

# Towards a Model to Reduce the Risk of Projects Guided by the Knowledge Management Process – Application on FERTIAL

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**Keywords:** Knowledge Management, Knowledge Capitalization, Risk Management, Project Management, GAMETH Method, Knowledge Sharing, Information Systems, Decision Support.

**Abstract:** Knowledge plays a key role in the information revolution. Major challenges are to select the information from numerous sources and transform it into useful knowledge. In this context and in an economy strongly focused on the "Knowledge", take the turn of Knowledge Management becomes a strategic issue for the survival of organizations. However, the researches in knowledge management focus mainly on the creation, capitalization, and knowledge transfer process. Researchers are, too, centred on the establishment of the knowledge management process in companies, but little about interaction between the knowledge management process and the risk management process. In this paper, we propose a new model to reduce the risk of projects guided by the knowledge management process represented by the GAMETH method. We apply our approach to ammonia industry presented by the Algerian-Spanish company - FERTIAL.

## 1 INTRODUCTION

Very many companies use the risk management for developing their activity (construction, computer science, ecology, industrial, pharmaceutical, health, etc ...). Among the different research themes addressed in the literature, the risk reduction of projects remains one of the most studied together other important works on detection, evaluation, estimation, solutions and tools to be implemented. However, it appears that appropriation (learning) and experience (know-how) are effective ways to prevent risks.

Such knowledge acquired in the past should be managed to allow more effective risk management: one role of knowledge management. The latter is a way of systematic management of tacit knowledge and explicit knowledge. Indeed, its purpose is to retain, to transmit and to develop knowledge in order to:

- improve the skills management,
- support decision making,
- increase productivity,
- promote innovation and creativity.

In sum, risk management and knowledge

management are two different fields that become more and more important for companies dealing in a global and multicultural environment.

In the first part, we present the main concepts that are used in our paper regarding to context and elements of the project, the theoretical concepts of risk management, and knowledge management. In the second part, we present our model to reduce the risk of projects guided by the knowledge management process by using the GAMETH method (Grundstein, 2007); (Grundstein, 2012). Thus, we refer to the knowledge stakeholders, their tasks, and the results of their problem solving activities as knowledge resources.

## 2 THEORETICAL FRAMING

This section deals with the main concepts that are employed in this paper regarding to context and elements of risk projects.

### 2.1 The Risk Management Process

The projects failures lead us to treat the existing risks preventing projects to arrive to their end or else

to meet their initial specifications. For this, the need for risk management in projects is unquestionable. Almost all norms, quality models and standards of project management claim that risk management is essential. With the diverse interpretations of risk, the domain of the risk management becomes even more complex with different organizations and entities defining it in different expressions. Related to ISO (ISO, 2009) defines it as a set of coordinated activities implemented in order to direct and control an organization with regard to risk. In fact, the risk management is a continuous process that will trigger further deliberation as soon as a fact is added to the knowledge base, which makes the situation risky. Recording Bradley (Bradley, 2011) risk management embodies an organizational culture of prudent risk-taking within an agency. It is the process of identifying, assessing and responding to risks, and communicating the outcomes of these processes to the appropriate parties in a timely manner. Dey (Dey, 2010) describes it as “The systematic process of identifying, analysing and responding to project risk”. For Rachna (Rachna and Shahid, 2013), the risk management process is a holistic approach includes the external and internal risks to be addressed in the corporate strategy in integration with corporate culture prevalent in the company. Moreover, he outlines a standardized approach to the identification, analysis, evaluation, treatment, communication and monitoring of risk. According Pender (Pender, 2001), the risks management is present in all the systems of the model presented above: strategic, technical, social, structural, and the project management. The project manager must then seek to reduce them, and if he/she can't reduce them, he/she shall monitor their evolution. He set up in this optic a risk management. This risk management is a principal component of the project management. For Emblemsvåg (Emblemsvåg, 2010), the risk management is required to take into account the past problems leading to complications, present challenges and predominant inclinations which impede the project's successful implementation. Generally, risk management process is defined as a concatenation of five (5) steps (see Figure 1):

- Risk Identification: attempts to establish threats (risks) to the project. Its goal is to anticipate what can go wrong in the project. The identified risks in previous similar projects can help the software engineer in that task;
- Risk Analysis: concerns analyzing the identified risks, estimating their probability and occurrence impact (exposure degree);

- Risk Assessment: aims to rank the identified risks and to establish priorities. The goal is to allocate resources only for the most important risks, without managing risks with low probability and low impact;
- Action Planning: concerns planning mitigation and contingency actions for the managed risks (those of higher priority). Mitigation actions aim to reduce probability or impact of a risk before it occurs. Contingency actions assume that mitigation efforts have failed, and are to be executed when a risk occurs;
- Risk Monitoring: as the project initiates and proceeds, managed risks should be monitored. Risks' exposure degrees could change, new risks could appear, or anticipated risks could be no more relevant. It is necessary to control managed risks, to identify new risks, and to accomplish the necessary actions and evaluate the effectiveness of them.

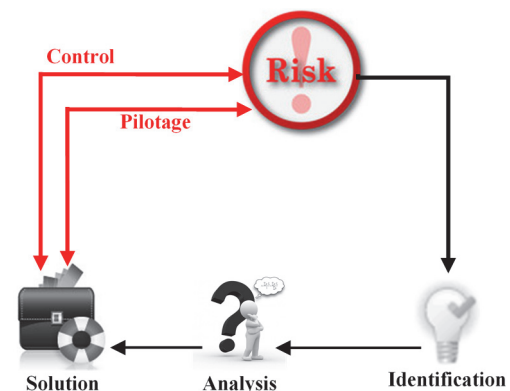


Figure 1: The Risk Management Process.

For to be reduced, the risk must first be identified it this is the first step. For the known risk, the analysis phase that follows consists in finding the causes of this risk and to evaluate its consequences. The project team then searches the possible solutions to reduce it and sets up the one which seems the most effective. This setting up of the solution is piloted and regularly monitored in order to check that it matches well to the expectations of the team that shall make changes if necessary.

In this context, managing organizational knowledge about risks is important to improve the accomplishment of this activity, and to allow organizational learning about risk management. In this way, many experts agree that “an organization can't manage its risk today without managing its knowledge” (O'Leary, 1998).

Finally, the Knowledge Management processes

as well have turned out to become a strategic resource for the organizations. The knowledge management can have a great influence on reducing organizations' risks (Rachna and Shahid, 2013). However, using the knowledge management processes to improve the application of the risk management processes is a recent and significant research area. In spite of its importance, this area of research has not been addressed intensively up to now. A company cannot manage its risks effectively if it cannot manage its knowledge, many projects failed due to lack of knowledge among the project team members or lack of knowledge sharing during project progress (Rachna and Shahid, 2013).

## 2.2 Knowledge Management

Before understanding how knowledge management allows reducing the risks in the projects, we find out its own characteristics.

In the literature, we find several definitions of knowledge management. For this, we are focused in our paper about a few definitions. Barclay (Barclay, 2004) defines the knowledge management as being "as a process of identification, formalization, disseminating and use of knowledge in order to promote creativity and innovation in companies". According Dieng-Kuntz (Dieng-Kuntz, 2001), Knowledge capitalization in an organization has as objectives to promote the growth, the transmission and the preservation of knowledge in this organization. According Grundstein (Grundstein, 2012), capitalizing on company's knowledge means considering certain knowledge used and produced by the company as a storehouse of riches and drawing from these riches interest that contributes to increasing the company's capital. In fact, the knowledge management is a way to answer the problem of capitalizing on the company's knowledge. This problem can be considered as a multi facet problem solving approach which is described by Grundstein as follows: (Locate, Preserve, Enhance, Actualize, and Manage). For Barthès (Barthès and Grundstein, 1996), knowledge management consists of capturing and representing knowledge of the company, facilitating its access, sharing and re-use. This very complex problem can be approached by several points of view: socio-organizational, economic, financial, technical, human and legal (Grundstein, 2007). Additionally, Alavi and Leidner (Alavi and Leidner, 2001) identified the KM processes: creation, storage and retrieval, transfer and application of knowledge. These processes are looking for creating value from

intangible assets: human capital, structural capital, intellectual capital, customer or relationship capital. For Nonaka and Takeuchi (Nonaka and Takeuchi, 1995), knowledge management systems are guided to capture, create, store, organize and disseminate organizational knowledge. This process takes into account the transformation and the evolution of tacit to explicit knowledge (O'Leary, 1998) and of individual to collective knowledge. Tacit knowledge is represented by experience, beliefs and technical skills accumulated in the people's minds. Explicit knowledge is the knowledge expressed in documents, data and other codified forms. The interactions and movements from tacit and explicit knowledge to tacit and explicit knowledge on the individual and organizational level generate the knowledge creation in an organization. The dynamic is expressed through the processes in Figure 2.

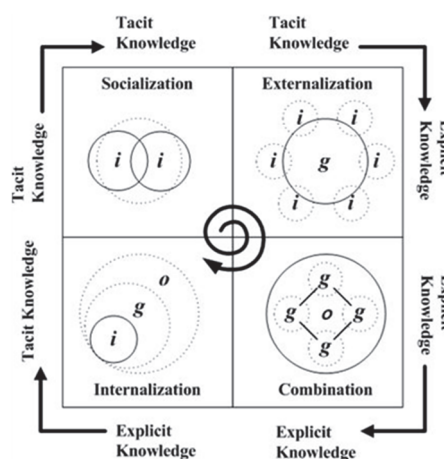


Figure 2: A Model of Dynamic Organizational Knowledge Creation (Nonaka and Takeuchi, 1995).

It can carry both theoretical knowledge and know-how of the company. It requires the management of company knowledge resources to facilitate their access and their re-use (Pender, 2001).

Moreover, we can find in the literature different proposals of life cycle used to realize knowledge management (such as GAMETH, MASK, REX, KOD, etc.). In our paper, we adopted the knowledge management life-cycle proposed by Grundstein (Grundstein, 2007), where, according to him, "in any operation of knowledge capitalization, it is important to identify the strategic knowledge to be capitalized".

For our purpose, the knowledge capitalization cycle was chosen as the most appropriate because of its generalizing point of view (see Figure 3). This cycle summarizes the knowledge capitalization tasks

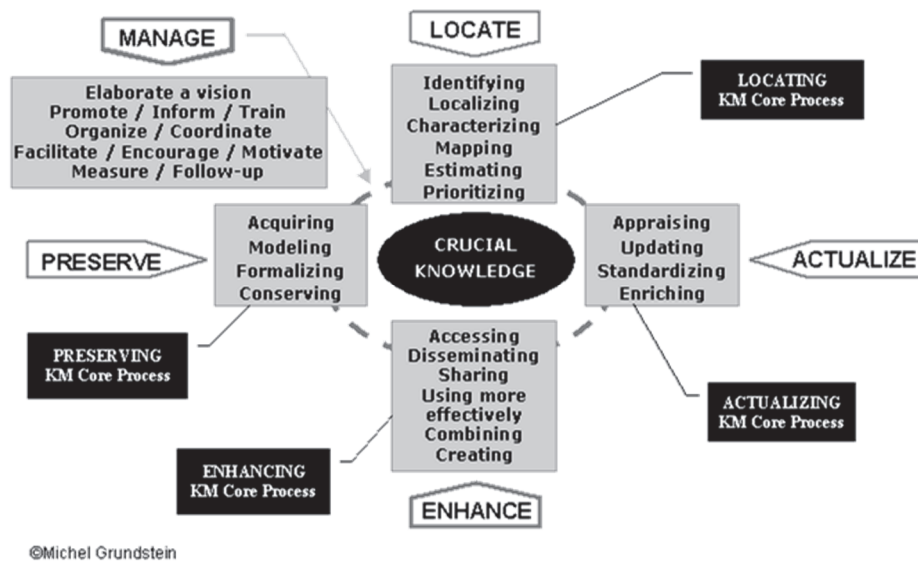


Figure 3: The Generic KM Processes (GAMETH method) (Grundstein, 2007).

in four major steps: detection, preservation, capitalization and actualization of strategic knowledge, each of them declined by several detailed tasks. These steps also reflect requirements for our objective, i.e. the development of a model to reduce project risks and a decision support system for FERTIAL Company.

### 3 THE MODEL TO REDUCE THE RISK OF PROJECTS GUIDED BY THE KNOWLEDGE MANAGEMENT PROCESS

The capitalization gathers the processes allowing of valorize the knowledge "acquired": the return of experiments on reducing risks, capitalization around the finding solutions to improve the teamwork, use of tools for modeling, and the planning within the FERTIAL (National Fleuron of the petrochemical industry) Company.

FERTIAL (National Fleuron of the petrochemical industry) (see the References section), Company of Fertilizer of Algeria, is a company resulting from a partnership concluded in August 2005 between the Algerian Group ASMIDAL (see the References section) and the Spanish group GrupoVillar Mir (see the References section). Also, it is composed of five major divisions specialized in numerous activities related especially the manufacture of fertilizers and agricultural fertilizers. Indeed, the security is a key factor in the Industrial

Policy and Human Resources, as well as staff training, quality and respect for the environment. The most important goal of the FERTIAL Company is to achieve zero accidents and ensure industrial safety of the surrounding communities by proposing an approach of knowledge capitalization in the trades' and its exploitation in the projects. These projects were intended for the renovation and modernization of industrial facilities to improve their capacity, the acquisition of new digital control system, to the environment and security ... etc (see Figure 4).

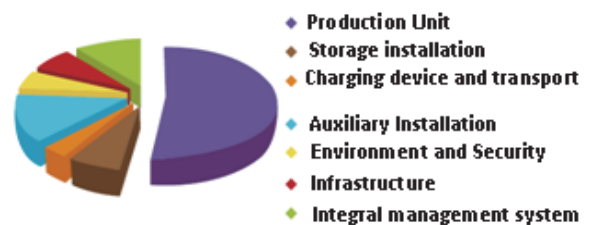


Figure 4: Destination of investment projects.

The knowledge management process can reduce the risk of projects. In fact, as we are going see through the Figure 3, the different phases of risk management correspond to the operational chain of the knowledge management process.

**During the identification phase**, the project team puts in common all the knowledge related to sources of the risk and searches for the presence of these sources at all levels of the project. For that, we are also interested in this study to identify the sources of risks for people, property, and work at the

level of FERTIAL group especially the complex Fertilizers Production. The table below recapitulates the identification of these risk sources.

Table 1: The different types of resources threatened by Risks in FARTIAL Company.

Management , Skills	<ul style="list-style-type: none"> <li>▪ Membership resignation of the project team;</li> <li>▪ Departures of consultants or experts, (Death, Injury, and illness of an expert);</li> <li>▪ Go to another company – project,</li> <li>▪ Stress, exhaustion</li> </ul>
Technologies / Materials / Middle	<ul style="list-style-type: none"> <li>▪ Pollution in terms of environment (hygiene, waste management).</li> <li>▪ Accident in terms of health,</li> <li>▪ Gas leak</li> <li>▪ Incendie, Explosion</li> </ul>
Identifying the stakeholders (i.e.,who is involved or affected).	<ul style="list-style-type: none"> <li>▪ Past events,</li> <li>▪ Future developments.</li> </ul>

This knowledge was accumulated during previous learning and from experiments of past projects. The acquisition of such knowledge that corresponds to the step of preserving (acquiring) the knowledge management core process is carried out using different means: learning, the experiments return, and the knowledge transfer between the actors of the project team. Moreover, we have used others project risk identification techniques including:

- Brainstorming sessions with staff or external stakeholders: This brainstorming process is likely to highlight a large number of risks of differing importance. As a result, it is necessary to score the risks in terms of the likelihood of the risk being realized, the impact the risk would have on the achievement of projects objectives and the quality of the mechanisms in place to control (manage) the risk. This enables the relative importance of each risk to be assessed and ranked;
- Use the documentation and existing project management tools: Project design tools (functional analysis, Pert (critical path key step), and budget);
- Check-lists or pre-established surveys covering the different areas of the project (Environment and Safety);
- Working from the problems encountered from previous projects (Post-mortem, expert advice, and experiences Returns);

In the concrete case of a project, we have clarified

some contextual information's: for example, which are users formed, what are the signatories and recipients of mail and what are the participants in the meetings...

However, these methods and tools each have their own limitations. For that, we find ourselves important to use them jointly in order to obtain a most exhaustive identification of the projects risk. This stock of knowledge feeds the discussions which occur during of the identification phase.

**During the phase of risk analysis,** the knowledge acquired in the past relating to the evaluation and estimation methods and the risk measurement are put to contribution. The solution for reducing and / or controlling the risk arises from the analysis developed just before. Through knowledge detained by team, its trade's actors can more or less predict the consequences entailed by the solution establishment.

Furthermore, the method chosen for the risk analysis that we used combines the possible consequences or impact of an event (management, skills, environment, technologies, and health) with the likelihood of these events which occurring. The result is a 'level of risk' (see Figure 5)

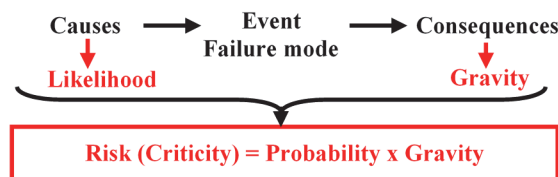


Figure 5: Characteristics of Risks.

Subsequently, the type of analysis that we used is qualitative (i.e based on a "simplified" evaluation) that takes into account the severity and probability parameters according to the following three levels.

Table 2: Index of risk criticality.

1	Null
2	Low
3	Medium
4	High

Also, we performed a mapping "Occurrence probability/ gravity." This mapping allows determining the nature of the risk treatment measures to be implemented depending on the type of risk (preventive measures for risk probability, measure of protection for gravity risks, avoidance or suppression, and priority by treatment ...).

It allows arbitrating the risk treatment with high probability of occurrence and strengthens protective measures for risks with high gravity (see Figure 6).

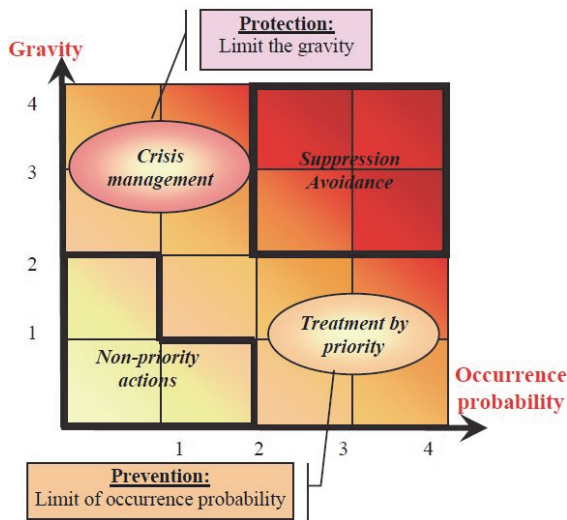


Figure 6: The mapping "Occurrence probability/ gravity".

The choice of preventive actions to engage is performed by comparing the costs of implementing them with the consequences costs of the risk, taking into account their occurrence probability.

Thus, the steps of identification and analysis constitutes the **interaction phase** of our model that we have integrated into the GAMETH method (Grundstein, 2012); (Grundstein, 2007) after the preserving phase (see Figure 7).

Moreover, the establishment of the solution is piloted and controlled by the project manager (leader) with the aid the effect evaluation of the

solution of the risk, for example by using of monitoring balanced scorecard which contains (control efficiency, control cost, and monitoring of action plans) or by dialoguing with concerned trades' actors.

Likewise, we can through this mapping to launch a regular activity to risk monitoring. The latter allows following the evolution of the risk appearance probability (stable, on the rise, on the drop) to control the relevance of preventive actions engaged and eventually to correct the planned arrangements.

The interaction between the solution and the two managerial skills (*piloting and control*) is similar to the **integration phase** of knowledge management process (see Figure 7). Indeed, the implementation of the solution is akin to an action process which is tested and regulated by the control and piloting of the project manager.

This control and this piloting pulls out a more or less thorough evaluation of the effects of the solution envisaged and this evaluation serves as the basis for knowledge creating, the third step (Enhancing KM core Process) of the GAMETH Method. Evaluation of the solution consists in comparing the results obtained to desired results (effectively). This difference, positive or negative, between real results and contemplated results, allows the team (managers and trades' actors) to make self-criticism of the solution and to define thus the advantages and disadvantages of the solution

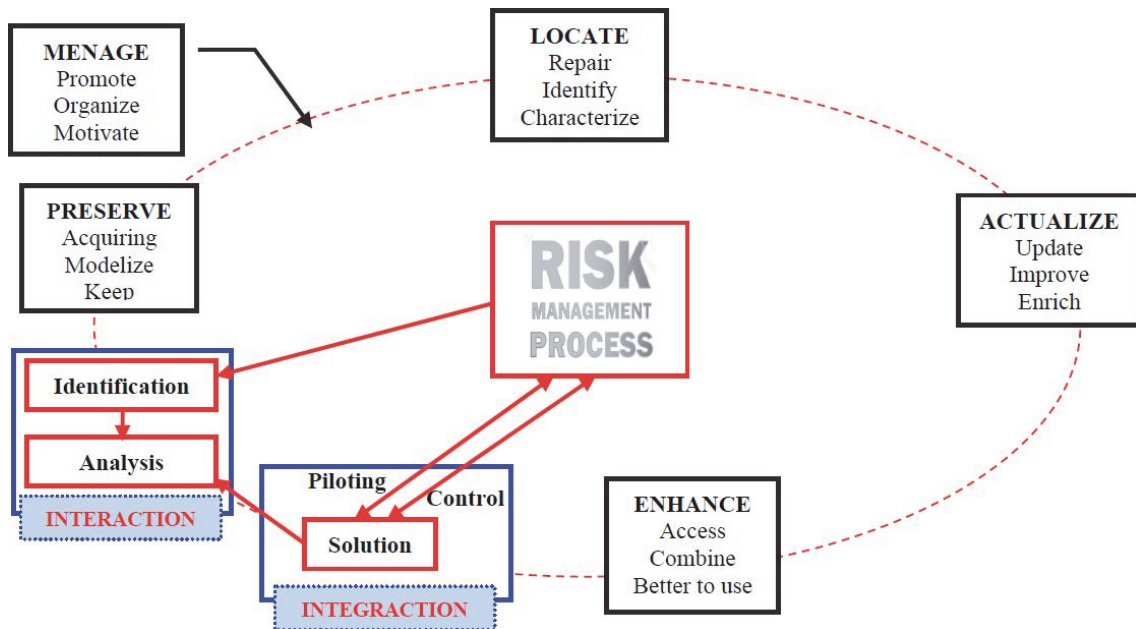


Figure 7: Integration of the Knowledge Management Process (GAMETH method) in the Risk Management Process.

developed to accumulate knowledge.

After updating, enriching, and appraising of the knowledge management process by the new knowledge (the fourth phase “Actualizing” of GAMETH process), this new knowledge is managed in a project memory (Matta et al, 2000) for that the knowledge management process can reduce the risks, follow-up the risks, and elaboration a vision of the future projects (the fifth phase “Manage” of the GAMETH process).

The knowledge management cycle is thus sealed off. The new knowledge accumulated over of the risk management is memorized and ready to be disseminated to the future of project teams. The risk management will be more effective because the phases of identification, of analysis, and setting up the solution will benefit from the experience of past projects.

The introduction of knowledge management thus allows reduce directly the risks. However, it also influences indirectly risk sources:

- The responsiveness lack: this is organized by the establishing of the alert system; information processing systems by exception which enable quickly identify the risks that can arise, and the procedures aiming at reducing these risks. In other, the responsiveness is improved by the detection, identification and rapid risk analysis.
- The cognitive biases: For Zindel (Zindel et al, 2014), the cognitive biases are cognitive processes which generate errors of appreciation and interpretation of the information at the individual level. Moreover, the cognitive processes serve to reduce and combine mentally of the information quantities. From sharing its process, knowledge management reduces the cognitive biases due to interactions between the team members.

## 4 CONCLUSIONS

We can summarize the contributions of knowledge management to reduce the risks in the following way:

1. The knowledge management allows evolving the cognitive processes of the various project actors.
2. The knowledge management favors the knowledge acquisition at the level the risks by making explicit the tacit knowledge of the different actors on the risks, retaining such knowledge and transferring them.

However, it must be noted that the use of the

knowledge management to reduce the risk is only relevant if an assessment and an experience feedback of projects is performed by all project actors. Indeed, it was only at this time that the knowledge about the risks can extend thanks to the measurement of deviations between what that was expected of the project and the real results, by analyzing these deviations and by fixing this analysis in the knowledge base.

It does must also not lose sight of the fact that the knowledge management takes an interest in the environment that surrounded the project, because, the solutions applied to reduce the risks may be different according to the project environment.

Finally, we are currently working with our collaborator of FERTIAL Company to put our approach and its stages, including the risk monitoring plan and the knowledge capitalization, in practice, in a project to increase production capacity of ammonia and fertilizers.

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