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A decision-making tool to maximize chances of meeting project commitments

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ABSTRACT

The project management team has to respect contractual commitments, in terms of deadlines and budgets, that are often two antagonistic functions. Then, during the invitation to tender phase or when faced with a risk situation, it has to determine its risk management strategy.

Based on the principles of a synchronized process between risk management and project management, we propose a decision-making tool to help the project manager choose the best risk treatment strategy.

The methodology developed, called ProRisk, uses the concepts of risk scenario, treatment scenario and project scenario to determine the consequences of possible risks combined or not with preventive and/or corrective treatment actions.

As a finding, the project manager is also able to indicate to the sales department if the financial and deadline conditions are sufficiently profitable with regard to the risks.

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1. Introduction

In the current context of market globalisation, and in order to find new clients, companies have to offer innovative products. They also have to change product ranges. More and more companies use project management tools and methods for managing their innovations, for ensuring better product quality, better deadlines and lower costs. In this context, particular attention is paid to project management methods by decision-makers and academics.

Every project type faces risks, whatever the size or topic concerned. Nevertheless, the more innovative the project, or if the technology area is poorly known, the more uncertain and risky the project. Professional organisations as well as standards bodies have for several years produced guides and books on project management and good practice (International Organization for Standardization (1997a,b), IPMA (1999), Project Management Body of Knowledge or PMBoK, International Project Management Association Competence Baseline or ICB, etc.). These reference framework documents present the process required for management. Turner proposes a review of progress on the global project management body of knowledge (Turner, 2000). He states that, even if the internal breakdowns may not be always appropriate, the guide to the PMBoK contains the core elements used by all project managers. The following dimensions are systematically mentioned in the reference framework documents: integration, scope, time, cost, quality, human resources, communication, risk and procurement management. Academic works also

exist. These aim to reinforce their use (Themistocleous and Wearne, 2000) and to add further details to the propositions in a range of different fields that defining and specifying notions of risk in order to reduce the polysemy of this term, they establish classifications and they propose new approaches.

In a project context, the manager has to take risks into consideration in two main situations. Firstly, when faced with a risk situation, the manager has to choose a strategy which keeps the project on budget and on time. Secondly, when the sales department answers an invitation to tender, risks have to be correctly evaluated and the strategies correctly chosen to obtain a realistic estimate (cost/duration) of the project.

This paper is interested specifically in approaches that allow projects to be managed by taking account of risks. These approaches aim to anticipate potential phenomena and to measure their possible consequences on the project life or objectives. They lead the manager to choose the risk treatment strategies appropriate to the project.

In the next part, we present a literature survey on risk management, which shows the diversity of the sectors of activity concerned. We illustrate the evaluation problematic of the influence of risk on project schedule. Then we describe our proposed methodology, "ProRisk", and a case study is detailed. Finally, we analyse the results obtained and present our conclusions to this work.

2. The risk management approaches

The risk management area is large and concerns a huge number of activity sectors, from finance to industrial, via chemistry, nuclear technologies, health, the environment, etc. In several sectors, the

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need for methods has been known for a long time. Numerous approaches and methods have been developed and proposed as a result of directives and regulations which are launched in the wake of more or less media-friendly disasters such as the Three Mile Island and Chernobyl nuclear accidents, the explosion at Bhopal, the floods at Vaison la Romaine, etc. Faced with these different disasters, populations have greater influence in their demands for more and more applications of the precaution principle. Then, to regulate the financial sector and promote corporate governance, several new regulations appear regularly, such as the Sarbanes–Oxley Act in USA or the financial security law in France.

2.1. Global approaches

In the literature, the risk management methods refer to a standard process presenting the well known steps: risk identification, risk evaluation and quantification, risk classification, proposed actions for treatment and/or impact minimization and risk monitoring (CSA, 1997; BSI, 2000; ISO 31000, PMI).

It would take too long to list every disaster and mention every method which has been proposed. Nevertheless, Tixier et al. (2002) propose a classification of 62 existing approaches. They sort methods as being deterministic and/or probabilistic, but also qualitative or quantitative.

As an example of the deterministic and qualitative we can mention approaches that are dedicated to a particular activity, such as the HAZard OPerability method (HAZOP) for the chemical industry (Kennedy and Kirwan, 1998), the Hazard Analysis Critical Control Point method (HACCP) for food chain security (Motarjemi and Käferstein, 1999), or some more general ones that cover several activity sectors, such as Preliminary Risk Analysis (PRA method) (Nicolet-Monnier, 1996).

For the probabilistic and quantitative approaches, there are the Fault Tree Analysis method (FTA) (Nicolet-Monnier, 1996), the Event Tree Analysis (ETA) (Tiemessen and Van Zweedden, 1998), the Monte Carlo method (Kalos and Whitlock, 2008), or the two main approaches for project risk management: the RISKMAN method (Carter et al., 1996) and the Project Risk Analysis and Management method (PRAM) (Chapman and Ward, 1997).

Deterministic and probabilistic and quantitative such as the Failure Modes, Effects and Criticality Analysis (FMECA) (Rogers, 2000), MOSAR or Accidental Risk Analyse Methodology for IndustrieS (ARAMIS) (Salvi and Debray, 2006). The latter presents the bow-tie, which can also be helpful to manage risk in projects.

Deterministic and probabilistic and qualitative, such as the Structural Reliability Analysis method (SRA) (Rogers, 2000). The approaches mentioned are summarized in Table 1.

In a project context corresponding to this work, a risk may introduce different modifications into a project. Tasks may appear or disappear, others could be longer or shorter than forecast. This,

therefore, impacts the notion of project planning. The specificities of the project context are: the notion of uniqueness (there is no recurrence in the projects), the notion of limited horizon (there are different milestones and contractual commitments) and the notion of a multi-expertise environment (numerous actors with different skills, perceptions and points of view are working together); together, these influence the choice of method. Uniqueness leads to use methods, such as the brainstorming, that are based on the expertise (very limited returns of experience and very few databases are available). The fact that time is limited forces the use of simple methods. Finally, the high number of actors implies that the model must share the information and help obtain a consensus.

In this work, we make the link between project planning, project management and risk management. To our knowledge, few methods are able to do that. They mainly apply risk management to an object, but the repercussions on planning are rarely modelled. Among the most closely related approaches, RISKMAN examines the notion of risk as an event that can affect the project. The PRAM mixes qualitative and quantitative elements by transforming events into uncertainties impacting the tasks (Chapman and Ward, 2003), and the ARAMIS method allows the notion of the scenario to be highlighted. The risk becomes one or several uncertainties that are taken into account in tasks as a cost or delay range. It is reflected in the global project by the means of delay distribution or total project cost distribution. In the following part, we provide more details concerning these three methods/methodologies that are, or that can be, used in the project risk area.

The RISKMAN method was developed between 1993 and 1996 during an EUREKA project (Carter et al., 1996). In accordance with existing reference framework documents, the RISKMAN methodology proposes a risk management process composed of the following phases: identification, evaluation, treatment and monitoring. The RISKMAN method recommends several interesting rules:

- a risk must always belong to only one risk category. Twelve risk categories are proposed. The risks relate to: strategy, marketing, contracts, finance, project schedule, definition, process (Work Breakdown Structure or WBS), organization (Organization Breakdown Structure or OBS), maintenance, business and to external events outside organization;
- each impact has to be measured (or evaluated) within only one unit;
- a risk can have one or more causes. A risk can increase the probability of several others to appear (risk interdependence);
- each risk with no direct financial impact must lead directly, or indirectly, to one or more risks with a financial impact.

The RISKMAN also proffers the notion of risk reduction strategy. A reduction strategy takes the form of an action required to reduce, eliminate or avoid the potential impact of a project risk. The scheduling of risk reduction must be applied at each project life-cycle phase, after the process of evaluating and quantifying the risks. In accordance with RISKMAN, the project manager can attenuate risk using different action types: avoidance, transfer, reduction, etc. Lastly, RISKMAN is a generic methodology applicable to all project types.

The Project Risk Analysis and Management method (PRAM) (Chapman and Ward, 1997) was developed for the Project Managers Association. The PRAM is supported by the Risk Management Process (RMP). This iterative process is composed by several steps such as define, focus, identify, structure, clarify, estimate, evaluate and plan or manage. The originality of this method comes from the simultaneous identification of the risks and of their associated reduction actions during the identification phase. Authors also indicate the case where reduction actions can generate new risks; therefore, they talk about secondary risks.

Table 1
Summary of the approaches mentioned.

Approach	Deterministic	Probabilistic	Qualitative	Quantitative
HAZOP	X		X	
HACCP	X		X	
PRA	X		X	
FTA		X		X
ETA		X		X
Monte Carlo		X		X
RiskMan		X		X
PRAM		X		X
FMECA	X	X		X
MOSAR	X	X		X
ARAMIS	X	X		X
SRA	X	X	X	

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