related to managing uncertainties;
4. Discuss anticipated effects of the recommendations derived in steps 1 to 3 and make final decision.

Each step will now be decscribed in more detail.

Step 1: Analyze costs and benefits of reducing uncertainty. This step conforms to most classic treatments of uncertainty. The aim is to increase transparency and predictability by obtaining information and by eliminating causes of opaqueness and unpredictability. Often this implies the use of power to force other actors to disclose their plans, to agree to binding arrangements or to accept that uncertainty is transferred to them (*Hickson et al.* 1971; *Marris* 1996; *Clegg et al.* 2006). The more uncertainties there are the more costly any reduction strategy becomes. For instances, resources have to be spent on measurement and control of internal and external processes. Also, sufficient power vis à vis other actors has to be established and maintained. Moreover, while the benefits of reducing uncertainty are quite obvious because control is increased, the costs are partially hidden. In particular, the

loss of flexibility is not always sufficiently taken into account. Reduction of uncertainties focuses perception on the expected. Thereby, threats as well as opportunities may be overlooked. Finally, it is important to note that more information does not necessarily reduce uncertainty, but may create new uncertainties if it allows for different interpretations or concerns events with unknown probabilities (*Becker* 2004).

Step 2: Analyze costs and benefits of maintaining or increasing uncertainty. To date, there is little empirical research on the deliberate increasing of uncertainties due to the dominant view of uncertainties as inevitable, but largely unwanted. The costs of acknowledging limited control, of increasing the variety in possible responses to external contingencies, and of building resource buffers are seen to easily outweigh the benefits of flexibility and responsiveness. Probably the most discussed case concerns uncontrollable external uncertainties which require an increase in internal flexibility and thereby often also internal uncertainty due to more complex work processes. A classic example of this strategy is diversification, be it with respect to products, markets or suppliers. "Unlike control and cooperation strategies which attempt to increase the predictability of important environmental contingencies, flexibility responses increase internal responsiveness while leaving the predictability of external factors unchanged." (*Miller* 1992, 324) Even in the innovation literature, uncertainties tend to be acknowledged only to the extent that they are an unavoidable side effect of discovery. It is assumed that control over innovation can be increased by partially routinized processes (e.g. *Nelson/Winter* 1982; *Brown/Eisenhardt* 1995). Generally, uncertainties may be increased by granting decision latitude to local actors, for instance by relaxing rules. This promotes adaptive action, but reduces predictability and control for members of management, which again often meets with resistance (*Senge* 1990).

Step 3: Explore belief systems in the organization related to managing uncertainties. The third step involves switching perspective from rational accounts of cost-benefit analyses to one of sensemaking and enactment (*Weick* 1995). This perspective holds that perceptions of uncertainty are more relevant for decision-making than objective accounts of uncertainty, and that these perceptions and the actions derived from them are embedded in and shaped by decision-makers' belief systems. Either minimizing or coping with uncertainty may be the preferred way of managing uncertainty based on beliefs about control and trust, irrespective of the actual effectiveness of either strategy (*Shapiro* 1987). How powerful belief systems are in shaping organizational practice as well as the underlying theoretical models has been illustrated more generally by *Ferraro* and colleagues (2005). They discuss how the – empirically contested – assumption that actors are generally motivated by self-interest permeates much of economic thinking, explaining, for instance, the emphasis placed on market mechanisms for handling conflicts of interest or the importance given to external incentives in influencing behaviour.

Step 4: Discuss anticipated effects of the recommendations derived and make final decision. In the fourth step, an overall evaluation of the chosen modes for handling uncertainties is carried out. The aim is to achieve a balance between stability and flexibility fitted to the particular needs of the organization. The basic assumption is that reducing uncertainty usually increases stability, while maintaining or increasing uncertainty supports flexibility. However, aiming to reduce uncertainty that would be better maintained can actually destabilize the system. For instance, if in production scheduling the sequence of orders is fixed with no decision latitude given to people on the shop floor to adapt it in response to local disturbances like machine breakdown, this may severely hamper the workflow in the affected unit and beyond. Furthermore, the chosen modes for handling uncertainties may

create the challenge to develop seemingly contradicting management styles (*Smith/Tushman* 2005), such as an empowering style in support of local coping with some uncertainties and a directive style for binding actors to predetermined plans in order to reduce others. Instead of making once and for all decisions on managing uncertainty, it often will be helpful to define probing strategies for continuous re-evaluations of the achieved balance.

4. An example: Managing uncertainty in a railway company

The example is situated in a railway company, which like the railway industry in general is faced with many new uncertainties through technological developments, privatization, stiff competition, especially regarding carriage of freight, and growing capacity demands. The safety department in this particular railway company was charged with evaluating the effects of all these developments on the capabilities and needs of different groups of employees for performing their jobs effectively and safely. It was decided to perform this assessment by means of a series of workshops in which the management of uncertainty framework was used as a guiding principle. As no one specific decision had to be made, but rather an evaluation of anticipated new uncertainties and their potential effects was to be carried out, costs and benefits of reducing, maintaining and increasing uncertainty were discussed quite broadly for different business operations. Therefore, no strict application of the decision process suggested in the previous section will be presented here. Instead the example may help to illustrate the practical viability of the underlying conceptual framework.

As a first step, the technological and organizational changes which are underway or planned for the next ten years were collated, highlighting three particularly important clusters of changes: increasing automation of train control, centralization of traffic control, and higher traffic density. In two one-day workshops with representatives from safety, quality management, infrastructure, train operation, and maintenance, the effects of these changes on the task profiles for train drivers, signallers, shunters, and maintenance and construction personnel were assessed. Each task profile was analyzed in detail in relation to assumed changes in complexity and uncertainty through increased automation and task interdependencies. For shunting, maintenance and construction, these analyses showed an increase in uncertainties related to managing task interdependencies within more interlinked and more tightly planned work processes. For train drivers, automation was considered to have the greatest impact, which in the long run will reduce train driving to mere supervisory control functions with the uncertainties particular to those functions like reduced system transparency and requirements for fast and flexible responses to non-routine events. Finally, for traffic controllers and signallers, it appeared that the integration of these two functions in highly automated central traffic control centres might lead to a new, more complex job profile for traffic controllers, and a less complex profile covering routine operation for the former signallers. While some workshop participants saw centralization resulting in fewer uncertainties for traffic controllers, others assumed that requirements for uncertainty handling might even increase, as needs for local adaptations will remain and will be more difficult to handle in central control centres.

In the discussions, the central role of traffic control and of the changes in that function through centralization and automation became very obvious. Depending on how the changes in traffic control will be implemented, uncertainties may be transferred to other actors and conditions for handling them may improve or worsen. One small example in this respect is an already implemented change in rules concerning shunting of trains onto

occupied tracks. Previously, signallers were required to communicate to train drivers if the assigned track was occupied because the signal used for this operation is ambiguous and only conveys the maximum speed of 40 km/h to the train driver. With increasing traffic density and more traffic to be handled by signallers in more centralized control centres, this communication requirement was dropped leaving the train driver with insufficient information regarding adequate shunting speed. This problem was addressed by yet another change in rules which set the maximum shunting speed to 30 km/h in stations with particularly low visibility where train drivers have little chance to discover track occupation in time to reduce speed sufficiently. Thus, uncertainty was originally increased for train drivers and then partially reduced again.

Overall, the most significant concern that emerged in the workshops was the growing difficulty of managing task interdependencies due to the greater centralization of traffic control, fewer buffers in resource planning, and loss of shared understanding of work processes through divisionalization of the organization. Detailed analyses of the coordination required between job functions showed that there is considerable potential for unduly transferring uncertainties to other job functions, especially from traffic control to train driving and maintenance. In order to address these concerns, several measures were taken: more integrated training across company divisions, the development of a guideline for job and system design tailored to the needs of the different company divisions, and the development of a guideline for rule management in cooperation with the railway regulator. An important element of the rule management guideline as it now stands is a decision tree that helps to clarify the amount of uncertainty to be handled in a given work process, the possibilities for reducing that uncertainty, and the requirements for training and for support by fairly open rules in case the uncertainty has to be maintained. Additionally and most importantly, an annual risk assessment was introduced that will permit the monitoring of changes in the uncertainty landscape for different job functions and of (mis-)matches between requirements and capacity for handling those uncertainties.

The integrated training and the participatory development of common guidelines for rule management and job and system design across company divisions are important measures in themselves, but they are also highly relevant for maintaining a shared culture. Culture is seen as a crucial coordination mechanism for dealing with high levels of uncertainties in the highly interlinked work processes in train operation and maintenance (*Grote* 2007).

At no point in the analyses undertaken in the railway company, was a systematic exploration of belief systems and their effects on perceived costs and benefits of the different ways of handling uncertainty carried out. In the workshops and in the subsequent development of the various guidelines, differences in preferences and beliefs regarding effective organizational design became apparent, but were not dealt with explicitly. Instead of confronting the different views – for instance regarding the appropriate distribution of power and control between the different occupational groups – broad participation in guideline development was sought as a means to further collective sensemaking and the building of shared belief systems. This may actually be a better way of addressing belief systems than trying to discuss them directly, especially in organizations with a rationalist culture, as in this case. From this experience a modification of the decision process described in the previous section can be derived: Depending on decision-makers' openness for reflecting their own decision premises, step 3 can be undertaken as suggested or may have to be embedded in the other steps, the latter requiring particularly skilful moderation of the decision process.

5. Conclusion

In this article, management of uncertainty has been discussed as a more generic organizational task than and as a crucial prerequisite for risk management. In the suggested decision process, reducing as well as maintaining or even increasing uncertainty are considered as potentially viable options. From a risk management perspective, this may seem unusual, because the focus there is usually to reduce or avoid risk and retain it only if all else fails. However, also from that perspective it is important to acknowledge that uncertainty and risk can, at best, be responsibly handled, but they cannot be managed away. Additionally, uncertainty and risk may even be essential to some business opportunities. The task then becomes to admit to necessary risks without unduly embracing risks.

Organizations have the power and presumably also the knowledge to make sensible decisions on risk involved in business operations. This creates the rightful expectation that they can also be held accountable for the decisions they take. However, the ensuing concern with living up to this expectation may lead risk experts to frame their judgments more in terms of reducing their personal, legal and reputational risks than in terms of providing honest assessments of the risks at hand (*Power* 2004). This may create the paradox that focusing too narrowly on risk management becomes itself a risk. In order to avoid this problem, *Power* argues for a new politics of uncertainty that "would not seek to assuage public anxiety and concerns with images and rhetorics of manageability and control, and would challenge assumptions that all risk is manageable. (...) Public understandings of expert fallibility would be a basis for trust in them, rather than its opposite" (*Power* 2004, 63).

While this new politics of uncertainty is very useful to promote open dialogue about risk, it clearly has the downside also that decision-makers may be encouraged to disclaim their contribution to failures, as has happened in the recent financial crisis. In order to live up to rightful expectations of responsible decision-making, decisions have to be based on explicit scenarios that demonstrate how adequate coping with uncertainty and risk can be achieved. However, these scenarios also have to include the acknowledgement of limits of controllability and the definition of accountability for business processes within and outside these limits. In view of responsibly handling the particularly high uncertainty and risk involved in financial operations, *MacKenzie* (2006) similarly called for broad conversations on the design of financial markets in order to help build and maintain financial systems that may serve the interests of all. The suggested decision process is hoped to promote such conversations in organizations and possibly beyond.

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