An innovative approach for project launch decision-making in risk and multi-criteria situations

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ABSTRACT

The realization of infrastructures and the deployment of processes can follow project formalism. Generally, a project goes through a design and a realization phase. Between these two phases, there is a crucial milestone: Launching the project, which is not at all an easy decision and constitutes a real problem. The main reasons to this are the numerous numbers of criteria (For Technical, Economic, Social, Environmental dimensions) and risks in the sense of feared event. Criteria and risks are most of the time not considered due to lack of time (for formalization) and the difficulty to handle them. The objective of this paper is to propose a relevant approach to make the decision of launching the project or not. The proposal outlined is innovative in that it can consider indicators based on several appropriate criteria, the associated risks and their ways of management. The fact to consider several criteria and risks, increases the probability of making the right decision. The proposed approach allows managing risks by determining acceptable scenarios, thus maximizing project aptitude to fulfil the objectives.
Keywords: Risk, Multicriteria, Project, Scenario, Decision, Criteria

INTRODUCTION

Nowadays, the building of most infrastructures and the deployment of most processes take the form of a project. After the design phase, the main issue is to decide whether the project can be launched or not. During this phase, the decision is either to launch the project in its actual configuration, abandon it or redefine it. According to [1], 90% of all major projects (of more than 1 million euro) fail due to bad decision-making. Making the right decision is thus the key element for the project's success [2], [3]. To make these decisions, stakeholders need a decision process, with metrics that indicate the likelihood of the project's success [4]. Thus, a project is likely to succeed if its assessed metrics are pertinent to the context and if they suit the project objectives.

The aim of this paper is to help stakeholders at the project launch phase, by proposing an approach based on a decision process and metrics on which they can rely. So that they can decide whether the project is qualified to be launched or not. There are few studies in the literature addressing this particular issue – which is also called the “go/ no go” question [5]. Most authors are more interested in the bid/no bid question [6], [7]. There is, however, a real need to consider this particular problem of go/ no go for the project launch. This decision is very often based on limited criteria – mainly the cost and the duration [8], [9], [10], [11]. This method can no longer be recommended, because customers are becoming increasingly demanding. Otherwise, cost and duration alone are insufficient as criteria to characterize the project success likelihood. Other criteria that take account of dimensions such as technical, environmental, social and regulatory requirements must be integrated in the assessment. Generally speaking, ignoring these dimensions widens the gap between what was planned and what was achieved and leads to the project failure. Another reason for project failure is the occurrence of non-identified and unpredicted events (risks). Thus, to make correct decisions in the launch phase, there are two main difficulties: (a) the need to integrate several criteria [12] and (b) the consideration of risk [13], [14]. Authors such as [15], [16] and [17] have addressed some aspect of these problems, but not all of them. For instance, [15] focused only on risk while [16] focused on criteria and [17] analysed only the project indicators. [18] and [19] proposed a decision framework without investigating risks.

The major drawbacks of these proposals are the lack of (1) a generic framework that can take into account several types of criteria, and several risks, and (2) an aggregation model to characterize the project from the characteristics of its tasks. A multi-objective programming approach proposed by [19] does not provide guarantees for the existence of the criteria, unlike our proposal which is based on aggregation functions. Finally, the evaluation of the project in a context of risk, investigated by [20], [21], [22] does not consider risks at the task level, as our proposal does. There is thus a real scientific need to find a framework that provides an indicator that includes several risks and criteria for the project launch issue. We make the hypothesis that the use of more and better-adapted criteria and risks may lead to an improved decision-making.

The innovation in this paper, in comparison to the shortcomings of the literature, lies in providing (a) a method for considering several criteria, risks and their treatment strategies, (b) an aggregation of these criteria from low level (on the task) to the level of the whole project, (c) indicators that include a wide range of appropriate criteria that are complementary to the cost and duration factors, (d) relevant indicators that make it possible to determine whether the project can be launched or not. Thus, it becomes possible for the stakeholders to make the right decision. This, in turn, leads to a reduction in the failure rate, saving time and money.

This paper begins with the presentation of our proposal. This consists of a description of the analytical process and a conceptual model. The latter describes the main concepts. Then the methodology to assess the risk impact on identified criteria is described, along with the aggregation procedures. Finally, some indicators for project success likelihood are proposed. Finally, our perspectives are outlined in the conclusion.

PROPOSAL

This section describes our proposal to handle the problem of deciding on the project launch in a situation involving risk, while considering several criteria. We propose a process that can be followed by stakeholders to determine if they can launch the project or not. The proposal provides relevant indicators that evaluate the success likelihood in a risk situation. Figure 1 shows the overall process. It consists of 3 steps that may be iterative: Data collection and modelling, Calculation, and an Analysis for decision-making. Every step has two levels: risk level and strategy level. The term Risk refers to any disturbing event. At the risk level, only risks and their impacts are considered. The strategy level also considers the identified strategies to manage risks.

The first step consists in characterizing the Tasks, Risks, their Impacts and the project's Objectives using several Criteria. Based on expertise and/or data, an analyst performs this characterization. It leads, in the second step, to a model of the project including risks. From this model, the Risk Scenarios (ScR) are generated and evaluated. A risk scenario is a combination of occurrence/ none occurrence of risks. Then a Risk Resulting Impact (RRI) is assessed for every generated risk scenario that affects a task. The value of the Risk Resulting Impact is aggregated to the task to obtain a Task Resulting Value (TRV). At the end, the Task Resulting Value of all tasks are aggregated from tasks to the project level to obtain a Project

Resulting Value (PRV). Project Resulting Value is a set of aggregated criteria that characterize the project for every risk scenario. Based on the Project Resulting Value and the objectives, a Scenario Success Indicator (SSI) is assessed for every pairing of (risk scenario, type of criterion). After this, a Scenario Success Indicator is assessed for every risk scenario for all criteria. From the Scenario Success Indicator, the step of analysis classifies the project into one of these three categories: Fully Acceptable, Acceptable, and Not Acceptable. Fully Acceptable means that the project, in its actual configuration, meets the objectives. Thus, the project can be launched. Not Acceptable means that the objectives are not respected, and the gap is too wide. In this case the project must be redefined and characterized again - or abandoned. Acceptable refers to a situation where the project does not fulfil the objectives, but some risk management strategies could be used to drop it into the objective's domain. In such a situation, preventive and corrective strategies for risk handling are characterized. From the new project model, including the management of risks, Treatment Scenarios (ScT) are computed for every risk scenario. A new Scenario Success Indicator is assessed, and the analysis categorizes the project and makes the decision to abandon, launch, redefine or characterize the project once again. Data collection/Modeling (1) and the Analysis (3) are performed by a stakeholder with the help of our built- in tool. The calculation (2) is totally performed by the tool.

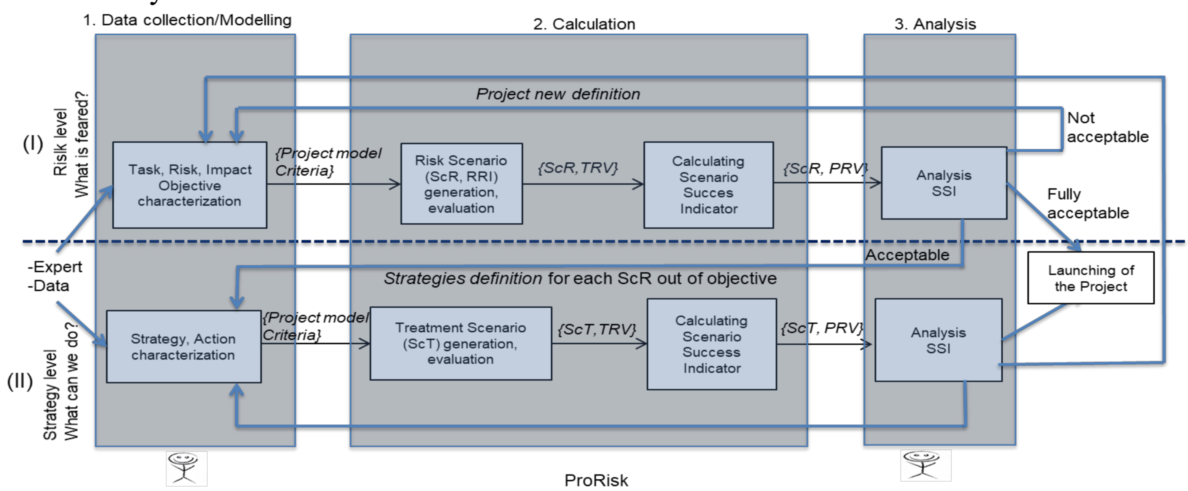

Figure 1: Decision-making process of project launch

Data collection modelling

Data is collected for six concepts: Project (P), Task (T), Risk (R), Impact (I), Strategy (St) and Action (A). A project consists of many Tasks. During task realization, Risks can occur. Risk is used in the sense of an undesirable event characterized by an occurrence probability which impacts on the project objectives [23]. A Risk affects one or many task criteria depending on the value of its Impact. Strategy aims to manage risk. It can reduce the impact of risks as well as the probability of their occurrence. Strategy consists of a series of Actions. An action can add new tasks to the project, remove or modify existing ones. The first innovation in the paper is to characterize each concept by several criteria representing a relevant dimension: Technical, Economic, Ecological, Social, Regulatory etc. The second innovation lies in performing an analysis by including the objective on the identified criteria. Therefore, an objective for every criterion is defined according to four values: a minimum unacceptable (MINU), a minimum acceptable (MINA), a maximum acceptable (MAXA) and a maximum unacceptable (MAXU).

Calculation and aggregation procedure

This section presents the aggregation procedure used to assess a success indicator. The third innovation in this approach is to begin by low-level information (values of criteria and impacts on tasks) then move to a higher level (the project level by assessing the Project Resulting Value for every risk scenario). For this purpose, let us consider a set of tasks $\vec{T}$, and Risks $\vec{R}$. A single task T, and Risk R are characterized by a set of criteria type $\vec{C}$. To manage Risks, sets of corrective and preventive strategies are available. $\vec{C}$, $\vec{T}$, $\vec{R}$, are vectors composed of several elements. A risk R has a set of impacts $\vec{I}$ (one for every criteria). For r = $|\vec{R}|$ risks, 2r risks scenarios are generated from our built-in tool. A risk scenario could be composed of a single risk, several risks or the situation where there is no risk (None). In the following part of this section, the proposal is described for one criterion. For risk scenarios composed of several risks, and impacting a single Task, their resulting impact corresponds to the Resulting Risk Impact (RRI). In the literature, the impact of a risk scenario composed of several risks is handled by summing their impacts. However, the "sum of value" model is not suitable to characterize all situations. For instance, both fire and flood can cause delays in a project. Their impact can be determined separately from a model or through data/expertise. But the simultaneous occurrence of fire and flood leads to a resulting impact different from that of the sum of fire and flood. For this reason, the Resulting Risk Impact ($\overrightarrow{RRI}$) of Risk Scenario (ScR), is calculated as follows:

$$\overrightarrow{RRI} = M_{RRI}(\vec{I}) \qquad (1)$$

where MRRI is a model. $\overrightarrow{RRI}$ is a set of aggregated criteria that characterize every risk scenario.

In the same way, the impact of a risk scenario on a criterion for a single task, that of the global project are aggregated. At the end, we calculate a Scenario Success Indicator (SSI) associated to every pairing of risk scenario i and criterion j according to the following formula:

$$SSI(ScRi, j) = \begin{cases} 1 \ if \ PRVij \ \in [MINAj, MAXAj] \\ 0 \ if \ PRVij \geq MAXUj \ or \ PRVij \leq MINUj \\ 1 - \frac{PRVij - MAXAj}{MAXUj - MAXAj} \ if \ MAXAj \leq PRVij < MAXUj \\ 1 - \frac{MINAj - PRVij}{MINAj - MINUj} \ if \ MINUj \leq PRVij < MINAj \end{cases} \qquad (4)$$

In equation (4) the value of MINUj, MINAj, MAXAj, MAXUj are given for a criterion j. PRVij is the Project Resulting value for the risk scenario i and the criterion j. The global Scenario Success Indicator for all criteria depends on its occurrence probability P. It is assessed as shown below.

$$SSI(ScRi) = \begin{cases} 1 \ if \ \forall j, PRVijc \ \in [MINAj, MAXAj] \\ (1 - Pi) \times \prod_j SSI(ScRij) \ else \end{cases} \qquad (5)$$

According to equation (5), the value of a Scenario Success Indicator is necessarily between 0 and 1. 1 is the best value and 0 the worst.

Analysis and use of the indicators for decision-making

According to the values of the Scenario Success Indicators, the decision on the project launch is determined as follows:

The project is in a *Fully Acceptable* situation, if the values of all scenario success indicators are 1 (one). In this situation the project can be launched.

$$\forall i \ SSI(ScRi) = 1 \qquad (6)$$

The project in a *Not Acceptable* situation if the values of all scenario success indicators are 0 (zero). In this situation the project needs to be abandoned or defined again.

$$\forall i \; SSI(ScRi) = 0 \qquad (7)$$

If some risk scenarios exist for which $SSI(ScRi) \in \,]0,1[$, the project is in an *Acceptable* situation. In this situation, the project is not so bad that it must be abandoned, but not good enough to be launched either. Then, some strategies must be redefined. The bottom part of the process in Figure 1 is followed and new Scenario Success Indicators are assessed. To avoid infinite loop (in the case where the project is in Acceptable situation again and again), the new value of the Success Indicator is compared to a threshold $\widehat{SSI}_t$. The threshold is the minimum acceptable value of the Success Indicator after the incorporation of strategies. Then, the project can be launched if $\exists i / \; SSI(ScRi) \geq \widehat{SSI}_t$.

CONCLUSION AND FUTURE WORKS

The objective of this paper has been to propose an approach to determine the likelihood of project success, to take the decision to launch, abandon or redefine the project by relying on an innovative indicator. For this purpose, we have proposed success indicators by identifying and aggregating several criteria, risks and strategies. We then proposed a methodology to assess risk impacts, strategies and the aggregation of criteria in all possible configurations. This approach is a way to evaluate the project from criteria defined to assess tasks. Finally, we proposed success indicators and decision procedures to determine whether the project could be a launched or not. Besides the proposal of the process, our contribution is based on three activities: (1) A project evaluation model (2) During data collection/modelling, we propose a project model that includes risks (3) During characterization, we propose the integration of several criteria; For the scenario evaluation framework, aggregation functions are proposed. Indicators to evaluate project success complete these functions; Finally, a methodology to categorize scenarios is proposed in the last part.

We have observed that (a) risk occurrence may compromise fulfilment of the project objective and consequently affect its launch, (b) the more risks included in the risk scenarios, the lower the success indicator is, (c) the inclusion of several criteria might change the analysis process and have a consequence on the launch decision (d) in some cases, a risk could become an opportunity. These findings demonstrate the need for an indicator on which to rely for decision-making in risk and multi-criteria situations. They confirm the initial hypothesis: the use of more and better-adapted criteria, including risks, may lead to a different launch decision. As a perspective, our aim is to look at the problem of relationships inside the criteria and risks.

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