INFLUENCE OF HUMAN AND ORGANIZATIONAL FACTORS, COMMUNICATION AND MANAGEMENT ON RISK IN ORGANIZATIONS AND PROJECTS

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ABSTRACT

This paper discusses the needs for risk analysis in industrial enterprises. Several major points of concern are raised. The first topic is risk communication and the inclusion of feedback from involved parties. This also includes openness from top management concerning 'bad news' and its effect on project work. The second topic is the importance of thorough risk analytical work including hazard identification, risk analysis, risk evaluation and subsequent management of risk-reducing measures. This paper suggests that risk analysis is an important tool for project management, highlighting the importance of paying early attention to issues arising in a project before they further escalate to more serious events.

This paper brings up important topics of risk management and offers scenarios of how different elements can affect project management. We question whether industry, and especially the oil and gas industry, is moving in the right direction of conducting proper risk management and whether the risk analytical work is turning into a 'numbers game' and a pro forma activity.

This paper focuses on the integration of risk management and project management, thereby risk analysis can be a powerful tool for project management, helping it to succeed in transferring the company into a high reliability organization.

Keywords: Human and organizational factors in risk analysis, issue management, integration of risk analysis and project management, risk analysis of project construction phases, role of the risk analyst.

1 INTRODUCTION

1.1 Risk analysis in the construction phases of projects

Following the loss of the offshore concrete gravity platform Sleipner A during the construction phase of the project in 1986 [1], methods for risk analysis of the construction process were implemented in several Norwegian offshore facilities' construction projects [2]. Furthermore, risks related to marine operations were highlighted [3–5], and risk reduction measures were implemented. Regarding the development of the methodology, references were made to works by Bea [6, 7]. Following major construction and marine operations projects on the Norwegian Continental Shelf, this risk analysis methodology was implemented and no failures were experienced. In these projects, the recommended risk–reducing measures were professionally discussed and were in general taken fully into account, as would be required for a company to be termed a 'High Reliability Company' [8]. It should be noted that it is important that the 'risk owner', i.e. the oil company management, managed the analysis and thus took the ownership of the analysis and the results.

We have, in particular, been concerned with implementing human and organizational factors (HOF) in these risk analyses [9, 10]. Over the years we have, however, witnessed changing attention to risk analysis in oil and gas industry enterprises as management comes and goes. This deterioration has recently been documented by ESReDA, the European Safety, Reliability and Data Association [11–13].

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At present, we are concerned that important risk issues are not identified and that probabilities of failures for potential incidents might be underestimated in the oil and gas industry, where the raising of relevant questions is not being permitted. This would be the case if the risk analysis was only a formality and not linked to thorough hazard identification: a hazid analysis with failure identification. As an example of a faulty risk analysis, we refer to the risk analysis preceding the Macondo blowout, which concluded that the probability of meeting polar bears in the Gulf of Mexico area was negligible. In such a case, it would be obvious that parts of the analysis were directly copied from the analysis of risks encountered in the Canadian or Alaskan Arctic without any attempt to proofread the document.

Even if we recommend risk analysis, we should realize that a 'numbers game' might not represent any more than a ranking of different technical alternatives. A qualitative risk analysis is never better than the assumptions made and the potential events identified, and a quantitative risk analysis must be build on a reliable database and good engineering judgments. To avoid a discussion regarding the results of the risk analysis, it is important to set the risk acceptance criteria before the risk analysis is carried out [14]. More recently, the relevant problems to take into account for cold climate projects have been highlighted in [15].

A complete risk analysis includes the risk acceptance criteria, the hazard identification, the hazid and the qualitative (and potentially the quantitative) analysis, as well as a discussion related to recommendations for implementing risk-reducing measures; see, for example, [16]. We should also take into account that in risk analysis, what we know about the threats is less important than what we do not know about them. This is the 'unknown' threat; we do not know what we do not know. Therefore, we should identify all the potential critical elements of the systems and assess the risk of failure for them.

In some industries, however, management seems to be concerned that too much attention is paid to risk identification. Examples are:

- An ongoing discussion in Norway related to the quality of the risk analysis for liquefied natural gas (LNG) facilities located very close to important port facilities (Tananger, in the Stavanger Area, Norway) and a residential area [17].
- A case (unpublished) where the risk analyst was investigated by his employer for potential 'bad behavior' when he asked an ice management contractor very thorough questions in a hazid, to the embarrassment of the contractor. The analyst was cleared as doing his job; the company, however, changed their hazids to become more compliant with the wishes of the contractors.
- A case (unpublished) where the project manager declared that 'I cannot see that a formal risk analysis will contribute to the project'. Unfortunately, during the project execution (a pipe laying project), the tension machine (a single tension machine was in effect) was not capable of holding the pipeline, and the pipe rushed over the stinger and fell damaged to the seafloor and the operations had to be reinitiated.
- It should be noted that such incidents will never be published, as the risk analysts involved do not want to act as 'whistle blowers'.

1.2 The importance of human and organizational factors and discussion of arising issues

The importance of HOF for project execution has, furthermore, been emphasized by Stølsnes *et al.* [18] and Gudmestad and Stølsnes [19] (refer [6, 7]). A project will normally mirror the attitudes and procedures of the mother organization, and it will be important to analyze the

HOF of the project as well as the company responsible for the project execution. This calls for an integration of the risk analysis and the project management, with the project management representing the company management seeing the risk analysis as a tool for successful project execution.

We should note that continuous successes in an organization may make it difficult to raise questions related to serious risk issues. When a company is very successful, a kind of complacency will ride the organization, and important issues may easily be overlooked [11]. It is only a professional management team and very competent personnel that will continuously ask questions related to unexpected issues.

There are organizations that could be described as being structured as a 'monkey tree'. The 'chief monkey', the chief executive, gets only the 'good messages' and refuses to accept 'bad news'. He sees only smiling faces. Further down the ranks, i.e. in middle management positions (where the project manager is placed), it is difficult to work, as one is supposed to report successes up to higher management; however, one does not see any smiling faces in this position. It is a strong warning sign if the personnel at 'the shop floor' describe their organizational hierarchy as a 'monkey tree'.

Shammas and Gudmestad [20] studied issue management; this refers to the handling of issues (problems) arising in a project, in particular when an engineer or an operator raises an issue (from the 'floor') that may escalate into a severe incident. Their conclusion was that *managing all issues at an early stage of a project* is particularly important because this can prevent escalation into first-, second- or third-order events (Fig. 1). Issues are normally more neutral and, therefore, easier to resolve if tackled at an early stage. They assumed that the management system in place normally is not perfect and not all managers know what is happening at all times. The system they proposed was one where project team members have a technical issue procedure (TI) for reporting technical issues when other communication tools would prove ineffective. They further proposed a ranking system where *issues are ranked* according to importance. Psychological boundaries between levels in the organization's hierarchy should, however, not be underestimated in issue reporting. They pointed out that it is important that leaders interact equally well with all members in a project team. Recognition of efforts, verbal or otherwise, is furthermore important in encouraging continual issue discussions.

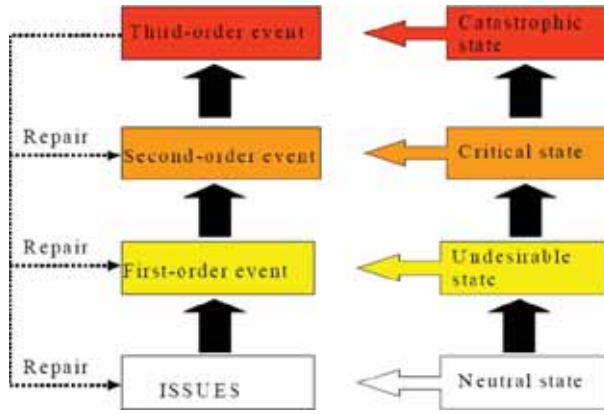

Figure 1: Issues progressing from a neutral to a catastrophic state [20].

1.3 Risk analysis model

Risk analysis models play an important role in any risk analysis. The question here is which analysis model would be fit to assess the influence of HOF, communication and management on the risk in organizations and projects.

It could be stated that the analysis model should be qualitative, as any attempt to suggest numbers would be highly subjective. As the risk identification process is most important, i.e. the identification of risks we do not know about being of highest concern, a very simple risk model can be adopted, for example using simple risk matrixes.

For an analysis of mitigating measures, a bow-tie analysis may fit well, as this method clearly identifies where to place barriers and the effect of the probability reducing and consequence reducing barriers.

2 EROSION OF BARRIERS IN A PROJECT

2.1 Issue communication and issue management in projects and organizations

Even when risk-reducing barriers are in place in a project, one should be aware of warning signs. One potential consequence of continually ignoring warning signs is illustrated with an unpublished example from a specific construction project. At each stage of the construction project, from the concept phase to the testing phase, warning signs such as ‘challenges with past similar structure’ and ‘questionable construction practices’ appeared, but these were ignored. As a result, systemic, engineered and human barriers were eroded until none remained and ‘cracks’ began to appear in the structure. Regarding the final outcome, the complete facility sank and imploded. In view of such a reference, one can easily understand why it is a requirement that all wells in an oil and gas exploration or production project shall always have at least two physical barriers against a blowout.

To deal with issues more efficiently, practical considerations of communicating issues should be considered. We assume that the organization and the project have a management system in place but that it is not perfect. That is, not *everyone* knows what *everybody* else is doing *at all times*. As we are assuming that no organization has a perfect management system in place, we have suggested that employees must be allowed to communicate issues in projects [20].

In the case of urgency, when there is an immediate danger of an incident leading to an accident, emergency procedures must be in place and the procedure must be simplified. This will give the project time to react against escalation of the issue, provide documentation of what went wrong and help the organization to avoid similar situations in the future. If the organization deals with issues successfully, this can help reduce stress. Although a certain amount of stress is necessary to create a good work rate, too much stress causes the work rate to decrease and has negative side effects. Stress is potentially disease provoking when occupational demands are high and the workers’ influence over their conditions of work is low, when there is insufficient social support, and when the reward offered to the worker does not match the effort he or she has invested [21]. Successful issue management can help alleviate stress and make the workplace safer.

A word of warning is necessary: in any organization that will take seriously any issue reported, there is a danger that some may ‘cry wolf’ inappropriately. Therefore, all must use the opportunity to report issues (knowing that their report will be seriously considered) with care and responsibility.

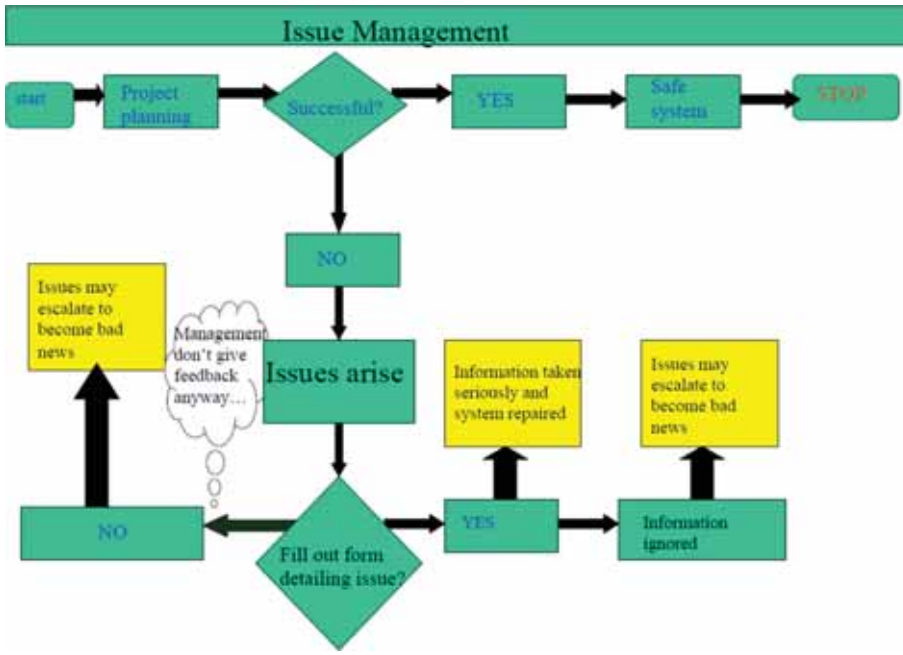

Figure 2: Possible pathways of issue management [20].

Inability to handle first-order events can, in the worst case, lead to secondary critical states or disasters [22]. First-order events (see Fig. 1) are often the result of previous unresolved issues, and it is rare for first-order events to suddenly appear 'out of nowhere'. If the organization can become good at handling issues at an early stage, first-order events can be avoided. The wording 'issue' is more neutral than 'bad news' and therefore easier to discuss and resolve. Figure 2 illustrates some ways in which issues can be dealt with, some more successfully than others.

2.2 Issue communication

At least two possible HOF can lead to issues escalating and becoming 'bad news':

- One possibility is the failure of the workers in avoiding reporting issues that arise. This could be because they fear blame, negative reprisals, being seen as 'whistleblowers' or because management has a reputation for not listening. People's inhibitions can also be a barrier to reporting issues. One should not underestimate the power of psychological boundaries. Employees in the United Kingdom working on the shop floor, for example, would not dream of walking into the manager's office for 'a chat about production issues' [23]. The hierarchy that exists in large organizations can create powerful psychological boundaries. Issues may then escalate to something more negative, making them even more difficult to report.
- The second possibility of failure is caused by management. If they choose to actively ignore issues because they do not know how to repair them or because resources are scarce, issues may also escalate to a more serious degree. In this respect, the responsibility of middle

management is of huge importance. The top management should trust the middle management to bring up all issues arising in a project. The top management should organize the company in such a way that issues can be raised, discussed and resolved.

One route that definitely yields a positive end result after an issue has been discovered relies on communication between workers and management. Issues are communicated by the employees and dealt with successfully by management, returning the system to a safe state. If issues are dealt with in this manner, the likelihood of a catastrophe (i.e. damage, pollution, huge loss of profit or loss of human life) is less likely. In the worst case, ignoring issues can lead to a catastrophe as illustrated in the Macondo blowout incident [24].

Neglecting issues can also lead to a number of secondary effects such as the media receiving information from frustrated individuals in the organization who feel they are not being heard. The organization may receive negative media attention and find itself being pressured by the public to return the system to a safe state. Such pressure can eventually lead to the media and organization seeing each other as adversaries [22] or, even worse, the fate of a disaster can also damage the organization's reputation to a high degree.

3 'BAD NEWS' MUST GET THE ATTENTION OF MANAGEMENT

3.1 When issue communication is regarded as 'bad news' in a project and the role of the organization

Information regarded as 'bad news' in a project can come from a risk analysis or from concerned 'floor workers,' which could either be project engineers or 'rednecks.' In a proper safety management system (SMS) one will prepare a 'plan' for the safety management implementation, the actions will be carried out ('do'), there will be 'checks' and 'feedbacks' in order to improve or update the plan. In this respect, the system will be self-healing. Projects might set up a 'risk register' to closely monitor the risks perceived to be of highest concern. In the case where the feedback loop does not function in the organization, the SMS of the organization does not function.

An example of such an organization is one lacking communication between top management and the lower levels and where 'bad news' is not communicated to the top level through the middle management. In some extreme cases, the 'bad news' might not even be understood by the higher management, in particular when the middle management lacks the necessary skills and the higher management does not want to listen. This could be caused by a lack of understanding, whether of engineering, of economic realities or of juridical matters regarding contracts entered into.

A poor working climate in an organization may be the result of unclear messages from the management and even the partial lack of management function. The worst imaginable organization would be a case where middle management filters out the 'bad news', while all the evidence the top management wants to hear is presented. Such an organization is extremely vulnerable to risks, as the managing level will not get the full picture of the risk situation in the projects and operations in which the organization is involved [25].

Such an organization will, furthermore, often ensure that the views of the employees are suppressed and that the employees are criticized routinely in a manner that ensures that all difficulties in the organization will not reach the ears of management. This could also create a situation of embarrassment and depression amongst the employees in the organization,

causing less attention to problems and poorer work performance [26]. A 'laissez faire' attitude could develop or, worse, antipathy towards management.

We suggest that the top management of an organization must take immediate action to avoid such a situation as soon as there is an understanding that middle management is trying to suppress 'bad news' from reaching the top decision level. It has been said about the most successful ship owner in Norwegian shipping, Sigvald Bergesen d.y. (1893–1980), that he was never ready to discuss the 'good news' in the morning management meetings as he saw the objective of the meetings as an opportunity to solve 'today's problems.'

There is, however, sometimes (in some organizations) a need for an eye opener. This could surface in the form of a well-arranged quantitative risk assessment (QRA); however, it may be necessary for somebody to point to the needs for a QRA of a project or an organization.

An example from the world literature is Andersen's tale about the 'Emperor's New Clothes'. Everybody agreed that 'the clothes which the weavers were preparing were extraordinarily magnificent' as they feared being declared stupid if they did not see any clothing. This was so until a *little boy* cried out the truth: 'But the Emperor has nothing on at all!' and then all the people cried: 'But he has nothing at all on!'It took a child to open the eyes of the crowd.

A manager (whether a middle manager or top management) who accepts that the 'bad news' must be dealt with in a professional way has laid the ground for a situation in the company where HOF are managed well, resulting in a manageable risk picture for projects and operations.

If NASA (with reference to the Challenger disaster, [27, 28]) had had open communication, they could possibly have been saved from the Challenger disaster. If they had allowed 'bad news' to surface, management could possibly have taken action to avoid the explosion of the Challenger in front of all the children who proudly watched their first 'teacher in space' on DIRECTV.

In some cases, a 'whistle blower' will surface to counter the effects of a poor organizational environment. Most will agree, however, that there should be no need for whistle blowers in a sound organization and that there should rather be an open channel to alert management of 'bad news.'

Risk elements could also be hidden in the organization, with what we do not know about the threats being more important than what we do know. In such situations, the organization (for example, a project) may have to involve independent experts to identify all potential critical elements of the systems and assess their risk of failure.

3.2 Example of a project and an organization where issue management functioned

In the case of an offshore platform project (the giant Troll A concrete platform [29]), the top management of the organization became aware of 'bad news' (through a qualitative and quantitative risk analysis); there was a possible flaw in the design of the ballast piping that potentially could lead to water ingress and water filling of the platform while floating. This news was eventually assessed with an action that the ballast piping should not be exposed to pressure loads that could cause pipe breakage. This decision resulted in a considerable reduction in the risk for loss of the platform in the temporary floating phases [25]. Implementing the recommendations of the QRA, the risk was reduced by several orders of magnitude. The platform construction and installation project went very smoothly, and the platform is

presently in production at the Troll North Sea gas field. This platform is at present the largest gas-producing center in the North Sea.

4 THE FUTURE ROLE OF THE RISK ANALYST

In view of the above discussion, the danger that important issues will not surface due to the staff being silenced from providing messages from 'the floor' is real in some organizations. Alternatively, risks might be identified in real hazids and risk analysis. Failure to carry out proper risk identification sessions, in which all risk elements that could possibly be encountered are identified, could put the project and the organization under very high risks; this will not occur in high reliability organizations [8].

In the worst case, it could be very unattractive to be a risk analyst who might be seen as a negative member of the team. Young engineers, on the way to making a career, could refrain from participation in hazard identification exercises. Senior personnel might fear being fired without the possibility of getting new jobs.

On the other hand, the insurance industry should demand proper risk analysis of projects or even involve their own experienced staff prior to granting insurance to projects and enterprises. Therefore, enterprises working in an unsafe mode might not be in the position to survive. Where this understood, the need for hazid leaders and risk analysts would be greater rather than in decline.

5 CONCLUSIONS

In this paper, we have clarified two scenarios for the handling of issues identified by the 'floor workers' or in a risk analysis: implementing the results from the risk analysis or neglecting the findings of the risk analysis.

In the case of the *Deepwater Horizon* accident and the subsequent oil spill from the Macondo well [24], several issue reports were overlooked or not handled with sufficient urgency. It is suggested that the fate of the rig could have been very different had the management carried out proper risk analysis and implemented procedures which immediately tackled the 'bad news' and in this respect listened to the concerns from the 'floor'.

We have discussed the results of risk analysis as well as concerns from the 'floor' in a project. Safety cultures of companies are discussed, and it is clear that the management system of a company could block issues regarded as 'bad news' from coming to the attention of the top management.

In this paper, we have suggested that *issue management procedures* should be incorporated to ensure that proper actions are taken in such situations. These procedures should be implemented by the management of the organization and serve as the management's tool to manage the risk in projects. This would result in an integration of risk analysis and project and company management.

The question could be asked as to whether the oil and gas industry is moving in the wrong direction with respect to implementing findings from 'the floor' or from risk analysis. It is suggested that the answer is (rewriting Mark Twain): 'Reports of my death have been greatly exaggerated'.

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