

Performance Improvement of Innovation Projects by Risk Management

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Abstract

This paper presents a survey on how Risk Management methods can improve an innovation project performance from planning to execution. Risk Management is devise management strategies to reduce a risk by using risk analysis which is the process of assessing risks. A successful Risk Management in innovation projects can affect the success of technical, cost and schedule performance and provide predictability in the execution of a project. But there is a set of issues which need to be addressed in a critical evaluation of these techniques such as definition of risk parameters and management of the selected parameters. Some presented methods in the literature would help to resolve these issues. This paper search and presents the methods in Risk Management which could contribute to the improvement of an innovative project management. By using these information, key issues for a Risk Management in an innovative project are listed.

Keywords : Risk, management, project, R&D, innovation

1. Introduction

Innovation is application of a new idea to a product, service or process. In this term, while product innovation involves a new or modified product, process innovation involves a new or modified way of making a product. While originally there is a tendency to equate R&D and innovation, innovation is much broader and R&D. If we explain the innovation as a transformation of a new idea into business, R&D can only be one component of an idea and also one of the ways of an innovation activity. The application of innovation in a project should be considered from conceptualization to commercialization to enhance the success rate of innovation or R&D projects. Because procurement of innovation means large amount of risk inherent, a Risk Management (RM) is required. The objective of this paper is to search and present methodologies to address the uncertainties in an innovative project. Procurement of innovation has challenges and therefore a good strategy should be defined to reduce or eliminate risks. Therefore, a RM is required with a good strategy. In this scope, in the second section of this paper, RM and its importance is described. Types of possible risks are presented and explained in the third section. Phases in a RM are explained according to ISO 31000 standard in the fourth section. In the scope of all these information, important issues for an innovative project are listed in the fifth section.

2. Importance of Risk Management in a Project

For the term risk, even if there is no single, universally employed definition, it can be defined as the probability of occurrence of an event and its consequence (positive or negative impact) on the achievement of objectives. Risks can be characterized by their nature, the likelihood of them occurring and the potential consequences. That means risk is the measurable uncertainty (likelihood) for something to occur that lets projects fail, decreases their utility or increases their costs and duration. RM means the process of understanding the nature of uncertain future events and making positive plans to mitigate them where they present. The RM strategy in a project should be tailored according to benefits and costs. The cost of RM cannot be exactly measured but procurers need to acknowledge in their budgets that it has a cost. It is therefore essential to get a better grasp for it and the cost of no RM may be a lot higher. The price of risk to customer can be expressed as the sum of supplier's cost of supply, risk assumed by the supplier and profit. It is very important to define the risk parameters of a project. RM should reduce costs. Unrealistic allocation of risk causes to higher price with hidden costs. A systematic approach to RM has to encourage decision-making inside an organization which is more controlled, more consistent and more flexible. An innovation project to become a success increase if risks are managed well, including monitoring and application of reflective learning and sense-making throughout projects. RM is different between the public and private sector. For instance, the main focus of RM is to maintain and enhance profitability in the private sector, whereas the focus is on the implementation of objectives and services for citizens in the public sector. Public procurement of innovation concerns the acquisition of new products and/or services. Typical risks in public procurement of innovation could be failure to comply with of the technical requirements, failure to comply with environmental requirements, failure to prevent malpractice, waste, or poor value for money or an inability to minimize adverse effects on public services delivery. In the public sector decision making is dispersed across multiple organizations pursuing different goals such as public actors responsible from procurement and innovation policy actors. This means that coordination between departments, ministries, agencies, contracting authorities or units is crucial, but, the various actors have an entirely different cost benefit consideration and accountability requirements when procuring and thus different risk perceptions and management approaches. There are different methods for analysing risk from quantitative to qualitative, including Monte Carlo simulation, Hazard identification methods, Failure modes and effect analysis, Fault tree analysis, Event tree analysis, What if scenarios, Risk Mapping, Influence diagram etc. [1,2]

3. Types of Possible Risks in a Project

The amount of time and resources spent on RM should be proportional to the level of uncertainty involved in a procurement project. In less complex projects, RM can contribute to minimizing delays and lower costs. In innovative and complex projects with many stakeholders, RM can make the difference between failure and success of the project. A list of examples of public procured innovations with budget overruns, delayed delivery, and even complete failure because of lack of acceptance can be easily crafted. Different types of risks play a role in RM. These categories are explained below [2,3,4,5]:

3.1. Technical risks

Technical risks are usually arises from suppliers and lead to a non-completion or under-performance of the procured product or service. Further, once a certain technology is chosen, it may be very hard to shift trajectories. In the case of radical innovation, a pre-commercial procurement stage may be necessary. In order to reduce technological risk, transmitting information to suppliers at an early stage enables capacity planning on the part of the suppliers and plan their innovation investment to react to public sector needs. Besides involving the suppliers and potential users together helps improve the acceptability of the innovation in the market place and thus reduce market risks. A fixed price contract may be appropriate for projects involving little complexity and risk can be shared between the buyer and the contractor. But cost effective contracts may be more suitable for procurement of innovation as cost-reduction incentives can induce the contractor to save on non-verifiable activities. This type contract can help allocate risk by providing financial incentives to limit cost and some insurance in case of cost overruns. In the evaluation stage, restricting competition will provide incentives for qualified suppliers to invest in preparing the bids. Procedures can include a framework agreements encouraging bidders to invest more in R&D before the competition stage and to select good bidders. For example, several suppliers may competitively selected in a first stage based on quality and price and then in a second stage only the selected ones compete on a regular basis for contracts. Thus a restricted procedure may be more effective in attracting innovative firms. In order to attract quality bidders, additional incentives may be given to participate, for instance through reimbursement of some of the bidding cost. Furthermore, a carefully selected scoring mechanism during evaluation will play a part in incentivising suppliers. By assigning a score to the various components of the proposal, and giving different weights towards the overall score procurer is able to adjust the incentives for suppliers, attract quality and reduce technological risks. Innovation and higher performance may be incentivised trough influencing the prospects of further contracting (e.g. attracting bidders based on past performance or customer satisfaction, or contract assurance through forward commitment procurement). Finally, for technological risks, Zsidisin and Smith (2005) [3] propose an 'early supplier involvement' that may reduce uncertainties of a new product development and help to ensure that suppliers keep on track. They advice to ensure alignment between designs and capabilities early in the design cycle, where feasible supported by scorecards to track current supplier performance for determining if they should be invited to participate in new projects. They also recommend to check for supplier capacity constrains trough measures such as sharing future demand developments with potential suppliers early on, providing in-house market intelligence to screen potential suppliers, and to consider second sourcing.

3.2. Financial risks

The financial risks in a procurement are mainly twofold, one related to uncertainty in meeting target costs (financial risks associated with non-delivery such as cost of additional auctions, non-completion, cost overruns and costs of non provision or poor provision of the public service as a result of non-delivery), the other the ability to secure the funds needed (adequate functioning of financial markets). Further, RM strategies themselves may need to be subject to cost-benefit analysis (the cost of RM strategies may offset the benefits in terms of cost-savings). In industries

that are severely financially constrained, R&D investments may not respond positively to the incentive of higher profits.

3.3. Market risks

Market risks are to be found on the supply and demand side. Demand risks occurs if demand does not respond in the scale expected result. For innovative products, markets are not large enough or built quickly enough to justify capacity investment (capital, labour, technology). Producers should be aware about investment cost in innovation activities with a scale to get the necessary return. Even worse, innovative product can open the door for second generation solutions of competitors. To overcome of insufficient demand problem is to implement additional demand side measures, such as market awareness and user training schemes. Further, the public sector can reduce the risk of scattered demand for innovation through bundling of different public demands, which enables them to recover the costs of investment in R&D. A supplier risk can be said if suppliers not responding to the tenders due to high risky specifications within complex technologies. Clearly, all companies within supply chains are exposed to all procurement risks mentioned here. This may lead to extra cost in the supply chain due to slow delivery risk or other technological risks. Measures to limit those supplier market risks would entail a broad market intelligence and in-depth technological knowledge through internal or external experts, paying attention to standards, regulation, as well as gathering intelligence on supply chains and their management. Besides, establishing too restrictive functionality requirements would not allow innovation to arise or can lead to reduced competition and a dependence on a reduced number of powerful suppliers. In consequence, may lead to excessive costing in future cycle of successor products. To overcome these problems, one can increase competition through trying to mobilize a high number of bidders, increase transparency of procedures, relaxing entry barriers, lowering pre-qualification criteria, encouraging and enabling suppliers to participate and breaking up contracts in smaller lots.

3.4. Management risks

Organisational risks are failure of the procurement process for some reasons such as lack of skills in administration, limited time in decision making, lack of strategic thinking and planning, lack of coordination between different policy goals, lack of capacity to understand the market and communicate effectively with market players, lack of compatibility of the product with existing products and institutional routines, change of specifications too often which leads to additional social and financial costs for the procurer and/or the supplier far beyond expectations. To limit the likelihood for those risks to occur transparency of procurement goals for the various actors involved is needed. In this term, a strategic intelligence need to be set up to understand markets, technologies and long term internal needs.

3.5. Risk of strategy

Risk of strategy means management of uncertainties which are hard to predict and measure. Risks emerge from a range of unforeseen events that lead various actors in the whole process to re-

assess their priorities, to change their expectations, which may lead to further reactions by other actors in the process and so forth. Strategic R&D program management is difficult to achieve in the public sector. Government R&D management usually seeks public-domain knowledge and technology products. Whereas the proof of success in industrial R&D is usually a commercial product or process. Another factor for a public sector is that departments are subject to external controls such as annual government budgets or political decisions. Thus, an R&D manager in public sector usually need to take into account the priorities of bureaucratic superiors, budget controllers, political institutions and researcher stakeholder groups. Another limiting factor on government side is the conflict of the goals among different bureaucratic units of government due to the different strategic goals. Therefore R&D projects should focus on the program level, the highest level at which one might expect a consistent goal structure. In strategic management of an R&D, instead of a single project management, a portfolio management “a dynamic decision process where list of new products and R&D projects is constantly updated and revised” often plays a central role. Portfolio refers to the resource allocation of different R&D projects and the criteria used to select and prioritize them. In the process, new projects are evaluated, selected and prioritized; existing projects may be accelerated, killed or de-prioritized; and resources are allocated and reallocated to the active projects. Calculating risk is one of the major factors in an R&D portfolio management. The R&D portfolio should reflect the priorities of the R&D strategy of a private or public sector. There is no one best model for R&D because every approach to R&D has strengths and weaknesses. R&D performance results from the interaction of many different decisions and choices including the size and location of R&D facilities, the division of labor between various groups, the choice of technologies used inside the R&D organization, the selection of personnel, the allocation of resources, the design of processes for managing projects, and other factors. A good strategy in R&D provides consistency, coherence, and alignment. For a good strategy in an R&D organization, good decisions should be made in the categories architecture, processes, people, and portfolio. Architecture refers to the set of decisions such as the size, location, and focusing topic of R&D.

4. Risk Management Phases According to ISO 31000 Standard

The ISO 31000:2009 is published in 2009 to provide principles & generic guidelines on RM by the International Organization for Standardization (ISO) and can be applied to any type of risk, whatever its nature, whether having positive or negative consequences. According to the standard, a RM system for a project is described in the following phases (can also be seen in Figure 1) [6,7]:

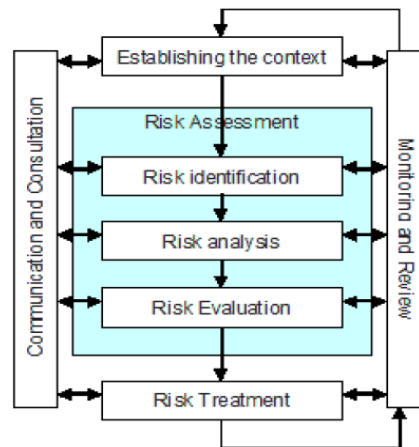


Figure 1. RM in ISO 31000

4.1. *Establish the context*

RM is undertaken within the context of organisation's goals. This is necessary in order to establish the internal and external context in which the rest of the process will take place. Establishing the context is about setting the boundaries around the organisation's risk appetite and RM activities. This requires consideration of the external factors. Some examples of external context are legal, regulatory, finance, relationships (could be international, national, regional or local, with, perceptions and values of external stakeholders). Examples of internal context are organizational objectives, strategy (policy), standards, resources, capacities, training and reporting processes, methodologies, plans, risk rating criteria, roles, responsibilities, guidelines and models adopted by the organization, contractual relationships. There is also RM process context such as objectives, scope, responsibilities, methods, defining risk criteria – measures, tolerance levels or views of stakeholders. The organisational context provides an understanding of the organisation, its capability and goals, objectives and strategies.

4.2. *Risk Identification*

Risk identification establishes the exposure of the organisation to risk and uncertainty. Risk identification describe a comprehensive list of risks which may affect the attainment of the organisation's objectives. A risk that is not identified at this stage will not be included in further analysis. The identified risk might enhance, prevent, degrade, accelerate or delay the achievement of objectives. Besides, identification should include risks whether or not their source is under the control of the organization. Risk identification can be done by using some of the following methods; Review of prior internal audit reports, Brainstorming, Risk questionnaires, review of financial statements, Securities and Exchange Commission reports, and management letter comments, Business studies, Industry benchmarking, Scenario analysis, Risk assessment workshops, Incident investigation, Auditing and inspections, Hazard and operability studies.

4.3. *Risk Analysis*

Risk analysis is a process to comprehend the nature of risk and to determine the level of risk. Risk analysis considers possible causes, sources, likelihoods and their positive or negative consequences to establish the inherent risks. The result of risk analysis provides an input to risk evaluation and risk treatment. This result can be used to prepare a risk profile which gives rating of significant to each risk and provides a tool for prioritising risk treatment efforts. Risk analysis also includes risk estimation

4.4. Risk Evaluation

The purpose of risk evaluation is to assist in making decisions, based on the outcomes of risk analysis, about which risks need treatment and the priority for treatment implementation. This involves comparing the level of risk, determined during the risk analysis and risk evaluation, with the defined risk criteria to prioritise the implementation of adequate measures for treatment and/or mitigating the risk. Decisions should take account of the wider context of the risk and include consideration of the tolerance of the risks borne by parties other than the organization that benefits from the risk. Decisions should be made in accordance with legal, regulatory and other requirements. In some circumstances, the risk evaluation can lead to a decision to undertake further analysis. The risk evaluation can also lead to a decision not to treat the risk in any way other than maintaining existing controls. The purpose of risk evaluation is to assist in making decisions, based on the outcomes of risk analysis, about which risks need treatment and the priority for treatment implementation with legal, regulatory and other requirements. In some circumstances, the risk evaluation can lead to a decision to undertake further analysis. The risk evaluation can also lead to a decision not to treat the risk in any way other than maintaining existing controls

4.5. Risk treatment

Risk treatment involves selection and implementation of the appropriate control measures to modify risks. Selecting the most appropriate risk treatment option involves balancing the costs and efforts of implementation against the benefits derived, with regard to legal, regulatory, and other requirements such as social responsibility and the protection of the natural environment. Risk treatment entails determination of what will be done in response to the identified risks. The purpose of risk treatments is to reduce the level of unacceptable risks to an acceptable level. It is necessary that risk treatment techniques should provide efficient and effective internal control because risk treatment itself can introduce new risks such as the failure or ineffectiveness of risk treatment techniques. Therefore, monitoring needs to be an integral part of the risk treatment plan to give assurance that the measures remain effective. Potential treatment options are developed based on the chosen treatment strategy. The selection of the preferred treatment options takes into account factors such as the costs and effectiveness. According to the standard, the risk threatment options can include avoiding the risk, transferring (or sharing) the risk to another party, mitigating the risk by changing the impact or accepting the risk in order to pursue an opportunity.

5. Key Issues for the Management of the Innovative Projects

In the scope of the emphasized issues in this paper, the following key points should be taken into account for an innovative project.

- Innovation contracts should be designed with proper requirement, management, approval and review procedure.
- Establishing functionality requirements too restrictive would not allow innovation to arise or can lead to reduced competition and a dependence on a reduced number of powerful suppliers. This may lead to excessive costing in future cycle of successor products.
- Transmitting some technical information to suppliers at an early stage enables capacity planning on the part of the suppliers and plan their innovation investment.
- Involving the suppliers and potential users together helps improve the acceptability of the innovation in the market and thus reduce market risks.
- Cost effective contracts may be more suitable for procurement of innovation as cost-reduction incentives can induce the contractor to save on non-verifiable activities.
- Innovative product can open the door for second generation solutions of competitors and may lead to insufficient demand problem. Market awareness to understand market, technologies and long term internal needs is important.
- To overcome limited supplier problem, entry barriers can be relaxed, pre-qualification criteria can be lowered or contract can be broken up in smaller lots.
- For a public sector, projects may be effected from external factors such as annual government budgets or some political dictates which put into risk the real time schedule of an R&D. Thus, an R&D manager usually need to take into account the priorities of bureaucratic superiors, budget controllers, political institutions and relationships with stakeholders.
- Internal factors for a public sector could be organizational objectives, strategy, standards, resources, capacities, training and reporting processes, methodologies, plans, risk rating criteria, roles, responsibilities, guidelines of an organization, contractual relationships.
- Performance of an innovative project results from the interaction of many different decisions and choices. Some reasons such as lack of skills in administration, limited time in decision making, lack of strategic thinking and planning, lack of coordination between different policy goals, lack of capacity to understand the market and communicate with market players, lack of compatibility of the product with existing products and institutional routines, change of specifications too often may lead to failure of the procurement process and additional costs.
- Public project can bundle similar public demands to reduce the cost of investment for an innovation. Besides, a portfolio management can be used for an innovative project management instead of a single project management. Portfolio management means a list of new innovation projects are constantly updated and revised according to updated priorities.
- RM encourages decision-making mechanism more controlled, consistent and flexible.
- The objective of a RM has to reduce costs. Therefore, it is very important to define the risk parameters without causing higher price with hidden costs. Risk parameters should be under the control of the organization.
- RM has also a cost itself and this issue should be taken into account within a project budget. Uncertainty in meeting target costs (such as non-completion, delays, cost overruns) should be considered when evaluating the risk.

- Time & cost spent on a RM should be proportional to the level of uncertainty in a project. Innovation investments may not be activities with a scale to get the necessary profits. In this scope, RM strategies may need to be subject to cost-benefit analysis.

Conclusion

RM is a highly beneficial management system to business enterprises. RM is an opportunity to manage uncertainty in advance with planned response to known risks. Identification of risk facilitate proactive management of possible risks at strategic and tactical levels, thus prevents reacting too late when a risk happens. Furthermore, it provides useful information to decision-makers in order to facilitate the best possible decisions at all levels. In this scope, RM minimize threats and maximize opportunities thus increases the likelihood of achieving both strategic and tactical objectives. If the managers do not consider the risk, the project may be failed and if they apply a lot of risk management systems, these methods could stifle the innovation. This research presents important issues in risk management to improve an innovative project performance from planning to execution. In this scope, important key points in managing the risk in the innovation projects are provided.

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