PROJECT RISK MANAGEMENT: CASE STUDY APPROACH

A THESIS SUBMITTED TO

THE FACULTY OF ACHITECTURE AND ENGINEERING

OF

EPOKA UNIVERSITY

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR

THE DEGREE OF MASTER OF SCIENCE

IN

CIVIL ENGINEERING

JANUARY, 2017

Approva ıe thesis:

PROJECT RISK MANAGEMENT: CASE STUDY APPROACH

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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ABSTRACT

PROJECT RISK MANAGEMENT: CASE STUDY APPROACH

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Construction sector in Albania has experienced several oscillations in terms of profitability. Except external factors what has caused industry downturn are serious problems with it performance in terms of cost, time and quality.

In this thesis it is strongly suggested that major reason behind cost, time and quality failure in construction and real estate sector is organizations inability to properly manage construction project risk. Thesis main objective is to discover which the most important gaps that a specific construction company experiences when managing risk. From literature was evidenced the most scientific method of risk managing, a step by step approach which will be used during analysis as the most efficient method of risk identifying, evaluating, responding and monitoring.

Methodology used in order to achieve this aim will be singular case study approach. One of the most important construction businesses operating in Albania is submitted in a in depth exploration in order to fully understand which are greatest obstacles and challenges in project risk management in construction industry.

In concluding the analysis all barriers in achieving performance objective will be identified by creating proper framework which can be used by construction and real estate management organizations to integrate proper risk management processes and instruments in project management.

Keywords: Risk Management;Construction; Time; Quality; Cost

ABSTRAKT

MENAXHIMI I RISKUT TË PROJEKTIT: PËRQASJA E RASTIT TË STUDIMIT

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Sektori i ndërtimit në Shqipëri ka përjetuar disa luhatje në terma të përfitueshmërisë. Përvec faktorëve të jashtëm, industrisë i kanë shkaktuar rënie edhe problemet serioze të performancës në aspektin e kostos, kohës dhe cilësisë së projekteve ndërtimore.

Në këtë tezë është sugjeruar se arsyeja kryesore që ka shkaktuar dështimin e arritjes së objektivave të kostos, kohës dhe të cilësisë në sektorin e ndërtimit dhe të pasurive të patundshme është paaftësia e organizatave të ndërtimeve për të menaxhuar siç duhet rrezikun e projektit të ndërtimit. Objektivi kryesor i tezës është të zbulojë boshllëqet më të rëndësishme në menaxhimin e rrezikut në organizatat e ndërtimit në Shqipëri. Nga literatura u evidentua se metoda më shkencore e menaxhimit të rrezikut është një qasje hap pas hapi që do të përdoret gjatë analizës si metoda më efikase: identifikimi, vlerësimi, përgjigja dhe monitorimi.

Metodologjia e përdorur për arritjen e qëllimeve kërkimore është qpërasja e rastit të studimit. Një nga bizneset më të rëndësishme të ndërtimit që operojnë në Shqipëri paraqitet në këtë tezë e analizuar nga një eksplorim të thellë, në mënyrë që të arrihet një kuptim i plotë se cilat janë pengesat më të mëdha dhe sfidat në menaxhimin e riskut të projekteve në industrinë e ndërtimit.

Në përfundim të analizës janë identifikuar barrierat në arritjen e objektivave të performancës duke krijuar kuadrin e duhur i cili mund të përdoret nga organizatat e ndërtimit për të integruar proceset dhe instrumentet e duhura të menaxhimit të riskut në menaxhimin e projektit.

Fjalët kyçe: Menaxhimi i Riskut; Ndërtim; Kohë; Cilësi; Kosto

Dedicated to my beloved family

ACKNOWLEDGEMENTS

It is a genuine pleasure to express first and foremost my deep sense of thankfulness and gratitude to my supervisor **Assoc. Prof. Dr. ELFRIDA ALLIU SHEHU.** Her dedication and supervision, valuable comments and suggestions, have been main contributors for accomplishing this Master Thesis. I express my appreciation to my **University and Professors** for the cooperative work during these 2 years. Special thanks go to **my family** for their endless love, support and encouragement throughout the entire process of my studies. I would like to thank also **my colleagues and friends** for their continued kind support provided.

And lastly I would like to thank **God** for giving me strength to finish this study.

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LIST OF ABBREVIATIONS

ANSI	American National Standard
PRAM	Project Risk Analysis and Management
RBS	Risk Breakdown Structure

CHAPTER 1

INTRODUCTION

1.1. Background

Implementation of construction projects is characterized by a variety of processes and actors involved in its implementation. Uniqueness (uniqueness) of each project makes them subject exposed to various risks, especially during the initial phase of implementation project.

Exposure to risks of an engineering project depend on the geographical location of implementation, the project size, complex nature of project, time available, the legislation, but also by the use of new techniques used for the first time [ANS, 2008].

Risk term means an event, which potential occurrence has an effect on at least one objective of the project, such as: the ultimate goal, timeliness, quality of work and materials and cost [Caron, 2009].

Risk is an event that depends on unpredictable processes, but also by the processes which are predicted to happen and will have a negative impact on the realization of the engineering project.

1.1.1. Objective of the Study

Given the importance of construction sector in Albania, by taking in analyze B.H & S.B Ltd construction company, this study aim at integrating all advanced methods of risk management and implement them in construction projects in order to achieve the following objectives: [1] To identify and categories risk types with which B.H & S.B Ltd is confronted during management of projects in whole lifecycle, [2] to evaluate the general level of insecurity and risk with which B.H & S.B Ltd is confronted, [3] To identify and evaluate risk Mitigating Strategy that B.H & S.B Ltd uses during different stages of project management during its lifecycle.

1.1.2. Motivation of the Study

Engineering projects, given that are unique and not repetitive processes have a high degree of uncertainty in meeting the project objectives set out during the technical and planning stage. In Albania as a country in transition, where rules, regulations and procedures followed for project risk management are not in accordance with best international practices, the potential of not fulfilling time, cost and quality performance objectives is further amplified.

Through the use of valuation techniques and analysis of risks, level of risk exposes of construction and real estate project may be calculated. Furthermore, with proper project management risk process a manager or engineer may calculate the relationship of risk occurrence with potential negative impact of risk into project objectives such as: cost, time and quality.

Given the above, main motivation for this research is to contribute in Albanian construction sector performance by presenting scientific methods of project management risk.

1.1.3. Significance of the Study

The construction industry as a sector, accounts for 10% of the Albanian's GDP, having an output of more than $ 1.2 billion [INSTAT, 2011].

Relying on the results of this study and the conclusions for determined objectives, construction and real estate businesses may increase time, cost and quality standards.

This research will present to construction and real estate businesses recommendation regarding: complete process of risk management, most important risks to be addressed in each stage of project management, calculation of potential impact in case of a risk occurrence, quantitative assessment proper strategies in achieving time, cost and quality project objectives.

1.1.4. Research Model and Theoretical Background

Research model of this thesis is based on two major parts:

PART ONE: Theoretical Background:

According [Crouhy, Galai, & Mark; 2014], in their book "The Essentials of Risk Management" ideally in project risk management it should be followed a step by step approach that manages each of the stages into which passes a project during its lifecycle. Furthermore, the authors claim that in each of the life cycle stages of a project (identification, evaluation, answer, monitoring and control) there are several imperative processes, instruments and analyses that should be implemented in order to be successful in risk management. The imperative processes, instruments and analyses that should be implemented in each step of risk management process are presented in the figure below.

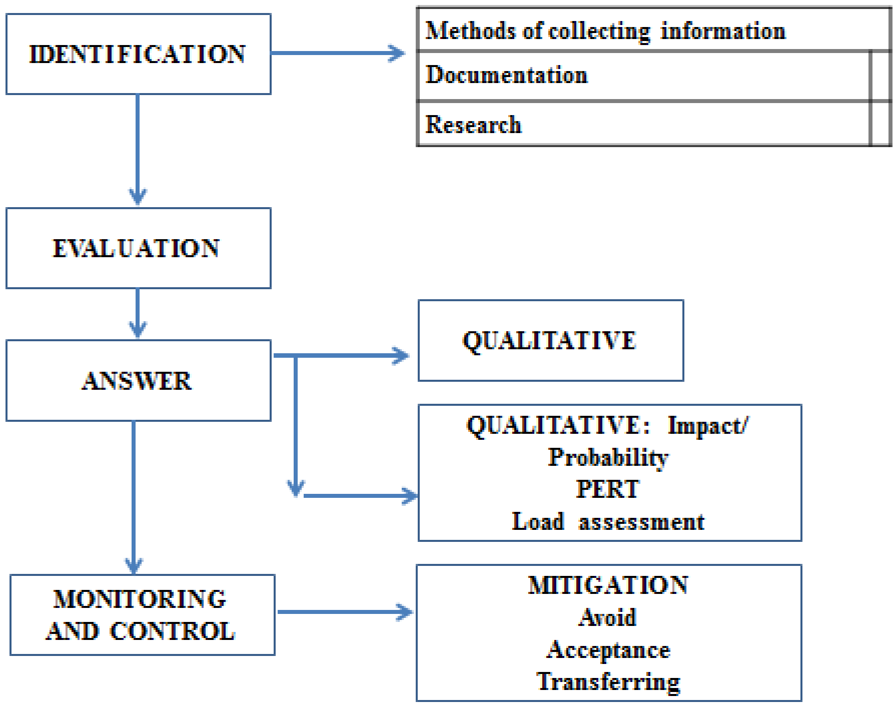

Figure 1. Ideal risk management process and the imperative processes, instruments and analyses that should be implemented in each step of it.

The above scheme will be a reference standard that will be used during all our analysis as and etalon to compare empirical data gathered from B.H & S.B Ltd in order to identify: (1) B.H & S.B Ltd successes in project risk management and (2) B.H & S.B Ltd failures in project risk management.

PART TWO: Empirical Research:

For this thesis, “B.H & S.B Construction” has been selected as the firm to be analyzed in project risk management process. B.H & S.B Ltd. was submitted to each step of *Fig 1* scheme which is created from literature review process of project risk managing. In each step of this scheme, were collected data from firm in order to find out if the firm has followed these steps.

In order to gather data for these risks managing steps was created a structured interview which is available in appendix and is explained in detail in second chapter.

1.2. Construction Risk Concept

Implementation of construction projects is characterized by a variety of processes and actors involved in its implementation. Uniqueness (uniqueness) of each project makes them to be exposed to various risks, especially during the initial phase of the implementation of the project.

Exposure to risks of an engineering project, except the diversity of the processes also depends on the geographical location of the implementation, the project size, the complex nature of the project , time available, the legislation, but also by the use of new techniques without previously used for implementation.

The term **Risk** means an event, which if fighting occurs has an effect on at least one objective of the project, such as: the ultimate goal, timeliness (deadlines), quality of work and materials and cost. If a risk happens it has a certain impact, which creates the possibility of negative results, but also positive in some cases [ANSI, 2008].

Risk is an event that depends on unpredictable processes, but also by processes which are anticipated to be incurred and will have a negative impact on the realization of engineering project.

1.3. Risk Management

In Plan Managing Risk represents an unfavorable event that corrective action must be returned in the event of favorable cost as low as possible. The process of Risk Management includes all activities necessary to identify and evaluate them according to a well-defined procedure. While after their identification process is decided this will be the actions to be undertaken to fully or partly avoid their effects [Caron, 2009].

Risk management is important during the planning stage /phase, but also the process is carried out throughout the project implementation cycle.

An efficient technique of Risk Management in the construction process is the method PRAM (Project Risk Analysis and Management). This method is used in case of major management projects, which includes a series of actors. PRAM method has not only an evaluation and analysis approach , but also the response analysis which suggests appropriate actions to be taken to avoid the risk and minimize its impact.

PRAM implementation technique does not replace other techniques of project management, but they go hand in hand/parallel.

PRAM method includes these following processes:

1. The risk management plan

2. The identification

3. Quantitative assessment /Quantification of their effect

4. The Response Plan

5. Monitoring and controlling

The determination of the responsibility of the Risk Management is the task of the Project Manager, ensuring that all risks are identified and each member of the project team have to manage the risks affecting the processes it performs. The weakness of the other techniques of Project Management makes it difficult to apply effective Risk Management techniques in construction [Kerzner, 2003].

The process of Project Management and control systems is an instrument of management uncertainties. Project Management and Risk Management are two processes closely related to each other and can be conceived as a series of instruments to reduce the impact of unforeseen events. Specific events are difficult to predict, but Project Managers should try to identify those project processes that can cause difficulties, from which can be started an evaluation of the risk processes.

The processes of the PRAM method are combined with Project Management processes, by not replacing them. The purpose of the Risk Management process is to select the uncertainties that characterize a project as soon as other management processes have not provided realistic parameters [Kerzner, 2003].

Two actions may be identified during the Risk Management process: the first action is to spread risks to each project actor and the second action: their management. Distribution of potential risks is based on the criteria of capacity to respond to them.

After the distribution of risk the management process is carried out by each actor and the calculation of the reserve fund for any potential risk [Hernández, 2013].

PRAM method has as the main function the identification and implementation of measures to prevent and the reduction of the risk’s by using human resources, legal and financial resources available. The method "Project Management Risk Analysis" to assess and respond to risks might have these approaches:

-Predictive

-Responsive

-Inclusive

-Predictive approach consists merely/simply in predicting, evaluating and recording risks, while responsive and inclusive approach consists in taking corrective or mitigating actions and distribute them in some actors.

Since engineering projects are unique and complex, they are threatened by risks where most vulnerable stages are: planning and early stages of construction. Collecting unreliable data and taking planning actions on these data would increase exposure to risks engineering project.

Each risk has a probability to show a certain impact and effect on the entire project. Unfavorable situations regarding the probability and impact of risks can be avoided at an early stage or during the realization of the project. In this regard, preventive actions can be taken, acting on causes that increase the probability of occurrence of risk or corrective action can be taken - mitigation, by reducing their impact and effect [Yin, 2009].

In the following table are presented reasons that are perceived from construction firms as barriers to manage risk.

Table 1. Barriers of Risk Management Implementation

	Akintoye and MacLeod (1997)	Baloi and Price (2003)	Tang et al (2007)	Hlaing et al (2008)
Lack of political, financial stability				X
Lack of time	X			

Lack of money		X	X	
Lack of familiarity and understanding		X	X	X
Lack of policy and procedures			X	X
Lack of transparency among stakeholders				
Lack of joint risk management			X	
Lack of formal risk management			X	
Lack of expertise to lead RM team				
Lack of cooperation and commitment among construction team members				
Lack of information and knowledge			X	X
No guidelines on the standard procedure of managing risk		X	X	
Multiplicity of variable factors in construction projects				
Unsupportive culture	X			
Communication and transparency with project				
Availability of resources		X	X	
Insufficient ongoing project information for		X	X	

decision making				
Not enough historical data		X		
Difficulties in interpreting the results			X	

1.3.1. Identification of the risks thesis.

In a project implementation can be identified two types of risks:

- Internal Risk
- External Risk

Internal risks are risks that occur within the company which will perform execution of works and they are related to the management and financial resources, human resources management and management of work performance.

While external risks are risks which are not related to the company which carried out the work, but are associated with the donor, sub-contractors, government entities, geographical conditions, climatic conditions, civil society, thirsty. Such risks may include:

- Determination of unrealistic objectives of the funder.

- Location of work

- Reactions from environmental associations or owners where engineering works will be built.

- The change of the legislation.

- The collapse of sub-contractors.

The method of assessing the risks of a project takes into account: the size of the project, the contract value, geographical location, set objectives and the capacity of the implementing company [Bhosekar, 2012].

During the implementation of the project some predicted risks materialize, others are identified, this makes PRAM techniques to be implemented progressively throughout the implementation stage of the project [Thomas, 2009].

1.4. Risk Management Plan

This process consists in the establishment of a risk management system in which decisions and findings are made in order to affect all the project implementation process.

Risk management plan is considered as one of the most critical stages, as it is part of the main document of planning process of the whole project to be realized. In the Risk Management Plan are described all the objectives to be achieved, processes, and techniques to be applied to their management [Zou, 2013].

PRAM techniques use all sources of information, at the time occurred but archived information for previous processes. In the Risk Management Plan are described in detail how the techniques and processes of PRAM will be coordinated with other management techniques of the project. This enables the planned deadlines of works to be carried out considering the potential risks for each process and leaving time for reserves planning process and for those activities that are considered risky.

1.5. Types of Risks

The determination of the risk type is a process that begins during the planning stage and lasts until the final stage of the project. This process is carried out with the help of experts of that field based on the previous “database" and the information of former managers of the company .The process of defining risks aims the creation of the Register of Risks, where are listed all the possible risks, detailed information about each of them and the actions that will be taken to avoid or minimize them. In the process of engineering construction works can be identified these types of risks and determine the level of priority depending on the project and the stage in which it is. The level of priority of a risk depends on the probability, impact and its possible effect .

In the case of facilities financed by the state budget above some of the above risks belong to the Contracting Authority.

1.6. Quantitative Risk Assessment

The process of the risk-engineering project quantity analysis aims to assessing the impact and of the common effect of different risks to performance of the project in terms of time, cost and technical parameters, consisting mainly to the change of the parameters of the project. Quantitative analysis has as main request availability of a model project. Model requires both "input" data about the distribution of characteristic parameters of the project, for example the duration of activity, distribution of resources and actors involved in its implementation. Using probabilistic simulation technique, the analysis of the type "What If" can be performed and can be estimated the general effect of changing parameters of the project on the performance of the project [Leung, 2004]. Switching from one accurate prediction of parameters to a prediction probability, through the use of techniques of simulation, saves the factor of uncertainty to the project itself, as well as switching to a higher grade of the prediction of costs and the overall length in contrast with traditional ways of determining type.

A significant deviation of the project expectations can derive from a single source with a significant variable (major risk) and by many smaller sources linked between them. The risk of exceeding the budget may come from a single significant risk which may not be successful passing of a commissioning and subsequent penalties. But also by variables associated with a variety of parameters of the project for example: it could be an increase in costs of materials, transportation and construction derived from a common source such as: the increase of the required amount of material in relation with the initial forecast.

Quantitative analysis of project risks requires:

- A model project

- Distribution of variables probability model

- A quantitative technique of the analysis of the model

- A project performance parameter

In general, models applied to analysis of project risks can be divided into two categories:

- Events oriented

- Changes oriented

Events oriented models are based on the vision of events as event risk and consider the joint effect of significant events affecting in this way the success of the project.

Each event is characterized by the parameters of classical probability and magnitude of the impact event. A typical example of this type of model is the "Tree of events", where the dependence between variables can be described by the conditional probability.

Changes oriented models are based on a vision of risk, as alterative parameters of the project and consider the joint effect of changing parameters of a project characteristic, typically described in terms of the probability distribution. Dependence between variables can be described by a coefficient, aiming to describe in terms of parameters probability characteristics of the project. Regarding repeated elements - such as cost and duration of a certain activity there are two alternatives:

- Describe the difference based on the characteristic data that belong to the parameter.

- Describe the difference on the basis of previous data taking into account the error from the change of the predicted values with actual values.

If the forecasting system is efficient, the change of forecasted error should be smaller than the change of the parameter by considering the knowledge used in the stage of the evaluation of the factors that influence the parameter itself.

Based on the non- repeating components of the project, when the duration of an activity realized for the first time, generally it is needed an expert’s opinion, which requires an accurate prediction, as well as a reliable estimate of the forecast itself. The estimation of parameter of time passes from an approach based on historical data (in the case of activities which are repeated) in an approach of "Bayesian" - based on the opinion of experts (in the case of activities which are not repeated). In this second case the degree of reliability given by the expert is proportional to the degree of knowledge disposed, which can be improved by obtaining additional information. "Bayesian" approach is important in the management of projects, taking into account the impact of non -repetitive components, allowing a rigorous approach in the integration of the two sources of information to assess: previous data "database" and expert opinion.

From this point of view, it can be reached the quantitative assessment of parameters characteristics of significant risks, the probability of the event, the degree of impact and their effects [Edwards, 2005]. Switching from a rigorous assessment in a probabilistic assessment, necessary data are obtained for an accurate assessment of the project reserve funds. It is important to remember that the reserve fund should cover the costs of the project from the remaining risks after the actions carried out for risks with high importance indicator.

In the above analysis is included:

- Determination of the probability and frequency of occurrence of each risk

- Determination of the impact and the effect of risk

- The relation with the remaining risks

- The level of control over risk

For each risk identified is assigned a person responsible for his analysis and is created a "Risk file".

The process of identifying files serves to create more accurate data for each risk, highlighting the risks with high impact, probability and frequency. Thus it is created the list of priorities, given the above risks parameters. The impact of a risk may be low, moderate or high and every risk may be classified as:

- Risk with inconsiderable impact

- Risk with low impact (requiring corrective action)

- Risk of moderate impact (requires re-planning process)

- Risk with high-impact (requires changes to the project objectives)

- Risk of catastrophic impact (failure jeopardizes the implementation of the project)

After the identification of the risks is performed for a specific project, the quantitative assessment is performed by estimating the probability of occurrence of a risk and the impact on the monetary value, time, quality, safety and the environment. The quantitative evaluation is conducted in order to set the right priorities, to which risk will be analyzed and if action taken against it, according to the importance and time to be displayed. In this way is done a risk ranking for all the risks that threaten the project. The probability of occurrence of each risk is calculated with the methods mentioned above, and has a scale from 0 to 1. Once found P probability for each risk, is founded the value and effects of the impact it will have. The quantitative process of the calculation of risk is an important part of the evaluation risks.

1.6.1. Quantitative Calculation of the Indicator of Risk Importance

The impact of risk is assessed depending on the negative impact that may have, placing a reference coefficient. Taking data from the table we calculate the indicator of the risk significance Ri. When the Indicator of the Risk Significance is $0 \leq <0.1$, the risk has a modest effect and does not require corrective actions. When the Indicator of the Risk Indicator Significance is $0.1 \leq Ri \leq 0.4$, the risk is acceptable, but analysis and corrective actions are needed.

PROBABILITY				
HIGH				
MEDIUM				
LOW				
	LOW	MEDIUM	HIGH	**IMPACT**

Figure 2. Probability Matrix/ Impact [Edwards, 2005].

In case of the Indicator of the Risk Significance of Risk $0.4 < R\text{i} \leq 1$, the risk has a huge negative effect, where his avoidance is impossible. To get a graphical representation of the concentration risk of a process based on its indicator of significance is constructed the Matrix Probability / Impact, where in the X- axis is paced the probability of occurrence of risk and to the Y-axis is placed its impact.

1.6.2. Quantitative Calculation of the Risk Significance in each target of the Project

At this stage the project is calculated the significance value of each risk, $Rijk$ is the value of significance of each risk i, actor j and the object of the project k. $\alpha i\text{j}$ is the probability of occurrence of each risk j i actor. Bijk is the impact of each risk by any j actor in each target k.

When risk is repeated several times during the project engineering, the Indicator of Risk Ri k is the Indicator of Risk Significance i in k objective, where is the number times n is the number of times it is repeated at every stage of the project.

At a point in time T, the risks have a certain probability for the entire project, but do not have the same impact in the different project objectives such as: Quality, Cost, Safety, Environment and Timeliness/Deadlines. This fact shows that the Indicator of Risk Significance is different for different objectives of the project, where the probability is the same for all targets, but its impact varies for different objectives.

1.6.3. Methods of Calculating the Risk Probability

Uncertainty of engineering projects, with constantly change of their settings, makes it necessary to calculate the indicator of risk significance, not based on a subjective approach anymore, but in a probabilistic approach. In this way is obtained a high degree of accuracy in the planning and control processes.

The use of probabilistic models, whether analytic or simulation type, brings an increase in the number of data, which can be used to perform predictions about events that may occur in the future. Quantitative risk analysis takes into account the effect of the joint various phenomena associated with certain parameters of the project, which provide a measurable effect on the results and project objectives.

For this purpose must be available:

- A model of the project.

- Description of parameters of the project in probabilistic terms, representing initial data "inputs" for the model.

- A system for calculating performance indicators of the project that represents a variable or an output of the scope of the project.

- A model processing technique, technique can be analytical type or simulation type.

- In this case must be analyzed the effects of each risk with high significance indication, which may cause a change in full or partial realization of the project parameters.

1.7. The Plan of Risk Response

The objective of this plan is to identify the actions necessary to reduce the probability and the impact of the occurrence of a risk or the overall risk of the project.

Actions in response to the risk effects represent the actions planned to in order to mitigate threats and favoring new opportunities.

Key strategies in response to a negative risk are:

- Prevention

- Reducing the Impact (mitigation)

- Transfer

- The deviation of a risk generally requires a re-planning of the strategy and objectives of the project in order to: eliminate the threat, the project works to avoid risk or to adjust effect of the project objectives in order to not be exposed to risks. Also to avoid a risk, which leads to the reduction of project implementation performance engineering can be performed a replace of sub- contractors involved in the project [Edwards, 2005].

- The reduction of the risk effect means taking actions which could reduce the probability of occurrence and impact below the acceptable limit. In the first case is paid attention to the source of risk in the second case is estimated that work package which suffers the impact. A typical preventive measure is to take a sample /prototype to reduce the risks that may arise from the implementation of large scale construction of an innovative process. In the financial context a preventive is the intervention of covered measures to exchange rate changes, interest rates and prices of raw materials in international markets.

The reduction of the impact of risks that lead to delays versus deadlines can be realized by calculating through the method of the critical path, time reserves which can be used during certain stages of the project implementation. Also mitigating the effects of delays against deadlines could be the signing of additional for postponement of the work period. Even the use of the opportunities associated with a positive risk may require the change of the project when is necessary to realize the unforeseen work ,which increase the volume of work and eventually winning the contractor [Caron, 2009].

Acceptance of risk is one of the strategies that should be taken into account especially during the planning stage. Generally this passive behavior is associated with the prediction of a reserve fund to cover contingencies that may arise during the project. The undertake of actions, in economic terms, with setting available additional resources or in terms of time, also with the identification of reserves of time analyzing the sequence of processes construction by the method of the critical path is one of the actions necessary to reduce the impact of risks.

-Risk transfer means to transfer the responsibility of the consequences of risk control to third parties or to higher levels of hierarchy. Risk can be transferred between actors (stakeholders) other than through a contract or to be transferred outside through insurance contracts.

It is also possible the risk transfer to a higher level of organizational structure, in a level of project portfolio management where the diversification among several projects makes the risk acceptable, where the level of a single project would have been difficult to confront its impact.

Replacement of an innovative technology with an older in a conditional project represents a change of strategy aimed at minimizing the risk of late completion of the works.

A risk is "manageable" only if effective measures can be taken. It is important, a that a risk manager managing risk (risk owner) responsible for the implementation of these actions, to be identified for each risk by selecting that one which is in the best position to understand the dynamics of risk, in order to intervene if it is necessary.

In general the shares must be efficient in terms of cost, where the cost of the required result is lower than expected profit itself. In terms of time, their efficacy appears before the occurrence of the risk.

Shares against the risks can be classified into shares of conditional or unconditional. Adoption of a communication plan represents an unconditional action. Performance decline on the construction site can bring a possible delay in the completion of the project, an event which requires a conditional action, and may be increasing the frequency of monitoring and controls. The plan of shares that may be undertaken includes the entirety of planned shares, whether conditional or unconditional. Planned shares should be involved early in the project implementation plan, both in terms of time and in monetary terms. Implementation of shares against risks can generate secondary risks, i.e. risks generated by the shares, which should be taken into consideration in the project management plan. After setting shares for each risk, can be attached in risk file the following information:

The plan of action should be based on the principles of risk, in order to avoid their transformation risk factor. Also to be planned conditional actions that aim to terminate its dynamics and actions aimed at reducing the uncertainty of the project through the exchange of knowledge.

1.8. Monitoring of Project Risks

Project risks should be monitored throughout the project cycle, considering their elimination or modification of the relevant shares or after the emergence of additional risks. Documentation regarding the risks should be updated frequently [Ollmann, 2010]. It allows identification of Risk that weighs on the project at any time interval, until the end consequently forecasting of critical time stages. The risk response graph appears in several versions over time alignment project. The first version, typical of the initial planning stage, describes time profile of the overall exposure to the risk of the project, regardless of possible actions that can be taken. The graph is built based on the parameters' characteristics of risks that may appear in time, impact and effectiveness of the action. This first version can be used as a benchmark of various plans and strategies against the risks, where each plan may correspond with some shares. The choice between the various plans may take into consideration such factors as: the effectiveness and speed of action undertaken. Action planning, conditional or not, generates a second version of risk graph, which represents progress in the overall time of risk that influences on the project during its life cycle. The graph of risk response should be subject to ongoing reviews progress of the project, which can interfere when new risks appear, or take measures to avoid secondary risks.

The performance management system project risks can be estimated on the basis of several parameters:

- The credibility of the plan.

- Capacity predictor of risk (impact of unforeseen risks).

- Effectiveness of actions and measures (reduction of the expected impact upon receipt of Measures).

1.9. Cube Risk Construction

An instrument for the detailed analysis of project risks is the risk Cube, which combines some elements of the planning process. In the above mentioned chapters we described how activities decomposed (split second) in decomposition structure SDP (WBS). Also companies and organizations decomposed in such DOS structure (OBS). The same method is used to decompose, creating the decomposition of Risk Structure DRS or expressed by international terms: Risk Breakdown Structure (RBS). Risks decomposition structure built starting from the types of risks mentioned above [design risks, procurement risks, environmental risks thirst] and by decomposing them in more specific detail. Risk Cube enables the combination of the above three structures: Structure, Process decomposition, the decomposition of the Company Structure and Structure Risks decomposition. Risk Cube is a three-dimensional element in each axis is set each decomposition structures. A point inside the cube corresponds to a specific activity, a person / group designated responsible company and a source of risk. Risk Cube is a very powerful instrument for planning and control of the project.Risk Cube gives a three dimensional representation of the status of the project, highlighting the activity of the working group and the relevant risks. Quantification (quantitative) risks assessment by assessing the impact and probability and placing them in three dimensional axis of the diagram by the upward trend, gives a clear picture of where activity and group management will have greater effect. Risk Cube enables the systematic collection of quantitative data about the risks that appear in the project. The data that define the parameters of the project risks can be quantitative values, or quantitative predictions, discrete or continuous distribution. Assuming the calculation of risk impact by quantitative forecasts can predict their impact on each activity or work package of the project decomposition structure.

This scheme shows the identification of all sources of risk and their effect on each activity. Also by Cube risk the identification of the relationship between risk becomes possible. A particular source can produce several risks that are automatically linked to each other and can include a variety of activities. The presence in a project related engineering risks between them represents a serious threat to their project. But using the Cube risk schemes, the action necessary to eliminate or re-dimensioning of the impact of risk is more efficient and increases the performance o

f their response.

1.10. Frederick Winslow Taylor's theories of scientific management

Frederick Winslow Taylor's is considered the father of scientific management principles. According to him, scientific management is the only efficient strategy in enhancing workers efficient and initiative [Taylor, 1919]. Taylor suggests that scientific management offers an absolute strategy of improving productivity and increasing creativity. In the book" Principles of Scientific Management" he explained his method aiming at persuading everyone at implementing them in their organizations, Taylor rules were designed to: (1) fight soldiering and improve productivity, (2) optimize time and motion ratios, (3) scientific the managerial approach. The most famous part of Taylor contribution was the four principles of scientific approach:

1. Rule-of-thumb work replacement in favor of scientifically analyzed work strategy.

2. In order to increase workers' productivity they need to be continuously training.

3. Cooperation is key for implementation of scientific management.

4. Delegate the work according careful study and specialization principles.

Taylorsism has played an important role in construction project management [Sjøholt, 1990]. According [Sjøholt, 1990], Taylorism is important for construction industry given that he is the basis for several other authors' works:

- Frank and Lillian Gilbreth. (diferrencies in strategies and speed of workers)

- Henry Gantt (graphs which compare actual progress against the required time)

- The Norwegian Building Research Institute (NBI) (Planning based on scientific methods).

CHAPTER 2

MATERIALS AND METHODS

2.1. Methodological Approach: Case Study Methodology

In order to achieve these thesis objectives singular case study methodology is chosen.

The clearest advantage of this methodology is that it enables in depth analysis of data and of one certain case. This case study begins by presenting background information and facts for the construction company under study, with the aim to analyze the real management of project risks.

This business is submitted to a step by step process for evaluating risk management.

In following paragraphs this approach will be presented and explained.

2.2. Case Study Background Information

For this thesis, “B.H & S.B Construction” has been selected as the firm to be analyzed in project risk management process.

This business has been operating in the construction market for over a decade. It construction projects include: residential and business environments, coherent with the European Standards and Regulations. In recent times it has constructed public buildings as well. According the company they have the most innovative and modern technology. It has expanded it cooperation with foreign firms.

Given the above background it is expected that the company has the most sophisticated project management tools. But in 2007 one of its projects collapsed and failed because one week before inauguration the building emerged into fire. Given that the fire was caused by low quality of electrical installaments; it was evaluated that this incident was a consequence of improper and insufficient risk management (quality control, supplier relationship, ect).

This is the project that this thesis take in analysis in order to find out what could have done different and what went wrong in project risk management.

2.3. Data Gathering Instrument

In order to conduct this research were gathered two types of data: (1) qualitative and (2) quantitative. So this research uses a mix methodology, by making simultaneous use of two types of data. Gathering instrument was a structured interview

2.3.1. Research Model

Research was based on project risk management **step by step approach.** Both data collection instruments were designed in order to gather relevant data for each step of project risk management. The scheme of project risk management is showed in the *Fig. 2.*

By using the data gathering instrument, which will be explained in the following sections, was made possible that B.H & S.B Ltd. to be evaluated for every step in managing project risk.

Figure 2 was based on literature and is only a visualization of step by step approach of project risk management. According to this approach, risk management passes through the following steps: (1) risk identification, (2) risk Evaluation, (3) risk answer, and (4) risk monitoring and controlling [Kendrick, 2015].

In each step of this scheme, were collected data from firm in order to find out if the firm has followed these steps.

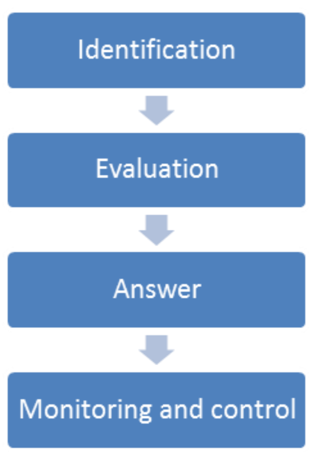

Figure 3. General Framework of data gathering for project risk management. [Crouhy *et.al.*; , 2014]

2.3.2. Data Collection Method - Interview

Risk management studies are carried out mostly by using qualitative data. In this research main instrument to gather qualitative data was a structured questionnaire submitted to project managers of B.H & S.B Ltd.

Steps that were followed in order to gather qualitative information were according suggestions of [James, 2013]:

Step 1 – Making explicit all research questions

Step 2- Designing of data gathering instrument- in this research data gathering instrument was a structured interview that is presented in Tab. 2.

Step 3- Selection of appropriate research sample- in this research the structured interviews were submitted to B.H & S.B Ltd. Project managers..

Step 4- Collection of data from sample by using the designed data gathering instrument.

Step 5- Analyze of data gathered- methods of evaluation will be presented in a specific section of second chapter.

Step 6- Testing hypothesis and make conclusion remarks.

In order to gather data for answering the research questions, the following structured interview was designed (Tab.2). This interview was designed to be compatible with the step by step approach of project risk management presented in *Fig. 2.* As mentioned before the interview was submitted to B.H & S.B Ltd. Project managers. Data gathered from this interviews will be structured, processed and used as an input in chapter three of the thesis.

Table 2. Table of Risk Management questionnaire according Construction Project Risk

IDENTIFICATION	Does the risk identification process include a method to identify a priority for the project?
	Are best practices and lessons learned being used to improve risk identification?
	Is there a process in place for the continuous improvement of the qualitative risk management process?
	Is there an improvement process in place to continuously improve risk identification to completely identify all risks as early as possible?
EVALUATION	Does the organization have a documented process for identifying project risks?
	Do project managers informally use scope statement and project milestones to help evaluating project risks?
	Do risk discussions typically take place when the risk is already a current problem versus a future possibility?
	Are all processes in place, documented and being used?
ANSWER	Does the project team examine the procurement management plan and staff management plan to help answer risks?
	Do project team members rarely suggest potential risks responses to the management or stakeholders
	Does documentation exist on all processes and standards for answering risk events?
	Does the process include efficient avenues for teams to answer risks (checklists, automated forms, etc.)?
MONITORING	Are project team discussions on risk sporadic and informal?
	Is the risk monitoring process fully integrated with cost management and time management processes and the project office?
	Is the process of monitoring considered as standard only for large, highly visible projects?
	Is the process of monitoring encouraged for all projects?
	Does the organization have a documented repeatable process for evaluating project risks which is fully implemented?

2.4. Evaluation Method

2.4.1. Evaluation Method - Interview

In order to evaluate qualitative data gathered from structured interview the following steps were followed:

Step 1 - Gathering information from all respondents (B.H & S.B Ltd project managers).

Step 2 - Analyzing the interview questions, organize them in order to find convergences and divergences in order to take a broader picture of the data.

Step 3 - Utilize this data by categorizing them in four groups that are compatible with four steps in managing project risk.

Step 4 – Use this data in engineering analyze apparatus: Probability and Impact Analysis; Cost, Time and Quality Matric and risk positioning; Risk Load Quantitative Assessment; PERT Technique

Step 5 - Interpretation of results by comparing the factual project risk management as conducted by B.H & S.B Ltd. with the ideal process of project risk management.

2.4.2. Evaluation Method – Questionnaire

In order to evaluate quantitative data gathered from the questionnaire (taken from [Edwards, 2005]) the following steps were followed:

Step 1 - Gathering information from all respondents (B.H & S.B Ltd project managers and B.H & S.B Ltd. clients).

Step 2 - Analyzing the questionnaire responds, processing them according to the necessary demands of type of analysis.

Step 3 - Descriptive analysis by comparing questionnaire results of B.H & S.B Ltd project managers with those of B.H & S.B Ltd. Clients.

Step 4 – Submitting data to correlative analysis between: project risk management (as reported by B.H & S.B Ltd project managers) and project benefiting (as reported by B.H & S.B Ltd project clients).

Step 4 – Submitting data to simple regression analysis between: project risk management (as reported by B.H & S.B Ltd project managers) and project benefiting (as reported by B.H & S.B Ltd project clients).

Step 5 - Interpretation of results in order to find out how successful was B.H & S.B Ltd. in managing project risk.

In concluding a visualization of data collecting and evaluation is presented in *Fig. 3.*

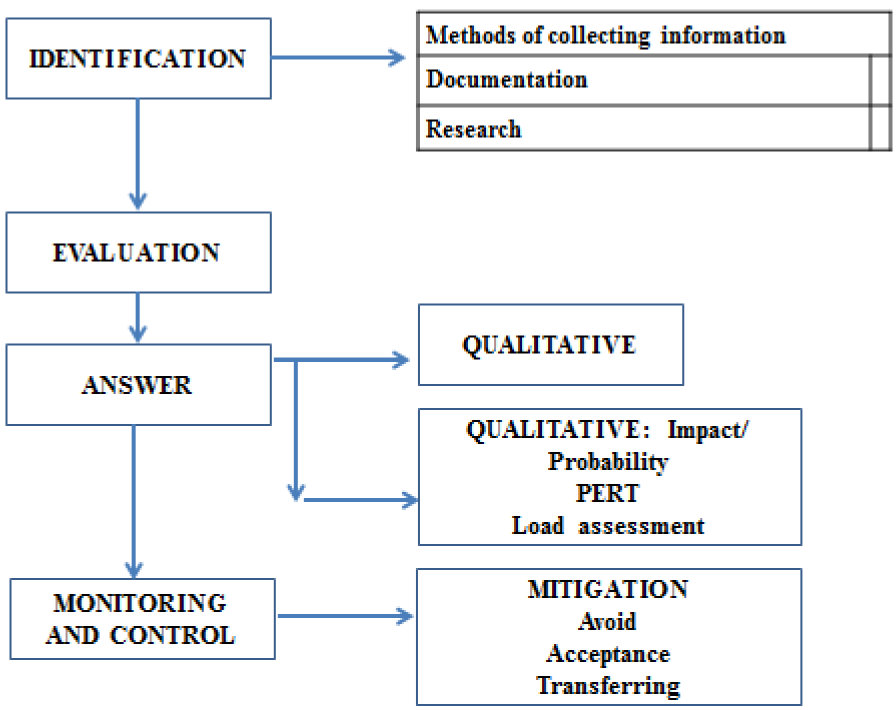

Figure 4. Data collecting and evaluation process during research.

CHAPTER 3

RESULTS AND DISCUSSION

In this chapter of the thesis results of data gathered will be presented.

In this chapter will be presented all results derived from data gathered by questionnaires submitted to B.H & S.B Ltd. Project managers. As was previously discussed in the method and material chapter, the questionnaire was designed in four sections in order to match with the four risk management stages developed by [Crouhy *et.al.*; 2014]. Given this fact, even results and discussions are presented in four stages in order to study in depth all risk management stages one by one.

In this chapter, are presented four stages of risk management (based on *Fig. 3*) as they are applied in B.H & S.B Ltd. Evaluation is based in information gathered from structured interview presented in second chapter (*Tab. 2*).

3.1. Step 1 of Project Risk Management: Risk Identification

B.H & S.B Ltd, risk identification as the first step of project risk management, is done in the beginning of every project. According to data gathered from this research interview, in risk identification process the whole team participated and contributed.

Exploratory questions that sought to analyze in depth first stage of Project Risk Management: Risk Identification, according *Table 2*, are:

- Does the risk identification process include a method to identify a priority for the project?
- Are best practices and lessons learned being used to improve risk identification?
- Is there a process in place for the continuous improvement of the qualitative risk management process?
- Is there an improvement process in place to continuously improve risk identification to completely identify all risks as early as possible?

The data taken from these three questions were furthered analyzed, processed, grouped and interpreted. Results of the first step of risk management are presented in the following sections.

3.1.1. Risk Information Gathering Methods

Based on structured interview results, project managers report that there are several instruments that B.H & S.B Ltd uses in order to identify risk. There are two major classifications in methods of collecting information: (1) Historical documentation and (2) ad – hoc research. According to team managers, ad hoc research (risk identification procedure undertaken exclusively for a certain project) is the main source of risk identification. The most effective way to identify risk is quoted to be: brainstorming. This method is quoted to be the most beneficial because all team managers are present in risk identification. This enables a holistic approach of the process of risk identification where different departments feel the responsibility to contribute in enhancing all potential risk sources.

In *Table 5* is presented an organized visual representation of information gathered from 15 "B.H & S.B Ltd" project managers, when explain methods of collecting information about risk identification.

Table 3. Methods of collecting information about risk identification

Methods of collecting information	
Documentation	Databases of scientific laboratories
	Historical data from other similar projects
	The study documents the project (plan, folders, etc.)
	Study literature specialists
Research	The engineering study
	Informal team responsibility (but not the authority for decision) to determine the risks, with a greater level of independence.

"B.H & S.B Ltd" has a simplified system for classification of identified risks. Likewise, of course, risks identified methods were simplistic. *Table 5* shows that the risk identification is mainly covered by the automated control for technical risks and employees are gathered informally whenever the risk is identified by computer systems. All these identifications are subject to documentation, and are used as input for the following projects.

3.1.2. Risk Identification in terms of Project Life Cycle

Besides giving an overview of methods of collecting information about risk identification; the most important information gathered for the first step of risk management is identification of risks associated with a specific construction project undertaken from "B.H & S.B Ltd".

In this section will be identified potential and real risks associated with B.H & S.B Ltd latest project. Such identification is logical succession of the first part of the first step. All risks identified by the team of project managers of "B.H & S.B Ltd" were classified in two groups by me: (1) according the type (technical, external, organizational, and related with the specific construction project ("ad hoc risk")) and (2) according life cycle into which the risk has probability to happen (initiation, mission review, closure). As showed in *Figure 3,* from risk identification process, B.H & S.B Ltd concludes in four types of risks: technical, external, organizational and exclusively project risk.

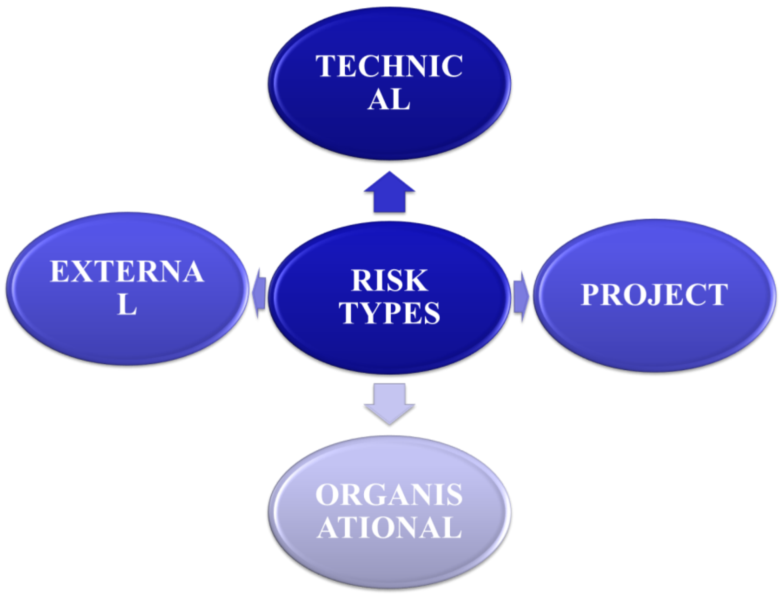

Figure 5. Risk types resulted from risk identification process

These four types of risks are categorized in the following *Table* according project steps: Planning Stage, Initiation, Mission Readiness Review Stage, Closure.

In order to construct *Table 6*, from the questionnaire were extracted all risks associated with a construction project as identified from project manager team of "B.H & S.B Ltd". This data are represented in the second column of *Table 6.* After this, I classified all risks in (1) risks that happen in planning/ mission review/ or closure stage of the project lifecycle (column 1 of *Table 6*) and (2) technical risk/

external risk/ organizational or related with the specific construction project ("ad hoc") risk (column 3 of *Table 6*)

Table 4. Risk Identification and response. [Bekteshi, 2017]

Project diffraction structure		Type of risk
PLANNING STAGE	The identification of opportunity to initiate a new mission	1. Misconception of opportunism features
		2. Failure to provide the support of stakeholders
	Defining the objectives of the mission	3. Lack of cooperation among stakeholders of the project
		4. Limitations in resources
	Creating Mission Management Team for that particular mission	5. Members do not have sufficient knowledge or experience
INITIATION	Conference to discuss new current of future anomalies	6. Loss of control over project
MISSI	Up-date of the unsolved problems of the Pre-Project Review	7. Impossibility of finding the cause of the problem
	Status of project implementing campaign	8. Security risk
		9. Technical risk
	Status of unique infrastructure needed for the project	10. Security risk
		11. Technical risk

O N	Annexes of project and dislocation status	12. Security risk
		13. Technical risk
R	Construction machineries consumption, energy and mass margins on start	14. Exceeding the budget limit
E A	Compilation of project interface	15. Failure in performing their function
D I N	Security status of the project (PFRs, deviations, ensuring product and the risk of the mission statement)	16. Security risk
		17. Technical risk
E S S	Payload readiness for starting (instrument to instrument reports of performance issues, actions readjustment, unclosed problems, the status of interfaces and integration)	18. Delays in the schedule
R	The device readiness for project starting	19. Delays in the schedule
E V	The status of preparedness of the facility control and project schedule	20. Security risk
		21. Technical risk
I E	Status of controlling interfaces integrated to project	22. Failure to support the launch
W	Security	23. Default in fulfilling predefined standards
S	Summary of product security of project	24. Problems of communication connections
		25. Difficulty in synthesizing skills
T	Plan of scientific operations and scientific centers	26. Failure in the data supporting

A G E	The status of the mission design (conformity with the requirements of the project)	27. security risk
		28. technical risk
	Status of Mission operating system (MOS)	29. Security risk
		30. Technical risk
	Status of Administrative System (Restitution of scientific data)	31. Security risk
		32. Technical risk
	Operating system status	33. Security risk
		34. Technical risk
	Proceeding tracking and status of connectivity and communications	35. Failure in performing their function
	Status of Project Communications Network	36. Security risk
		37. Technical risk
	Criteria Start-Do not start	38. Problems of communication connections
		39. Difficulty in synthesizing skills
	Summary of providing command and statement of access to risk	40. Problems of communication connections
		41. Difficulty in synthesizing skills
C L O S U R E	Formal verification of contractors readiness	42. Delays in the schedule
	Certification of specific project element form managers	43. Delays in the schedule
	Certification from the program manager	44. Delays in the schedule
	Review reporting results of the project readiness on level I	

3.1. 3. Final Classification of Project Risks in B.H & S.B Ltd

Starting from the above breakdown, we can list the risks in key categories according to the literature. This diffraction *(Fig. 3)* gives a complete list of all the main risks that may affect B.H & S.B Ltd project.

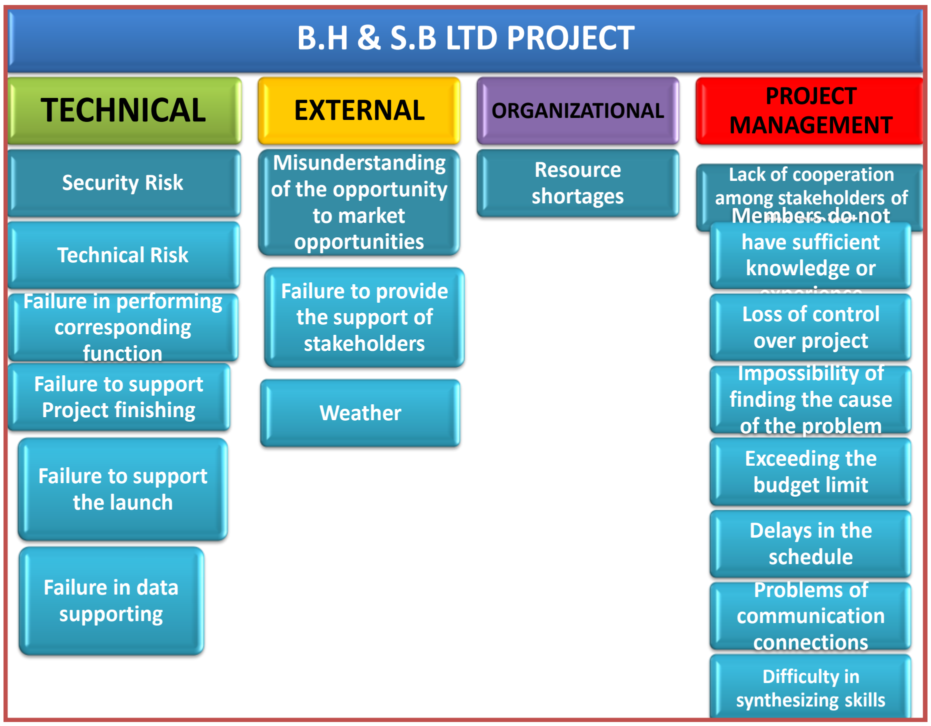

Figure 6. Risk Structure, B.H & S.B Ltd Project

Using this scheme reduces the chance for a potential risk to not be considered.

At the end of analyzing proper methodology of the first step on project risk management this step, we will address the question: how it was managed by B.H & S.B Ltd. in reality during their last project? This question will take response in the following paragraph.

3.1.4. B.H & S.B Ltd Errors in The First Step of Project Risk Management

In the end of analyzing the information's and data gathered from first phase of interview, it was possible to identify several mistakes that B.H & S.B Ltd. Made during "identification of risks" for a certain construction project.

- ✓ Aggregate Risk vs. Risk Components

  At the end of this step, the conclusion reached is that none unique risk or combination of risks should not have had to prevent the finishing of the project as long as the aggregate risk remains acceptable. This is considered as one of the most fatal errors of B.H & S.B's Ltd., as an organization with a high curve experience, which should have demonstrated greater rationality in weighing all the components of risk and not just the aggregate level.

- ✓ Predefined List of Risks

At this stage, the risk identifiers can conclude the existence of any risk, but the risk ultimately should be present in the predefined list of risk in B.H & S.B LTD.-s. Given the uniqueness of the project, nonappearance in the predefined list of risk the specific risk or electrical malfunction, can be classified in the category of unforgivable mistakes.

- ✓ Relationship with contractors

Contractors and suppliers were used as an excuse and a safeguard to transfer the responsibility of identifying the components of the project risks. This contributed to mistakes and unnecessary additional risks.

- ✓ Composition of Risk Management Team

Risk Management team consisted solely of fundamental members of the organization, important stakeholders (contractors), but at no point has achieved risk specialist involvement in it.
This combination of factors led to the failure of the risk management process in its first stage. Let's proceed to the next stage.

3.2. Step 2 of Project Risk Management: Risk Evaluation

One of the mistakes of the first phase was precisely to consider the aggregate risk level and not considering each of project risks one by one. Managers' justification for this decision was that not all the risks merit attention. To see how this argument was justified, we implement the second step.

The second step is the most interesting one, and is the step which is more scientifically analyzed and processed. In this stage of risk management, project managers were asked to give data according researcher needs. These data gathered from managers were used as input in order to apply scientific quantitative methods of risk evaluation. Three quantitative methods of risk evaluation were used: probability and Impact Analysis, risk Load Quantitative Assessment and PERT Technique.

The main aim of this step is to select which risks should be eliminated as irrelevant and which need attention, i.e. to prioritize risks.

3.2.1. Probability and Impact Analysis

The aim of the analysis is to estimate the probability and impact of occurrence of each risk identified in the first stage. Impact of risk occurrence will be addressed in terms of three performance objectives: time, cost and quality. The rate used for this analysis is adapted from the book of [PMI,2004], and are presented in *Table 7* and 8 respectively.

Table 5. Probability Evaluation. [PMI, 2004]

PROBABILITY	Very Low	Low	Moderate	High	Very High
RISC X	0.1	0.3	0.5	0.7	0.9

IDENTIFIED RISK	PROJECT OBJECTIVE	Very low (0.05)	Low (0.10)	Moderate (0.20)	High (0.40)	Very high (0.80)
RISK A	COST	Insignificant cost increase	<10% cost increase	10-20% cost increase	20-40% cost increase	>40% cost increase
	TIME	Insignificant time increase	<5% time increase	5-10% time increase	10-20% time increase	>20% time increase
	QUALITY	Quality degradation barely noticeable	Only very demanding applications are affected	Quality reduction requires sponsor approval	Quality reduction unacceptable to sponsor	Project end item is effectively useless

Figure 7. Risk impact in time, cost and quality. [PMI,2004]

Furthermore, *Table 9* shows how can be calculated the total value of for each risk. Risks listed in the upper right corner of the evaluation matric are the most threatening risks on the progress of the project. On the other hand, risks listed in the lower left corner are categorized with the lowest impact on the project. Risks remaining between extreme corners the matrix are classified as moderate risks, which disturb project performance but not as extremely as most threatening risks (upper right corner of the matric). From this matrix, it is easy to reflect on the action to be taken against an evaluated risk. All risks will be ranked for signaling which are the most critical ones.

Impact					
0.8	0.080	0.240	0.400	0.560	0.720
0.4	0.040	0.120	0.200	0.280	0.360
0.2	0.020	0.060	0.100	0.140	0.180
0.1	0.010	0.030	0.050	0.070	0.090
0.05	0.005	0.015	0.025	0.035	0.045
Probability	0.1	0.3	0.5	0.7	0.9

Figure 8. Risk Matric Probability of each risk multiplied with it impact in terms of time, cost and quality performance objectives. [PMI, 2004]

Where:

Probability- the like hood that a certain event occur

Impact- consequences that may arise if a risk occur

As may be understood the cells of the *Table 9* are numbers that are result of multiplication of risk probability (column) with by the degree of risk impact (row). In this risk evaluation method, depending on the type of probability, a rate from 0 to 1 is assigned to each risk. In this way we gain a result for each risk type .

This is the theoretical apparatus necessary to implement Probability and Impact Analysis. In order to implement probability and impact analysis for a certain construction project of B.H & S.B Ltd. Managers were submitted to the following procedure:

- *Table 6* of this thesis (Risk Identification and response) which was a conclusion of the first stage analysis was submitted to them (used as input in column 3 of *Table 10*).

- Each project manager of B.H & S.B Ltd. was asked to rate each risk presented in Table 6 of this thesis (Risk Identification and response) in terms of probability of happening (used as input in column 3 of *Table 10*).

- Each project manager of B.H & S.B Ltd. was asked to rate each risk presented in *Table 6* of this thesis (Risk Identification and response) in terms of impact that the occurance of the risk would have in terms of time, cost and quality of the project (used as input in column 4 of *Table 10*).

After above input was gathered, each risk probability was multiplied with time, cost and quality impact and by referring to *Table 9*, each risk was classified as part of red zone (high priority risk), green zone (low priority risk) or in yellow zone (medium priority risk) (column 5 of *Table 10*).

Finally, the results are combined in a table (*Table 10*). Based on the above matrix, risks which are marked with red color (*see Table. 9*), right corner above] are those with the largest negative impact on the progress of the project and with higher occurrence probability.

To be more explicit, in this second step, we aim at evaluating the importance of each risk and the level by which it can threaten a construction project. We retake risks classified in the end of the step one of project risk management (*Figure 2,* in Risk Identification Stage), and evaluate their probability and impact by concluding to an overall result for each risk (probability multiplied with impact). In the end each result is positioned in the risk matric (*Table 4*). This positioning enables to highlight most threatening risks and to priorities the long list of risks identified in the first step of project risk management: Risk Identification Stage [Crouhy *et.al* ; 2014].

Table 6. Risks evaluation results according "Probability Impact method"

Identified Risk	Project Objective	Probability	Impact	Matric
Misconception of market opportunism characteristics	TIME	0.3	0.4	0.12
	COST		0.4	0.12
	QUALITY		0.1	0.03
Failure to provide the support of stakeholders	TIME	0.5	0.8	0.4
	COST		0.8	0.4
	QUALITY		0.8	0.4
Lack of cooperation among stakeholders of the project	TIME	0.5	0.2	0.1
	COST		0.8	0.4
	QUALITY		0.8	0.4
Limitations in resources	TIME	0.7	0.8	0.56
	COST		0.8	0.56
	QUALITY		0.8	0.56
Members do not have sufficient knowledge or experience	TIME	0.3	0.8	0.24
	COST		0.4	0.12
	QUALITY		0.8	0.24
Loss of control over project	TIME	0.5	0.4	0.2
	COST		0.1	0.05
	QUALITY		0.8	0.4
Impossibility of finding the cause of the problem	TIME	0.5	0.8	0.4
	COST		0.2	0.1

	QUALITY		0.8	0.4
Security risk	TIME	0.7	0.05	0.035
	COST		0.05	0.035
	QUALITY		0.8	0.56
Technical risk	TIME	0.1	0.4	0.04
	COST		0.4	0.04
	QUALITY		0.8	0.08
Exceeding the budget limit	TIME	0.3	0.1	0.03
	COST		0.8	0.24
	QUALITY		0.2	0.06
Failure in performing corresponding function	TIME	0.3	0.1	0.03
	COST		0.4	0.12
	QUALITY		0.8	0.24
Delays in the schedule	TIME	0.7	0.8	0.56
	COST		0.8	0.56
	QUALITY		0.05	0.035
Failure to support the launch	TIME	0.3	0.8	0.24
	COST		0.1	0.03
	QUALITY		0.1	0.03
Default of fulfilling predefined standards	TIME	0.1	0.4	0.04
	COST		0.4	0.04
	QUALITY		0.8	0.08

Problems of communication connections	TIME	0.3	0.4	0.12
	COST		0.1	0.03
	QUALITY		0.8	0.24
Difficulty in synthesizing skills	TIME	0.3	0.4	0.12
	COST		0.1	0.03
	QUALITY		0.4	0.12
Failure in the supporting with data	TIME	0.3	0.2	0.06
	COST		0.2	0.06
	QUALITY		0.8	0.24

Now we may came to one of the most important instrument of scientific project risk management: matrices of relationship between risks and performance objectives.

To fix the most important risks in terms of time, cost and quality results, below are presented in three separate graphics position of each risk regarding it probability of occurrence and its impact over each performance objective. *Table 4* shows the most significant risks that affect the time, while *Table 5* and *Figure 6* show the same results, respectively, for cost and quality. Risks located in the upper right corner of each graph are the most critical ones, while those located in the lower left corner were identified as irrelevant in their influence.

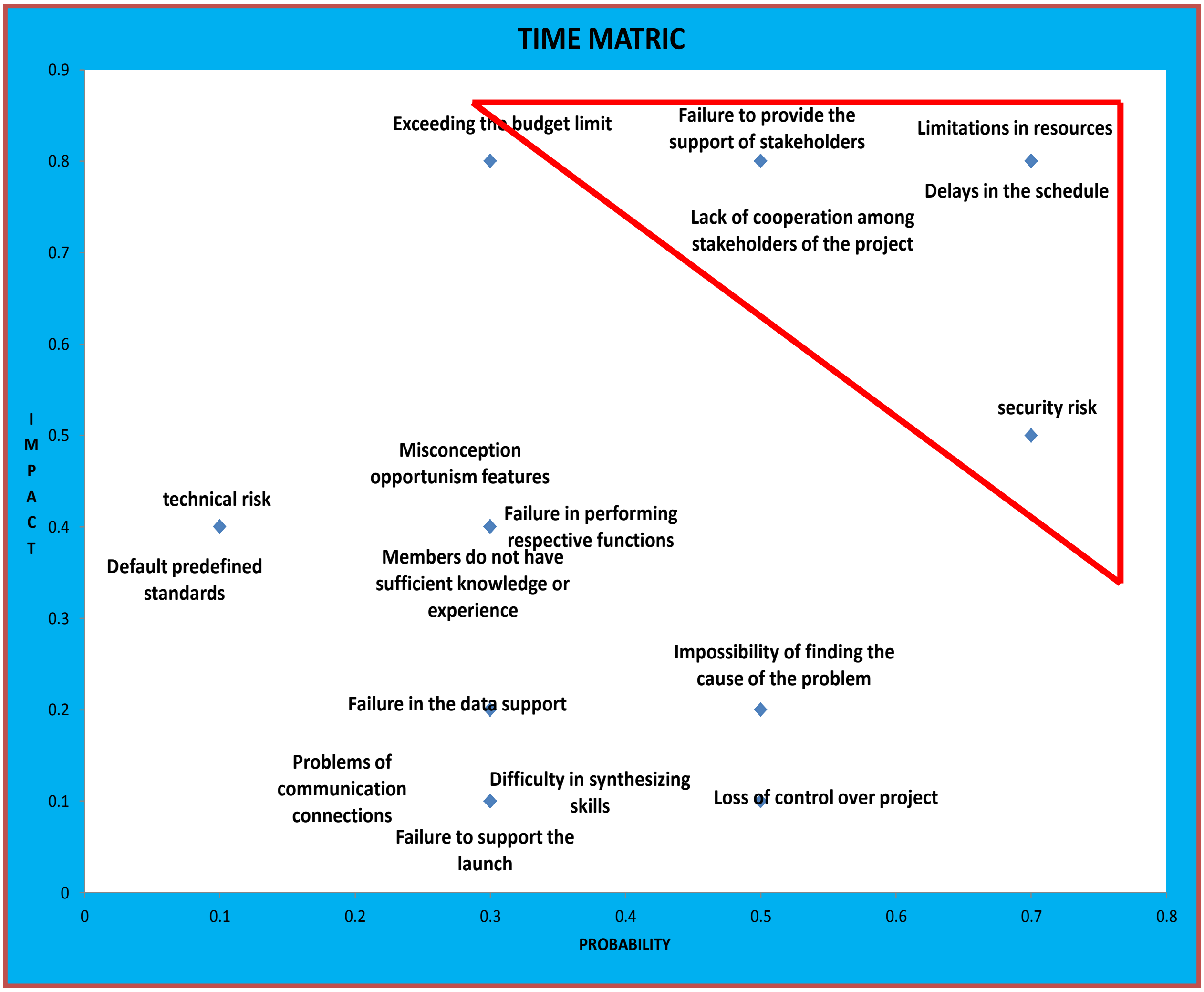

Figure 9. Time Matric and risk positioning

Regarding risks which are identified in the first step, some are more critical than others on the basis of this analysis. In this case, the limitation in resources and delays in the schedule are rated as the biggest risks that may cause delays in the timetable. As soon as these risks are under control, the more it can prevent delays.

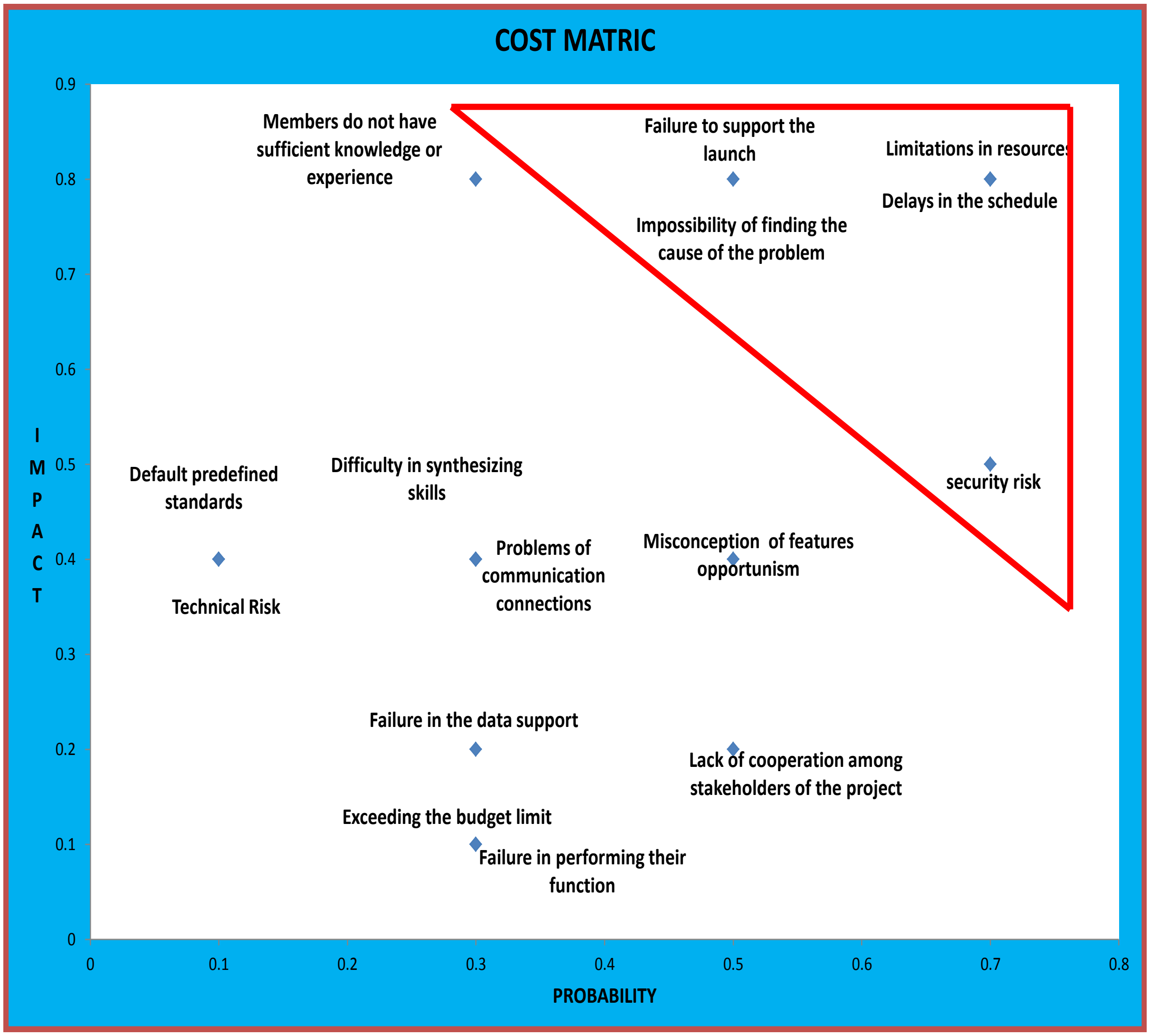

Figure 10. Cost Matric and risk positioning

Critical risks that impact the construction project in terms of cost are, for example, failure to support the launch and technical impossibility of finding the cause of problems. If Construction Company do not pay attention to these risks, it means that this would result in additional costs to the project.

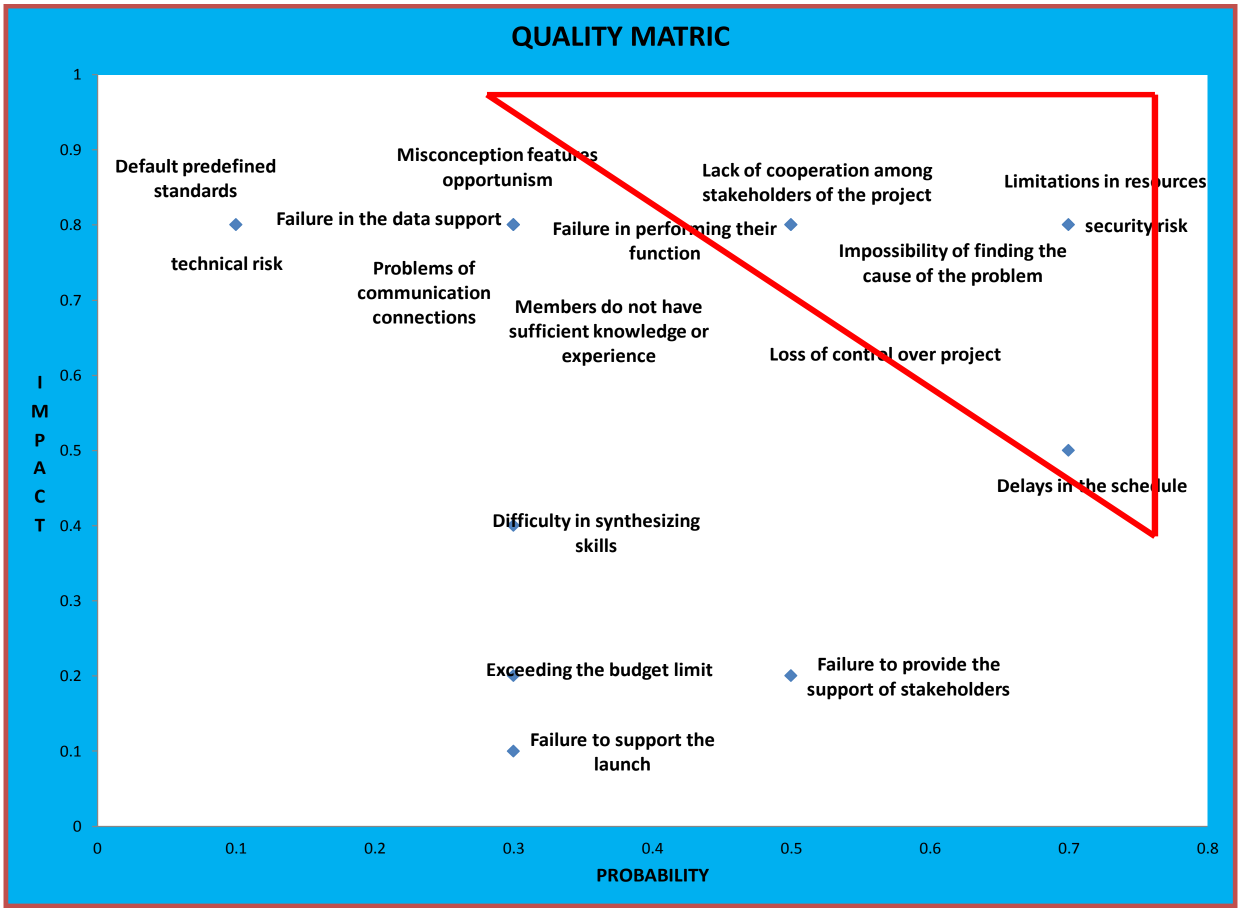

Figure 11. Quality Matric and risk positioning

Risks that could challenge the quality of the project are, for example, lack of cooperation and failure in performing respective function. The risks referred above are major risks that may affect the project in a great level. For example, in case of bureaucratic barriers of communication between hierarchical levels, the quality can be affected in a negative way, which could result in the launch of the project without actually filling needed guarantees.

Therefore, it is important to manage risk at the time that they are still under control in order to meet agreed targets. This is why the three objectives - cost, time and quality are controlled and evaluated in this second step of construction project risk management.

3.2.2. Risk Load Quantitative Assessment

In order to conduct Risk Load Quantitative Assessment, we should evaluate total probability to happen each project risk type [Kendrick, 2015]. In this research we have identified four main risks into a project of B.H & S.B Construction passes through: technical risk, external risk, organizational risk and project risk (as showed in *Fig.5*) In *Table 4* there are showed every specific risk possible to happen for every stage of project life- cycle.

In order to conduct Risk Load Quantitative Assessment analysis, according Fraser & [Simkins,2010] we should use both: the probability and impact of each risk calculated in *Table 8* and *Table 4* and *Figure 5* to combine data.

In *Table 9* I have categorized each of the risks (represented by Arab number) presented in *Table 4* in two dimensions: Project stage in life-cycle and project risk type.

Table 7. Risk Load Assessment

	Technical	External	Organizational	Project
PLANNING		1,2	4	3,5,6
MISSION REVIEW	8,9,10,11,13,15,16,17,20,21,22,27,28,29,30,31,32,33,34,35,36,37			7,14,18,19,23,24,25,26,38,39,40,41
CLOSING				42,43,44

By making use of the above table results and formulas presented in [Crouhy *et. al.*;; 2014]

$$\text{Total risk} = \sum E_i(Pi, Ii) \qquad \text{(Eq. 3.1)}$$

Where:

Pi- probability that i risk occurs

I i – *Average* impact that the occurrence of a risk would have in terms of time, cost and quality.

i-The risk that is possible to occur for a specific life-cycle stage or type of risk

we have the following calculations.

Total technical risk=

$\sum E_i(P,I) = P_8 * I_8 + P_9 * I_9 + P_{10} * I_{10} + P_{11} * I_{11} + P_{13} * I_{13} + P_{15} * I_{15} + P_{16} * I_{16} + P_{17} * I_{17} + P_{20} * I_{20} + P_{21} * I_{21} + P_{22} * I_{22} + P_{27} * I_{27} + P_{28} * I_{28} + P_{29} * I_{29} + P_{30} * I_{30} + P_{31} * I_{31} + P_{32} * I_{32} + P_{33} * I_{33} + P_{34} * I_{34} + P_{35} * I_{35} + P_{36} * I_{36} + P_{37} * I_{37}$
=

0.56+0.4+0.4+0.03+0.12+0.4+0.035+0.24+0.56+0.06+0.03+0.12+0.4+0.06+0.03+0.4+0.12+0.1+0.12+0.56+0.06+0.03=4.835

Total External risk= $\sum E_i(P,I) = P_1 * I_1 + P_2 * I_2 =$ 0.4+0.12=0.52

Total Organizational risk= $\sum E_i(P,I) = P_4 * I_4 =$ 0.56

Total Project risk=

$\sum E_i(P,I) = P_3 * I_3 + P_5 * I_5 + P_6 * I_6 + P_7 * I_7 + P_{14} * I_{14} + P_{18} * I_{18} + P_{19} * I_{19} + P_{23} * I_{23} + P_{24} * I_{24} + P_{25} * I_{25} + P_{26} * I_{26} + P_{38} * I_{38} + P_{39} * I_{39} + P_{40} * I_{40} + P_{41} * I_{41} + P_{42} * I_{42} + P_{43} * I_{43} + P_{44} * I_{44}$

= 0.56+ 0.035+ 0.24+ 0.56+ 0.06+ 0.03+ 0.4+ 0.12+ 0.06+ 0.24 +0.4+0.12+0.06+0.12+0.56+0.06+0.03=3.655

In concluding the risks that are more probable of happening in B.H & S.B Ltd project during whole lifecycle, ranked in descending order are: technical risk (4.835); External risk (3.655); Project risk (0.56); Organizational risk (0.52).

3.2.3. PERT Technique

We have used PERT technique to evaluate time risk performance of our firm, given that is one of most common used analysis in risk assessment [Fraser & Simkins, 2010]. *All our calculations on implementing PERT in this section are based on formulas presented in* [*Fraser & Simkins,2010]*.

In below table, based on interview responses of B.H & S.B Ltd project managers, there are evaluated that pessimistic time, expected time and optimizing time of finishing each of four steps of project management,

Table 8. Time of activities (in month) during project life cycle, pessimistic, optimistic and expected time

PROJECT LIFE CYCLE STATE	Pessimistic Time	Expected time	Optimistic Time
PLANNING	15	11	10
INITIATION	10	7	5
DEVELOPMENT	19	20	50
CLOSING	10	8	5

Where:

Pessimistic Time- the longest period that a project stage may need in order to finish

Expected Time- the normal period that a project stage may need in order to finish

Optimistic Time- the shortest period that a project stage may need in order to finish

In order to be able to evaluate PERT time, it is necessary to calculate for every project stage two main indicators: average and variance.

Formula for calculating average time of concluding each project stage is:

$$t = \frac{(a + 4m + b)}{6} \qquad \text{(Eq. 3.2)}$$

Where-

t- Average time of concluding each project stage

b - Pessimistic time

m- Normal time

a- Optimistic time

Formula for calculating variance of time of concluding each project stage is:

$$\sigma^2 = \left[\frac{(b - a)}{6}\right]^2 \qquad \text{(Eq. 3.3)}$$

Where-

σ^2- Variance of time of concluding each project stage

b - Pessimistic time

a- Optimistic time

If we apply the above formulas, for each project stage we would have:

Table 9. Time of activities (in month) during project life cycle together with PERT time and variation times

PROJECT LIFE CYCLE STATE	**Pessimistic Time**	**Expected time**	**Optimistic Time**	**t**	σ^2
PLANNING	15	11	10	11.50	0.69
INITIATION	10	7	5	7.17	0.69
DEVELOPMENT	19	20	50	24.83	26.69
CLOSING	10	8	5	7.83	0.69

For the whole project, the evaluated expected finished time and variance is calculated according the following formulas:

$$T_M = \sum_{i=1}^{N} t_i \qquad \text{(Eq. 3.4)}$$

Where-

T_M- expected finished time for the whole project

t_i - Average time of concluding each project stage

$$\sigma^2 = \sigma_{ti}^2 \sum_{i=1}^{n} \sigma_t^2 \qquad \text{(Eq. 3.5)}$$

Where-

σ^2- expected variance of time for the whole project

σ_t^2 - Variance of time of concluding each project stage

If we apply the above formulas we would have for the subject under analyze:

T= 11.50 + 7.17 + 24.83 + 7.83 = 51.33

And

σ^2 = 0.69 + 0.69 + 26.69 + 0.69 = 28.78, standard deviation is: σ_T= 5.364

According to above PERT techniques results, average time of concluding a construction project from B.H & S.B Ltd is 51.33 month and this time it is possible to vary:

$$51.33 \mp 5.364 = \;]51.33 - \; 5.364; \; 51.33 + \; 5.364[= \;]45.97; \; 56.70[$$

Of course, it is logical that the above calculations need to be statistically proved. In order to do so, we have exploited the normal distribution approach. According this approach, the probability for total finishing time of projects undertaken from B.H & S.B Ltd; to be less than times calculated as above from PERT analysis, is calculated according the following formula:

$$P \{T \leq T_s\} = P \{Z \leq (T_s - T_M)/\sigma_T\} \qquad \text{(Eq. 3.6)}$$

Where:

$P \{T \leq T_s\}$ - probability for total finishing time of projects undertaken from B.H & S.B Ltd; to be less than times calculated as above from PERT analysis.

Z- Standatized variable with normal distribution.

If we apply the above formula for our case data, we would have:

$$P \{T \leq 51.33\} = P \{Z \leq 1.96\}$$

If we refer to statistical tables, for Z= 1.96, the corresponding probability is: 95%.

In the end we evaluate that with probability 95%, we can state that average time of concluding a construction project from B.H & S.B Ltd is 51.33 month, with a standard deviation of 5.364.

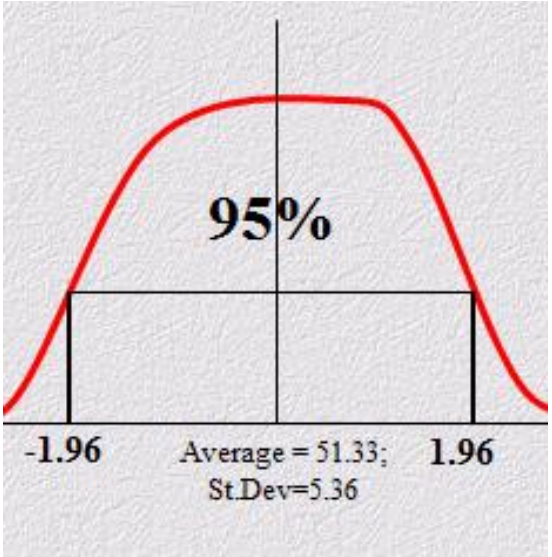

Figure 12. Normal Distribution of the Probability

3.2.4. B.H & S.B Ltd Errors in the Second Step of Project Risk Management

- ✓ Usage of "Exemption from the rule"

Deviation from the protocol was only justifiable under the existence of a clause: the case of exemption from the rule. This clause came to be used whenever a critical risk level was evidenced. What is punishable here is not the use this rule, but its use it as an excuse for not to manage the eventual risks.

- ✓ Support to the previous results

To undertake construction project under similar conditions appears to have been important for engineers in B.H & S.B LTD. because it meant that the forces acting on the project were on their range of experience and can be managed with existing data. The successful completion of first life cycle stages of project added superiority to historical data, ensuring that these are acceptable interval even for future projects. Managing projects with acceptable risk culture became the norm in the B.H & S.B LTD.-s

- ✓ Risk quantification

Management made a decision to seek concrete evidence of the existence of risks. This handicap was further extended when engineers had not statistical training to enable such a thing. This led to the decision under irrational judgments. The fact that for a risk may be impossible to be quantified gives management an alternative to ignore and manipulate risks according to equivocal interpretations. On the other hand the fact that for a risk may be impossible to be quantified it doesn't mean that it does not exist.

And when there is no need for quantification to evaluate the real effect of a risk, again B.H & S.B Ltd. ignores it.

3.3. Step 3 of Project Risk Management: Risk Mitigating Strategy

3.3.1. Risk Response

The following table presents the real answer of B.H & S.B Ltd.'s to all risk factors. The point is not in their listing and demonstrative value, but on the understanding that B.H & S.B LTD. has devoted efforts toward all risks identified in the first phase. Given that it failed in the second stage, it didn't take advantage on the filtering of these risks, in the third stage of construction project risk management unnecessary costs and confusion emerged. Data were taken from interviews of B.H & S.B Ltd.'s project managers.

Table 10. Risk identification and response

Project diffraction structure		**Type of risk**	RESPONSE	
			Response Type	Description
PLANFICATION STAGE	The identification of opportunity to initiate a new mission	Misconception of opportunism features	Risk Acceptance	The pursuit of internal objectives, no matter how they find an echo outside the organization
		Failure to provide the support of stakeholders	Risk mitigation	Negotiations on win-lose positions with contractors (Construction Company abandoned security standards in order to gain financial support)
	Defining the objectives of the mission	Lack of cooperation among stakeholders of the project	Risk Acceptance	Pursuit of bureaucratic practices despite the urgency of the presented risks
		Limitations in resources	Risk mitigation	Negotiations with stakeholders
	Creating Mission Management Team for that particular mission	Members do not have sufficient knowledge or experience	Risk Acceptance	They yielded to the fact that managers do not quantify the risk as it was not in their domain
INITIATION	Conference to discuss new current of future anomalies	Loss of control over project	Risk Acceptance	They did not classified it as real risk
M	Up-date of the unsolved	Impossibility of finding the cause	Risk mitigation	Calculations and inspections performing

I S S I O N R E A D I N E S S R E V I E W	problems of the Pre-Project Review	of the problem		
	Status of project implementing campaign	Security risk	Risk mitigation	Parts are periodically controlled
		Technical risk	Risk mitigation	Parts are periodically controlled
	Status of unique infrastructure needed for the project	Security risk	Risk mitigation	Parts are periodically controlled
		Technical risk	Risk mitigation	Parts are periodically controlled
	Annexes of project and dislocation status	Security risk	Risk Transferring	Parts are periodically controlled
		Technical risk	Risk Transferring	Parts are periodically controlled
	Construction machineries consumption, energy and mass margins on start	Exceeding the budget limit	Risk mitigation	Negotiations with stakeholders
	Compilation of project interface	Failure in performing their function	Risk Transferring	Interface compilation done by contractor
	Security status of the project (PFRs, deviations, ensuring	Security risk	Risk mitigation	Parts are periodically controlled
		Technical risk	Risk mitigation	Parts are periodically controlled

	product and the risk of the mission statement]			
	Payload readiness for starting (instrument to instrument reports of performance issues, actions readjustment, unclosed problems, the status of interfaces and integration)	Delays in the schedule	Risk mitigation	Complex software controls a large number of parameters details. If a malfunction is detected the system provides correction signal, if not continue with monitoring.
	The device readiness for project starting	Delays in the schedule	Risk mitigation	Complex software controls a large number of parameters details. If a malfunction is detected the system provides correction signal, if not continue with monitoring.
	The status of preparedness of the facility control and project schedule	Security risk	Risk mitigation	Parts are periodically controlled
		Technical risk	Risk mitigation	Parts are periodically controlled
	Status of controlling	Failure to support	Risk	Continuous control

	interfaces integrated to project	the launch	mitigation	
	Security	Default in fulfilling predefined standards	Risk Avoidance	Change of risk parameters to pursue the original objectives
	Summary of product security of project	Problems of communication connections	Risk Acceptance	Pursuit of bureaucratic practices despite the urgency of the risks presented
		Difficulty in synthesizing skills	Risk mitigation	Team meeting for discussion
	Plan of scientific operations and scientific centers	Failure in the data supporting	Risk Acceptance	Surrender to the fact that a fundamental risk (project correlation resistance - weather] cannot be quantified
	The status of the mission design (conformity with the requirements of the project)	Security risk	Risk mitigation	Parts are periodically controlled
		Technical risk	Risk mitigation	Parts are periodically controlled
	Status of Mission operating system (MOS)	Security risk	Risk mitigation	Parts are periodically controlled
		Technical risk	Risk mitigation	Parts are periodically controlled
	Status of Administrative System (Restitution of	Security risk	Risk mitigation	Parts are periodically controlled
		Technical risk	Risk mitigation	Parts are periodically controlled

	scientific data)			
	Operating system status	Security risk	Risk mitigation	Parts are periodically controlled
		Technical risk	Risk mitigation	Parts are periodically controlled
	Proceeding tracking and status of connectivity and communications	Failure in performing their function	Risk mitigation	Providing support with backup equipment
	Status of Project Communications Network	Security risk	Risk mitigation	Parts are periodically controlled
		Technical risk	Risk mitigation	Parts are periodically controlled
	Criteria Start-Do not Start	Problems of communication connections	Risk Acceptance	Pursuit of bureaucratic practices despite the urgency of the risks presented
		Difficulty in synthesizing skills	Risk mitigation	Team meeting for discussion
	Summary of providing command and statement of access to MOS risk	Problems of communication connections	Risk mitigation	Pursuit of bureaucratic practices despite the urgency of the risks presented
		Difficulty in synthesizing skills	Risk mitigation	Team meeting for discussion
	Formal verification of	Delays in the schedule	Risk mitigation	Setting the schedule as the winner in all kinds of compromises during the

C L O S U R E	contractors Readiness			project life
	Certification of specific project element form managers	Delays in the schedule	Risk mitigation	Setting the schedule as the winner in all kinds of compromises during the project life
	Certification from the program manager	Delays in the schedule	Risk mitigation	Setting the schedule as the winner in all kinds of compromises during the project life
	Review reporting results of the project readiness on level I		Risk mitigation	Setting the schedule as the winner in all kinds of compromises during the project life

Let's see now risks respond only to those risks which have resulted important in the second step according to the analysis carried out by us.

Table 11. Risk Response only toward most important risk

Security risk	Risk transfer	Parts are controlled from suppliers
Delays in the schedule	Risk mitigation	Setting the schedule as the winner in all kinds of compromises during the project life
Limitations in resources	Risk mitigation	Negotiations with stakeholders
Failure to provide the support of stakeholders	Risk mitigation	Negotiations on win-lose positions with contractors (up security was removed to gain financial support)
Lack of cooperation among stakeholders of the project	Risk acceptance	Pursuit of bureaucratic practices despite the urgent risks presented

Failure to support the launch	Risk mitigation	Continuous control
Impossibility of finding the cause of the problem	Risk mitigation	Performing calculations and inspections

It can be deducted that the answers to respond to most important risks were: risk mitigation. But, lack of cooperation, is accepted which leads to higher risks management in terms of cost, quality and time performance objectives. .

For risks that are followed mitigation strategy will build contingency plans.

3.3.2. Contingency planes

The next step is to identify contingency plans in case of risk happens.

Table 12. Contingency Matric

RISK	RESPONSE	CONTINGENCY
Delays in the schedule	Risk mitigation **(Trade off)**	Provide extra resources (human)
Limitations in resources	Risk mitigation **(stakeholder)**	Finding new missions, alternative-to-use resources
Failure to provide the support of stakeholders	Risk mitigation **(contractor)**	Finding new missions, alternative-to-use resources
Lack of cooperation among stakeholders of the project	Risk mitigation **(control)**	Provision of spare equipment
Failure to support the launch	Risk mitigation **(inspective)**	Benchmarking with companies outside the industry

3.3.3. B.H & S.B Ltd Errors in the third step of project risk management

- ✓ Institutional pressure

Members of B.H & S.B Ltd.'s were under pressure to resolve problems internally instead to escalate them to the chain of command. Managers were afraid to inform higher levels than they had problems, even when problems exist.

- ✓ The blind pursuit of a target

On the third level of risk management mitigation techniques are forecasted. In reality, only risks acceptance techniques were implemented because of objective of not delaying schedule.

- ✓ Ignoring the signals Step 3 was failing

In a memo between a sub-contractor with B.H & S.B Ltd.'s representatives was written: "I have found that we have 20 problems on table, 11 were opened during the past month, 13 have been active for more than 6 months, one for more than 3 years, two for 2 years, and only was 1 closed during the past six months. As you can see our closing records are very poor. "
This came as a result of the decision chain mismanaged.

- ✓ Re-run of previous steps

B.H & S.B LTD. was forced to take a risk management decision, but it kept repeating the second step to find evidence to justify the initiation of the project.

3.4. Stage 4 of Project Risk Management: Control And Documentation to Respond To Risk

This was the well-managed step in the whole process. B.H & S.B Ltd. was estimated to have a documented copy of all events (and even informal memos). Its risk register, as was previously noted, has identified risks, including descriptions, categories, impact and emergency plans. What is missing it is an estimate of the probability due to lack of feasibility of performing measurements.

Step 4 is combined with step 1, and assists to step 1 of future projects.

CHAPTER 4

CONCLUSION

4.1. Thesis Implications

The crucial aim of this thesis is not to suggest an innovator risk management process, nor to give general concussions regarding risk management in construction project in Albania. The crucial aim of this thesis is to analyze in depth a mismanaged project in a concrete construction company as a consequence of improper and errors in risk management process.

Why was this theme chosen?

The motive behind this decision is because in this work was attempted to verify how does a concrete construction company applies project risk management process in *reality*, and how it *should* apply it according guiding principles of modern literature. By following this methodology, this work will attempt to represent main sources of error that the chosen company exhibit in a specific project as a consequence of inappropriate and insufficient project risk management.

Which is the main value of this thesis?

This thesis has showed how a company may be pass through detailed scanning and: (1) detect its errors in managing project risk, (2) attempt to follow a more scientific and professional approach toward risk managing. The benefit from this thesis is that it arguments and justifies the potential advantages of a formalized, scientific risk project management in a step by step approach that may be followed through whole life – cycle of the project.

Instruments used here and the step by step technique of managing project risk, have many applications and may be used by other companies that are facing projects that fail in accomplished the desired objectives. In this way the team of managers project will improve their decision-making.

4.2. Conclusions

B.H & S.B Ltd. was chosen in this thesis to serve as singular analysis unit, in order to study project risk management in construction industry. The reason why is chosen this methodology is that it enables for in depth analysis. We have followed a "step by step approach" in order to analyze how B.H & S.B Ltd is able to successfully manage each step of project risks.

In the end it resulted that this company had several mistakes in each step of project risks management process. The real value of this research is not to evidence a bad example of project risks management process; but to demonstrate a valuable approach of managing risk step by step by presenting how scientific methods and methodologies may apply in real life examples in order to successfully achieve project risk management.

This interesting case resulted valuable, given that as one of the oldest construction firms in Albania it has one of the most sophisticated apparatus of risk managing. But after all, it became subject of one of the most failed constructions in the history of construction industry in Albania.

We believe it was be useful to review the hidden after the accident, to provide real world experience in the treatment and management of the project. After we applied step by step scientific method of risk managing and compared it with the real management, gaps were identified. In the following figure, it can be concluded which are the gaps and errors of this construction firm in managing its construction projects risk.

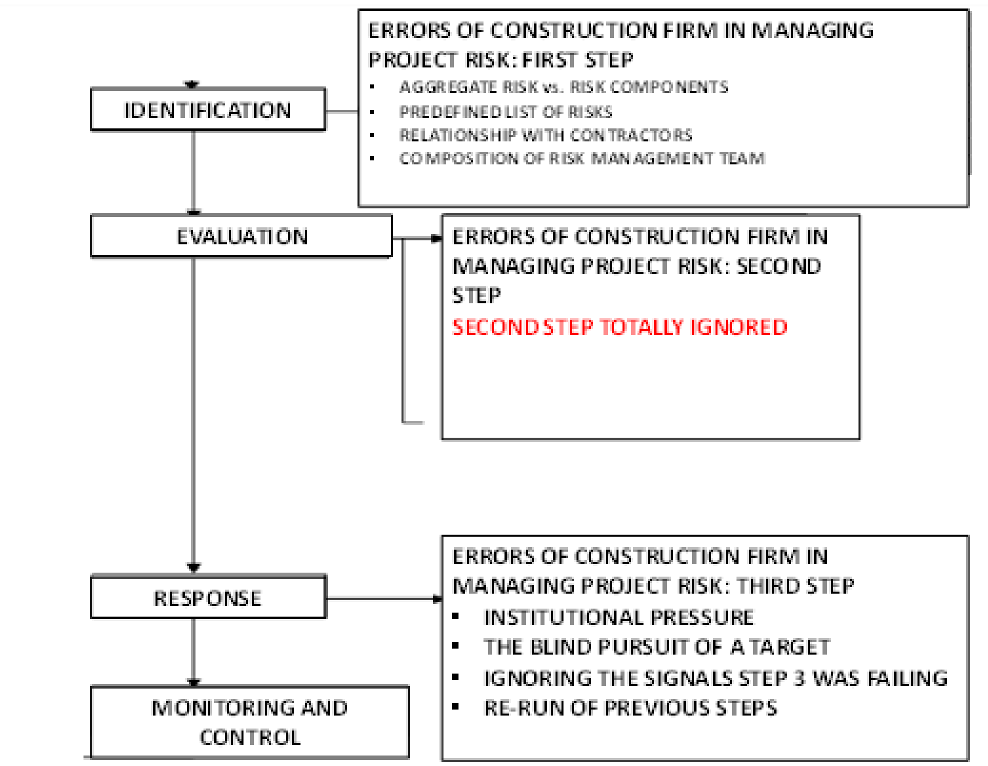

Figure 13. Construction project risk management errors in each step

Research conclusions will be based on thesis objectives:

[1] To identify and categories risk types with which B.H & S.B Ltd is confronted during management of projects in whole lifecycle,

In the result chapter we have argued that B.H & S.B Ltd is confronted with four risks: technical, organizational, project related risks and external risks. In the research all these types of risks are concretized, detailed, and classified according three stages of project lifecycle.

[2] To evaluate the general level of insecurity and risk with which B.H & S.B Ltd is confronted,

In risk evaluation, in this research are used several procedures and advanced types of analyses: (1) Probability and Impact Analysis (each risk is classified according two criteria: impact and probability; and then plotted in time, cost and qualities matrix by identifying major risks), (2) Risk Load Quantitative Assessment, (3) PERT analysis.

[3] to measure identify and evaluate risk Mitigating Strategy that B.H & S.B Ltd uses during different stages of project management during its lifecycle.

For each risk identified in first step of risk management (first objective), was identified response type and description of the strategy of response. Furthermore a Contingency Matric was constructed based on gathered data.

Some other conclusions are:
B.H & S.B Ltd has simplistic methods of risk managing, which is focused mainly in risk identification and response by totally surpassing importance evaluation of risk.

- *B.H & S.B Ltd has* the tendency to evaluate risk management of each construction as a whole result and not one by one evaluation for each individual risk.
- Register of risks is a valuable tool for registering and keeping record of potential risks for construction models, but *B.H & S.B Ltd* has the tendency to use it as a predefined list of risk in spite of using it just as a base of reference.
- *B.H & S.B Ltd* used risk responsibility delegation as a risk response strategy.

- *B.H & S.B Ltd* completely ignored second step of risk management, which consequently it didn't take advantage on the filtering of identifying risks, by causing unnecessary costs and confusion in managing each of the risks and neglecting most important ones.
- Sometimes *B.H & S.B Ltd* may neglect important risks by following only one performance objective.

4.3. Recommendations for B.H & S.B Ltd

Given the above conclusions we can raise the following recommendations that are directed toward B.H & S.B Ltd., but of course may serve as lessons for other companies trying in managing project risk.

- B.H & S.B Ltd. , should immediately integrate scientific qualitative and quantitative methods of project risk management in their total system of construction project risk management.
- In choosing and developing risk response strategies B.H & S.B Ltd., should prioritize risks according most important performance objectives: time, cost and quality.
- During risk response step B.H & S.B Ltd., should balance attendance of several performance objectives simultaneously and should follow stakeholder's interest without compromises.

There are so many recommendations for construction firms emerging from this thesis but the above are the most important ones.

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APPENDIX A

QUESTIONNAIRE

EPOKA UNIVERSITY

INTERVIEW FOR ASSESING CONSTRUCTION RISK MANAGEMENT

Name of Organisation: ______________________

PART ONE: RISK IDENTIFICATION ASSESSMENT

1. Does the risk identification process include a method to identify a priority for the project? Please Explain in Detail.

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2. Are best practices and lessons learned being used to improve risk identification? Please Explain in Detail.

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3. Is there a process in place for the continuous improvement of the qualitative risk management process? Please Explain in Detail.

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MASTER THESIS

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4. Is there an improvement process in place to continuously improve risk identification to completely identify all risks as early as possible? Please Explain in Detail.

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PART TWO: RISK EVALUATION ASSESSMENT

5. Does the organization have a documented process for identifying project risks? Please Explain in Detail.

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6. Do project managers informally use scope statement and project milestones to help evaluating project risks? Please Explain in Detail.

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MASTER THESIS

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7. Do risk discussions typically take place when the risk is already a current problem versus a future possibility? Please Explain in Detail.

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8. Are all processes in place, documented and being used? Please Explain in Detail.

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PART ONE: RISK ANSWERING ASSESSMENT

9. Does the project team examine the procurement management plan and staff management plan to help answer risks? Please Explain in Detail.

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MASTER THESIS

10. Do project team members rarely suggest potential risks responses to the management or stakeholders? Please Explain in Detail.

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11. Does documentation exist on all processes and standards for answering risk events? Please Explain in Detail.

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12. Does the process include efficient avenues for teams to answer risks (checklists, automated forms, etc.)? Please Explain in Detail.

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PART ONE: RISK MONITORING ASSESSMENT

13. Are project team discussions on risk sporadic and informal? Please Explain in Detail.

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14. Is the risk monitoring process fully integrated with cost management and time management processes and the project office? Please Explain in Detail.

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15. Is the process of monitoring considered as standard only for large, highly visible projects? Please Explain in Detail.

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16. Is the process of monitoring encouraged for all projects? Please Explain in Detail.

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17. Does the organization have a documented repeatable process for evaluating project risks which is fully implemented? Please Explain in Detail.

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