

RISK MANAGEMENT TECHNIQUES

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Abstract

The task of this work is to demonstrate risk management techniques in the real construction project. Stakeholder identification, risk identification, risk assessment and risk control play the key role to achieve projects goals successfully and on time. Therefore, risk management plays very important role as well such as covering all organizational objectives and missions which are considered in operational projects of organizations. Thorough many discussions were made about risk management none of them I read considered risk management as a necessary part of the project management. Many discussions were made about the risk. However, they are mostly about risk in general. Only the minimum of works considers the risk in the construction projects. Therefore, this work is aimed on a specific project of residential house and the handling of all risks the project might face in each phase of the project life cycle. The used risk management techniques which have been considered in this work are the mix of risk management techniques and strategies which are used in Anglo Saxon countries and Czech Republic. The main aim of this work is to analyse relation and extent of risks in each stage of project lifecycle so that we can achieve desirable results of the project by defining and implementing management processes of project risk.

Keywords

strategic management, project lifecycle, risk management, project management, risk management plan

Introduction

This paper is about the Risk Management Techniques used in Anglo Saxon countries and in the Czech Republic. I will introduce the procedures which are used before the final Risk Management analysis. Therefore, I will describe the procedures which are used in the real construction projects in the Czech Republic.

Evolution of the Risk Management

FROM	TO
Risk as Individual Hazards	Risk in the context of business strategy
Risk Identification and Assessment	Risk portfolio development
Focus on all risks	Focus on critical risks
Risk mitigation	Risk optimisation
Risk limits	Risk strategy
Risks with no owners	Defined risk responsibilities
Hazard risk quantification	Monitoring and measurement
Risk is not my responsibility	Risk is everyone's responsibility

Table 1: Evolution of Risk Management. Source: (KPMG 2001)

Risk and return

There is a relationship between risk and return. "It is often said that no company can make a profit without taking a risk. The same is true for all organisations: no organisation, whether in the private, public or third sector can achieve its objectives without taking risk. The only question is how much risk do they need to take? And yet taking risks without consciously managing those risks can lead to the downfall of organisations. This is the challenge that has been highlighted by the latest UK Corporate Governance Code issued by the Financial Reporting Council in 2010." (IRMR 2013)

Risk Appetite Management

What is the risk appetite? It is the degree of understanding the risk-reward trade-offs within the business. It is accountability within leadership and policy to guide decision-making and attack gaps between perceived and actual risk. The Risk appetite defines the boundary of acceptable risk and risk tolerance. It can be said that the risk appetite management is the variation of measuring risk appetite that management deems acceptable. (Jepson 2013)

Decision making

Risk management is a specific form of decision making in project management. Risk management itself is the topic of many textbooks and papers. Risk management isn't about forecasting the future. Risk management is about comprehending the project itself and do a better decision and conclusions with respect to the management of the project. Sometimes the conclusion might be to leave the project. If leaving the project is the correct outcome which will save assorted parties from wasting,

money, time and expert human resources, then the demand for a rational, repeatable, justifiable risk methodology and risk interpretation is cardinal. Nonetheless, the exact boundaries between decision making and the aspect of other problem-solving methodologies and techniques have always been difficult to set up. Essentially, the decisions are done against a designated set of rules, objectives and priorities. It is based on the knowledge, data and information which are relevant to the issue even though this is not the case too often. Frequently, the decisions are badly made, not based on logical judgement of the project specific criteria and it leads to later difficulties. Therefore, it isn't always possible to have conditions of complete certainty. Indeed the risk management likely have a considerable amount of uncertainty about the construction project at this phase. The verbalism risk and uncertainty might be used in different ways. The term risk is originated from the French word *risqué*, and started to appear in Great Britain. The English form, was used in insurance transactions in approximately 1830. Term risk might be defined in many ways. It can be assessed in terms of fatalities and injuries, in terms of probability and reliability, in terms of a sample of population or in terms of the probable effects on a project. These methodologies are valid and concrete industries and sectors have decided to adopt these concrete measures as their normal approach. This work focuses on engineering projects, where risk is defined in the project context. Engineering projects widely follows the guidelines and terminology adopted by the British Standard on Project Management BS 6079, The Association for Project Management Body of Knowledge (PMBOK), The Association for Project Management Project Risk Analysis and Management Guide, the Institution of Civil Engineers and the Faculty of Actuaries Risk Analysis and Management for Projects Guide and the HM Treasury, Central Unit on Procurement Guide on Risk Assessment. Numerous authors state that uncertainty should be thought of as separate from risk. That's because these two terms are distinctly different. Uncertainty may be considered as the chance of occurrence of some particular event where the probability is not known. Therefore, the uncertainty is related to the occurrence of an event about which is not known much, but the fact that it might happen. The experts who distinguish uncertainty from risk define risk as: risk is taking place where is the outcome of an event, or each set of possible outcomes and scenarios, can be predicted in advance on the fundamentals of statistical probability. This kind of risk understanding means that there is certain knowledge about a risk as a separate event or a combination of circumstances. This opposes to an uncertainty about which there is no knowledge. In majority of cases, project risks might be identified from an experience which is gained from similar projects to the one we are working on. Risks may be divided into three categories; namely known risks, known unknowns and unknown unknowns. Known risks are the ones that include small variations in productivity and changes in the material costs. These risks occur often and are an unavoidable feature of all construction projects. The known unknown risks are the risk events which occurrence is predictable or expectable. Therefore, the probability of occurrence or their possible effect is well known. The unknown unknowns risks are those events which probabilities of occurrence and their possible effects are not predictable by even the most experienced and skilful employees. These risks are commonly considered as force-majeure. In some scenarios, the term risk doesn't necessarily refer to the probability of bad consequences. It might refer to the possibility of good consequences. Therefore, it is vital that the definition of risk has to include some reference to this fact. Risk and uncertainty have been defined in following ways. Risk exists when a decision is expressed in terms of a range of possible outcomes and when known probabilities can be attached to the outcomes. Uncertainty exists when there is more than one possible outcome of a course of action but the probability of each outcome is not known (frequently termed estimating uncertainty) particular type of decision making is needed in risk management. (Smith, Merna, Jobling 2006)

Identify Risks: Inputs, Tools & Techniques, and Outputs

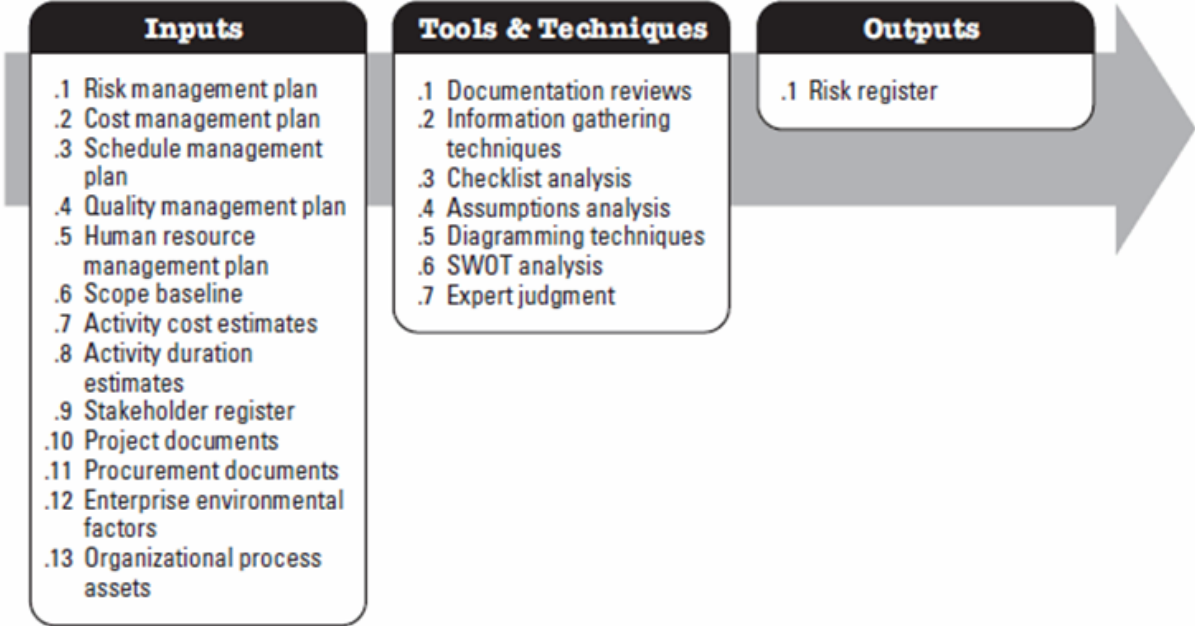


Fig. 1: Identify Risks: Inputs, Tools & Techniques, and Outputs. Source : PMBOK

Tools for risk identification

There are various tools for risk identification. Namely, they are:

Brain storm – mind maps, what if?
Visual inspections e.g. Site plans, check lists
Delphi Techniques
Checklists Analysis
Diagramming Techniques such as cause and effect
Risk Library and Reports e.g. accident reports, cases going to arbitration etc.
Research and environmental scans (SWOT)
Expert Judgement and consultants
Communication with staff (listening)

Table 2: Tools for risk identification. Source: lecture of Dr. Nicholas Chilese 2013

Qualitative Risk Analysis

The qualitative risk analysis is method which prioritizes the risks. It actually judges the probability and impact of the event and judges it on the scale from 1 to 5. Therefore, this method is a process of analysing potential and substantial impacts to the projects competing demands

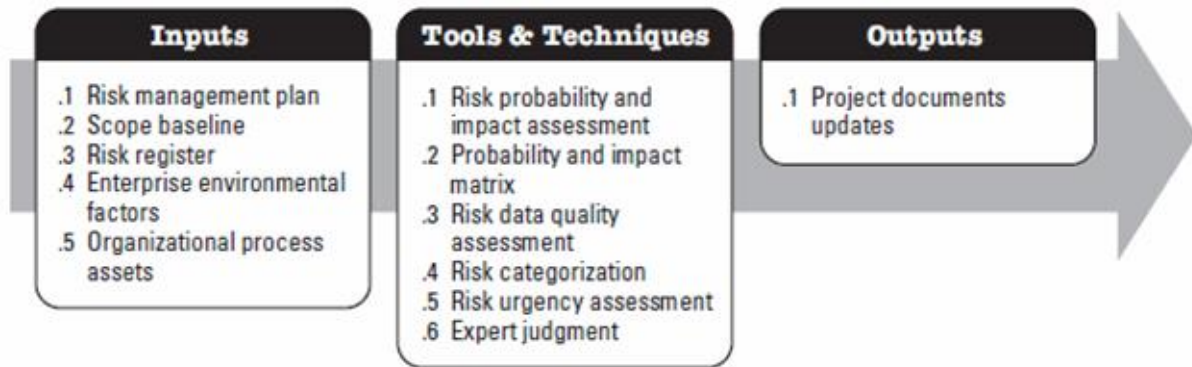


Fig. 2: Qualitative Risk Analysis, Source: PMBOK

Qualitative Risk Analysis: Inputs

The outputs of qualitative risk analysis, as can be seen in table above, are Risk Management Plan, Scope Baseline, Organizational Process Assets, Enterprise Environmental Factors and Risk Register. I am going to explain these inputs in more detail bellow.

Risk Management Plan (RMP) - The most important elements of the risk management plan for Qualitative Risk Analysis includes: Roles and responsibilities for conducting risk management, budgets and schedule activities for risk management, risk categories, definition of probability and impact, the probability and impact matrix, and well analysed stakeholders’ risk tolerances.

Scope Baseline – Projects of common or cyclical type tend to have better understanding of risks. Projects are using innovative or frontier technology or applications. Therefore, the highly complex projects tend to have more uncertainty than common projects.

Organizational Process Assets – Organizational Process Assets are basically data about risks on previous (past) projects and the lessons learned. This knowledge can be used in the Qualitative Risk Analysis process.

Enterprise Environmental Factors- This is basically industry studies of similar projects by risk specialists. Therefore, there is Risk database which can be used by certain industries.

Risk Register – The main item from the risk register for Qualitative Risk Analysis is the list of identified risks, which is obtained through risk identification process.

Risk Probability and Impact Assessment

5X5 Matrix: The 5X5 matrix shows the likelihood and consequences (Impact) from low to high and from 1 to 5 where 5 represents the biggest threat.

E	M	H	E	E	E
D	L	M	H	E	E
C	L	M	H	H	E
B	L	L	M	M	H
A	L	L	L	L	M
CONSEQUENCE	1	2	3	4	5
	LIKELIHOOD				

Table 3: Likelihood Consequence Matrix

Quantitative Risk Analysis: Outputs

We need to have risk register updates. The risk register itself is a part of the project management plan. The updates consist of the following main components.

Probabilistic analysis of the project. – Estimates are made of potential project schedule and cost outcomes, listing the possible completion dates and costs with their associated confidence levels. This output, typically expressed as a cumulative distribution, is used with stakeholder risk tolerances to permit quantification of the cost and time contingency reserves.

Probability of achieving cost and time objectives. -With the risks facing the project, the probability of achieving project objectives under the current plan can be estimated using quantitative risk analysis results.

Prioritized list of quantified risks. This list of risks includes those that pose the greatest threat or present the greatest opportunity to the project. These include the risks that require the greatest cost contingency and those that are most likely to influence the critical path.

Trends in quantitative risk analysis results. As the analysis is repeated, a trend may become apparent that leads to conclusions affecting risk responses. (Chilese 2013)

Risk Treatment

Risk treatment consists of the selection of one or more options for modifying risks, and implementing those options. In the moment it is implemented it involves treatments or modifying controls. It can be said, that the risk treatment is a cyclical process of following steps.

- Assessing the risk
- Deciding if or not the residual risk levels are tolerable
- If they aren't tolerable, provide a new risk treatment
- Assessing the efficiency of the treatment

Risk Strategies

The purpose for identifying the higher and extremer risks of a project is so that the organization can be sufficiently prepared if one of these potentially project-ending risks occur during the project lifecycle. As stated by Jeynes (2001, p.74) risk management strategies are considered to be “an action/device/strategy intended to eliminate/alleviate/reduce the negative impact on the business or individual of a situation or event”. It is far better to develop mitigation strategies during the planning stage, than have high impact issues arise during the execution phase of a project as this will most definitely lead to additional costs or time needed to be added to the schedule.

Risk Avoidance

By which the organization has decided to avoid the risk by not commencing the activity or service. Majority of cases this will not even be considered as a possible option, but is necessary for any extreme risk that will affect the safety of the team or the project members. An alternative approach must be considered that is either different or more tolerable to completing the required activity with

a less risky methodology processes within the activity (Borghesi & Guadenzi 2013, p.90). This option can also be considered for Risk Transferring.

Risk Control

Essentially where the organization has decided to continue with the activity that creates high or extreme risk, but manage the potential risk closely so it will be less likely to occur. Risk control aims to “reduce the frequency and severity of losses and making the losses more predictable” (Borghesi & Guadenzi 2013, p.89). This can include strategies such as loss prevention, loss reduction, separation, duplication and diversification.

Risk Financing

This will be when the organization decides to provide resources to meet the cost of the risks when and if they happen to occur. This is achieved through acts and decisions to generate the funds to pay for losses or offset the volatility in cash flows that may occur from the loss. Risk financing has the primary “strategic goal to maintain the appropriate level of liquidity, managing the uncertainty resulting from loss outcome”, and therefore managing the total cost of the risk (Borghesi & Guadenzi 2013, p.89).

Risk Transfer

By which the risk is mitigated to a third party to perform the risky activity, essentially transferring the risk externally to another organization. Risk transfer is about the “convergence” of capital markets and insurance, convergence of corporate finance and risk management or the convergence of swap dealers with (re-)insurance companies (Frenkel, Hommel & Rudolf 2005, p. 384).

The biggest risks in a real projects

I have done the analysis, which is mentioned in the text above on a project of residential building. The procedure I have done are following. Firstly, I have identified the stakeholders. They are in regular project of residential building following: Investor, Construction Authority, Environmental Authority, Hygiene Authority, Fire Protection Authority, Infrastructure Authority, Operator of Technical Networks (gas, water, sewer system, electricity and cable information system), Owners of neighbouring land, Project Manager, Project Team, Survey Manager, Employees, Designer, Subcontractors, Suppliers and Safety Authority.

Secondly, I have done Risk Identification. According to Risk Register of several construction companies, including SKANSKA, HOCHTIEF and DEGREMONT, I have divided risk into risk categories. The risk categories are Strategic Market Risks, Product Risks, Contract Risks, Risks connected to the Client, Financial Risks, Construction Risks, Environmental Risks, Risks Connected Towards Media, Weather risks and Insurance.

Thirdly, after the Risk Identification, where I have defined 48 risks, I have performed the Risk Probability and Impact assessment. You can see the extreme risks I have identified with the help of Risk Register of the companies mentioned above in the table bellow.

ID	RISK	RISK DESCRIPTION	LIKELIHOOD	SEVERITY	LEVEL OF RISK
26	Quality of project documentation	If there is not good project documentation, there is room for some mistakes. Therefore, it might cost more money	4	5	20
15	Financing of the project	To have sufficient funds for the project	5	4	20
48	Insurance	Insurance of the designer	4	5	20
1	Geography	Right location of the construction	4	4	16
3	Type of construction	If the apartment building is needed in the area. Demand	4	4	16
5	Type of contract	What type of contract is it (Design and Built, etc.) Different contract have different risk layout	4	4	16
22	Sum of the retaining money	The height of the sum which is going to be retained and paid at the end of the project completion	4	4	16
30	Responsibility for the Project documentation	Who is responsible for the Project Documentation	4	4	16
35	Insufficient project documentation	Some difficulties with the construction can occur. Therefore, the construction can cost more money	4	4	16
38	Subcontractors	Perform in time and quality	4	4	16
47	Insurance	Insurance of the contractor	4	4	16
11	Debt of the client	Can cause the bankrupt of the client. Therefore the client is no longer able to pay	3	5	15
13	Liability of the bills	The liability of the bills from investor	3	4	12
44	Medial	Bad reputation in the media. Damaged reputation can cause lack of contracts in the future	3	4	12

Table 4: Extreme Risks in the real construction projects

Risk Treatment of the chosen Extreme Risks

ID 26, Quality of Project Documentation

The chosen risk strategy for this risk is to control the risk. First of all, the project documentation must be done by some renowned company. Therefore, there are coordination meetings which all the involved parties (professions) in project documentation should attend to make sure all the processes in project documentation are well and properly organized and designed.

ID 15, Financing of the Project

The chosen risk strategy for this risk is to control the risk. First of all we need to know out of what sources will the project be financed. The source can be the own sources of the investor, loan or sources from capitation grants. This is called document of construction financing. Now I will explain how can we control the risk in three sentences. Firstly, all the costs of the project are known and properly valued. Secondly, the Investor must have conclusively/provably ensured the sources of financing. Thirdly, fluent financing of the construction will be connected to factual performance.

ID 48, Insurance

The chosen risk strategy for this risk is to control the risk. This Insurance is the insurance of the designer. He should be insured for mistakes in the project documentation which occurs in the project construction phase and which cause the increase of the cost.

ID 1, Geography

The chosen risk strategy for this risk is to control the risk. In this risk we need to control subsurface and the foundation conditions, terrain configuration, direction of the ascendant winds and insolation (if the construction in the area will have sufficient amount of the sun light)

ID 3, Type of Construction

The chosen risk strategy for this risk is to control the risk. The investor should analyse the location according to the demand for the type of construction in that area. He should do some marketing and make sure there will be demand after the apartments.

ID 5, Type of Contract

The chosen risk strategy for this risk is to control the risk. It is necessary to decide what kind of contract it will be. It can be Traditional Fashion of construction or it can be Design and Build Contract etc. Different type of contract represents different responsibilities and different risks. Therefore, the investor and contractor should agree on such a contract which will make both parties happy.

ID 22, Sum of the Retaining Money

The chosen risk strategy for this risk is to control the risk. The retaining money covers the risks of decent completion of the construction. Usually the retaining money is 10 percent of the total cost of the construction. Therefore, the retaining money serves as a tool for the investor to make sure the contractor will finish all the works, defects and backlogs. From the other side, the contractor must assure by contract the right for the release of retaining money by investor.

ID 30, Responsibility for Project Documentation

The chosen risk strategy for this risk is to transfer the risk from the view of the investor. For the investor is favourable that the contractors designer will be responsible for the project documentation.

ID 35, Insufficient Project Documentation

The chosen risk strategy for this risk is to avoid the risk. The insufficient project documentation is dangerous because it can cause increase of the cost of the construction. Therefore my risks treatment of this risk is to avoid this risk. I am recommending that if the project documentation is insufficient, I will recommend complete the project documentation.

Conclusion

The main conclusion of this diploma thesis is that it is better to think about risks in the project preparation phase. We have to think about the project in preparation phase in terms of "What if?" Most of the things can be prevented by good project preparation. Therefore, the main idea is that the risk management should have proactive approach rather than reactive approach.

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