

Risk Assessment in the Planning of Development Projects

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Abstract

In today's dynamic business world full of opportunities, risks and business transformations, organizations need to become more agile while managing their risk. Risk assessment provides industrial companies a mechanism for identifying the risks, which represent opportunities and which in their way represent potential pitfalls. With a smart conducted risk management process, we take a broad perspective on identifying the risks that could cause a company to fail to meet its strategies and objectives. This study provides a background for future creation of a comprehensive quantitative approach to risk assessment in a project of engineering company. Into account are taken changes coming to traditional risk management process caused by implementing the Industry 4.0 in the automotive industry. The aim of the new proposed approach for risk analysis, is to provide a fertile ground for project managers of an engineering company on dealing with risks and reach the project success with the reduced costs.

Key words: project risk management; risk analysis; quantitative methods; cost reduction

1. Introduction

The traditional manufacturing industry is in the throes of digital transformation that is accelerated by exponentially growing technologies. Companies and their industrial processes need to adapt to these rapid changes. These changes affect almost all production areas, and project management is not the exception.

It is well known that projects worldwide are still struggling to meet their objectives. During project execution, unforeseen events arise that disrupt plans and budgets and that result in substantial overruns. Risk management is widely recognized as a compulsory discipline to deal with this kind of project uncertainty.

Dealing with risks and opportunities professionally is becoming one of the key success factors in business. Most companies have realized the requirements turbulent markets present and have started to adapt to this turbulence. But risks and opportunities are greater in turbulent markets, so they call for active strategic risk management. Good risk management requires a risk analysis process that is scientifically sound and that is supported by quantitative techniques. The goal of the risk analysis process is to generate insight into the risk profile of a project and to use these insights to drive the risk response process.

The contribution of this article is to continue gathering all the possible quantitative techniques for risk analysis, to compare them in future and choose the suitable ones for the concrete Research and Development project in an engineering company. From the chosen risk assessment tools will be created one integrated risk management framework, which main idea is to deal with possible risks and reach the project success with the reduced costs.

2. Basic Concepts

2.1. Risk Management

The word risk contains two key ideas: uncertainty and loss. As the uncertainty is one of the most important characteristics of the risk, it is necessary to investigate one of the most important characteristics of the risk – the sources of risk factors. Risk management activities involve a role to produce a distribution estimate of potential possibilities, not a point estimate. [1] Risk management is now seen as a systematic approach that is coordinated and comprehensive approach to managing all the risk assessment process. The basis of the declaration and documentation of policies such as liability management, which must correspond to areas of strategic aims, objective and nature of business organization, work in the risk management program. [2] A general risk management framework is shown in Fig.1.

There are different types of risk an organization may face, including market risks, credit risks, health and safety risks, environmental risks, fire risks, bomb threats, computer risks, theft and fraud, industrial espionage, technical risks, kidnap and ransom, extortion, accidental and criminal risks and many more. [3] However, the subject of this research is confined to the management of risks associated with internal and external operational disturbances which can affect project in a manufacturing organization; these fall into three categories namely, operational, occupational and economic risk. [13]

Skillful risk management is based on the fact that during the development of strategy, the company also develops a risk management strategy. When developing the strategy, the company should indicate the purpose of risk management, identify risks, make measurements propose

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Fig. 1. Risk Management Process Framework.

risk mitigation tools, monitor, and control risk and create a homogenous system of risk management. [12] In a few words, risk management is not oriented toward the whole company, but an effective and efficient way that supports the implementation of developed strategy and reads those signals that indicate a need to modify assumptions, financial flows, programs and results. [4]

The main objective of risk analysis is to obtain the risk profile of the project leading to the process of creating a response to that risk. The attained knowledge includes the probability of reaching a specific project outcome, the function of time distribution needed for the completion of the project, etc. In the process of obtaining responses to the risk, that knowledge will be used to define practical responses which allow project managers to mitigate risks by reducing the impact of risks on project objectives. Using the so-called ranking indices, such as criticality or importance, it leads to the most suitable position for mitigating risk. Project activities and associated risks are ranked according to those indices, considering the impact they have on the project goals [5]

Research & Development(R&D) is a process that is riddled with uncertainty, which comes together with risk. R&D and New Product Development (NPD) projects, by its nature, are influenced by numerous factors. As for measuring R&D project success, there have been a number of recent studies to identify specific risk management tools and techniques that can be used by R&D and NPD project managers to manage uncertainties more effectively.

2.2. Industry 4.0

The manufacturing industry is going through great changes. The fourth revolution, driven by the Internet of Things, is happening. It is creating intelligent networks – connecting machines, work and systems – that can autonomously exchange information, trigger actions and control each other independently.

In manufacturing, these cyber-physical systems cover smart machines, storage systems and production facilities – not just in one factory but across many. Smart factories take a completely new approach to production – products can be identified, located and moved by alternative routes as needed. Manufacturing systems relate to business processes as well as external networks, across the value chain, and managed in real-time. [5] These changes will impact the whole supply chain – from design, prototyping, ordering, industrial processing and sales, up to maintenance and service – with your business partners becoming

more closely intertwined with your business. Industry 4.0 focuses on developing concepts and methods to make production processes more flexible and transforming currently fixed production lines into automated, autonomously organized assembly lines. [6]

Industry 4.0 is characterized by a progressing integration of ICT into manufacturing systems. Based on that, so-called cyber-physical systems emerge at the intersection of IT components for information processing as well as data exchange and mechanical or electrical machine components. [7]

3. Transformation of Project management for Industry 4.0

Addressing strategic risks requires manufacturers evaluate whether risk assessments are conducted in a manner that benefits the organization to the fullest extent possible. This evaluation should prompt questions as to whether risks are discussed in an ongoing fashion or just at formal, periodic presentations; and what methodologies beyond traditional interview and survey techniques may be needed.

Technological innovation enables the manufacturing business model more every day and it can present a strategic risk as well. Among other benefits, technological advances enable companies to more effectively manage expansive international supply chains and adjust production plans to meet changing market conditions. Increasing reliance upon technology also means that technological risks can morph into strategic risks for manufacturers. To survive and thrive amid such a changing risk landscape, a company's risk assessment focus and practices should align with those changes.

Understanding the risks involved with protecting company assets and containing such costs is essential. In addition to an effective risk management program, which includes cyber security education programs and monitoring, internal audit can help the organization better understand its preparedness by using analytics to detect breach patterns and reviewing cyber-controls in a regular cadence.

Industry 4.0 still has been bringing many careers to transform and businesses to change as well. The career of Industry 4.0 project manager gets another dimension with the coming changes in development projects. Traditional project management strategies need to be transformed taking into consideration digitalization and automation of manufacturing operations, connecting various machines

with multiple software platforms and interconnecting departments within production environment, collecting and analyzing big data stream, providing data to partners such as suppliers and machine builders, monitoring IoT predictive maintenance and cloud platforms, and virtual and augmented reality.

The implementation of integrated risk management system within an organization is a prerequisite according to the generally accepted international standards, „it should be a continuous process which runs throughout the organization`s strategy; it should address methodically all the risks surrounding the organization`s activities; it must be integrated into the culture of the organizations; it must translate the strategy into tactical and operational objectives, assigning responsibility throughout the organization with each manager and employee responsible for the management of risk as part of their job description.“ [1]

4. Overview of Quantitative Methods

Project managers should be prepared to perform different types of risk analysis. Quantitative Risk Analysis is a method of quantifying your highest priority risks in order to determine the probability of achieving your overall cost and schedule objectives. Individual risks are evaluated in the qualitative risk analysis. But the quantitative analysis allows us to evaluate the overall project risk from the individual risks.

Quantitative Risk Analysis tools and techniques include but are not limited to:

- 1) Three Point Estimate – a technique that uses the optimistic, most likely, and pessimistic values to determine the best estimate.
- 2) Decision Tree Analysis – a diagram that shows the implications of choosing one or other alternatives. Click here to see an example.
- 3) Expected Monetary Value (EMV) – a method used to establish the contingency reserves for a project budget and schedule.
- 4) Monte Carlo Analysis – a technique that uses optimistic, most likely, and pessimistic estimates to determine the total project cost and project completion dates.
- 5) Sensitivity Analysis – a technique used to determine which risks have the greatest impact on a project.
- 6) Fault Tree Analysis (FMEA) – the analysis of a structured diagram which identifies elements that can cause system failure. [9]

Within different application areas of risk assessment various rather specific methodologies have been developed and this has had the effect that risk assessments across the boundaries of application areas are difficult to compare and even more difficult to integrate. Numerous procedural schemes for risk-based decision making are available, but these focus on the project flow of risk assessments rather than the framework for risk assessment itself.

Risk can be defined also as “the possibility of loss or injury”. This definition can be translated into the fundamental concept of risk management: the concept of Risk Exposure (RE), sometimes also called risk impact. Risk Exposure is defined by the relationship. This definition can be translated into the fundamental concept of risk management: the concept of Risk Exposure (RE), sometimes also called risk impact. Risk Exposure is defined by the equation:

$$RE = Prob(UO) * Loss(UO) \quad (1)$$

where Prob(UO) is the probability of an unsatisfactory outcome and Loss(UO) is the loss to the parties affected if the outcome is unsatisfactory. To relate this approach to R&D project planning situation, we need a definition of "unsatisfactory outcome". For customers and developers, budget overruns and schedule slips are unsatisfactory. These components of an unsatisfactory outcome provide a top-level checklist for identifying and assessing risk items. [10]

After we have calculated Risk Exposure of a risk factor we can define Risk Reduction Leverage (RRL) as a ratio of risk reduction (the difference of RE before and after introduction of the measures) and the cost of the risk reduction measures:

$$RRL = \frac{RE_{before} - RE_{after}}{Risk\ Reducton\ Cost} \quad (2)$$

Managing of a risk factor with its reducing is always associated with costs. Therefore, we must consider the extension of the risk reduction will pays us off, the classic analysis of costs and benefits is used. The effectiveness of the measure what is the size of the risk reduction cannot be easily quantified. A widespread practice for the risk reduction is an expert estimation. An appropriate risk reduction measure is one that reduces the risk impact to a sufficient level(reasonable) level at acceptable costs. Impact reduction equation risk and the cost of action is illustrated in the following figure.

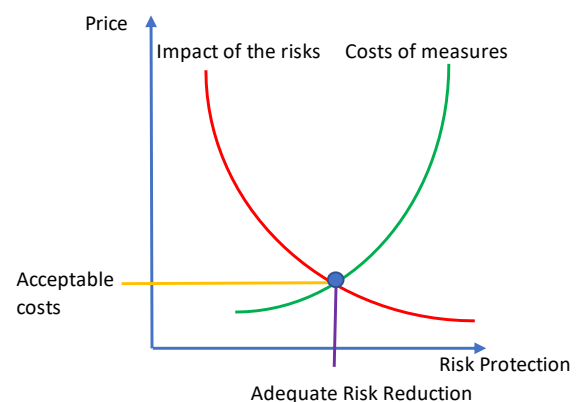


Fig. 1 Relation between cost and risk reduction.

4. Conclusions and Future Work

There are many benefits of risk management for companies. To ensure stability and reduce the threat, risk management becomes inevitable for companies. The necessity of risk management can be summarized under the following headings:

- Uninterrupted continuation of the company
- To minimize surprises
- Reducing the cost of losses
- Income stability
- Sustainable growth
- Social responsibility
- Compliance with regulations. [2]

Organizations have long practiced various parts of what has come to be called enterprise risk management. Identifying and prioritizing risks, either with foresight of following a disaster, has been a standard management activity. Treating risk by transfer, though insurance of other financial products, has also been common practice. Although risk assessment practices have not progressed uniformly through different industries the general evolution of risk assessment is noticed.

The main effort of this article is to extend knowledge about traditional risk management process. Taking into consideration the right steps in this project management area gives us a background for development of one comprehensive technique for risk analysis. [14] Our idea is to create a model for risk assessment combined from the best quantitative methods for risk analysis and to apply it for as many as it is possible real Research and Development projects in manufacturing industry. We are still on the stage of gathering the best planning projects that way this work was more theoretical than practical.

Our idea is that suggested approach to risk assessment will analyze source of the most severe risk factors and anticipate the time and cost impact converted to the expected money value. The contribution our preceding and current works is to provide the engineering manager a tool for a simplest way to keep one's eye on project and arrange risks. The main reason of project is interrelated with the idea that risk management process in an organization must become part of the culture.

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