Impact of risk analysis related to time, quality and cost in construction projects

Master thesis

International Master of Science in Construction and Real Estate Management

Joint Study Programme of Metropolia UAS and HTW Berlin

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Hochschule für Technik
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Conceptual Formulation

Master Thesis for Mr. ADONIS MUSTA

Student number 1700201/ 557531

Topic: ***"Impact of risk analysis related to time, quality and cost in construction's projects"***

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1. *Area of interest and proposed title:*

This research will focus on project management in construction industry, and to define how several aspects of project management such as timing, scheduling, type of contract will affect the process of cost estimating and the entire budget of the project, which are major risk assessments to take in considerations when one of the above aspects is not accomplished according the project's requirements.
Title proposed for this research will be:
"Impact of risk analysis related to time, quality and cost in construction's projects"

2. *Reason for choosing this topic:*

Construction management is about controlling time, money and quality and producing work in a safe manner. Another aspect has been added recently, risk analysis as a process of identifying the uncertainties.
Construction is a competitive industry, related with a dynamic process, and each construction company is requiring efficient techniques and methods, which allow to maximize the quality of the buildings (projects), in same time to reduce the time of completion of the project (each phase), also to minimize the cost of construction.
Nowadays, each construction company wants to reach the maximum level of satisfaction for the client, in same time because of competitiveness of the market compromise between time, quality or cost are not accepted, there is a significant increase of demands and performance and the statement "high quality-high prices" has been considered not an appropriate solution.
For that reason, they are pushing the project managers to embrace and to develop methods, through risk analysis, that keep the right balance between time, cost and quality.
In my opinion, always there is a need to focus on aspects of project management, as a process that is present during all life cycle of the building, to define the relationship between several aspects, to understand how the construction's companies operate now, how those techniques affect the cost of the project, how a project manager through risk assessment methods anticipate and handle different issues concerning budget, how we can improve those techniques.

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3. ***Objectives of the research***

The main objective of this research is to give an explanation how the implementation of risk analysis affect the balance of time, quality and total costs. How risk analysis can help us to obtain the optimal balance between time, quality and total costs?

This research will be focused on how new techniques of planning and risk analysis have changed the way of planning, what are their advantages/ disadvantages and their trends.

Through different analysis from real information and cases, and a process of comparison the objectives is to give an answer for the differences in total costs when risk analysis are applied and when not, to give an answer for the right method to use in different situations in order to get the optimal balance time, quality and costs.

4. ***Questions to be answered for this research are:***

1- Which are most dominant factors that affect the budget of the project
2- How the risk management methods and risk analysis affect project duration, quality and total costs.
3- Which are the differences in total cost of a project when risk analysis are applied and whene are not
4- How timing,quality and the type of contract affect the budget of the project
5- How to create a good balance between quality, and cost of the project
6- What techniques are advisable for the project manager to maintain the quality and in same time to minimise the budget
7- Which are the trends in construction management related to cost-effective and timely construction

5. ***the key findings of research up to now in the area of your proposed topic***

This research will focus on time, quality, costs, and risk analysis taken in consideration in construction. The main purpose of this research is to define a suitable method used in construction, which make possible to obtain the optimal balance time, quality, costs. Is it possible to manage the construction's project in that way to minimize time and costs but in the same time without affecting the quality.

How are developed the techniques of risk analysis, and which are nowadays trends related to cost-effectively, which is the impact of risk analysis illustrated by real data, collected from real construction's company, how the implementation of risk analysis has changed the way of thinking and planning for the project managers.

6. *Methodology and plan to use in conducting the research:*

This research will be developed based on different literature, also risk analysis and other planning techniques related timing, quality and cost will be made from real collected data, from different construction's companies, real cases, minimum two construction projects. Those data are to be collected from German construction companies, developing a comparison process, to understand how different companies have operated in different situations related timing, costs and quality, which were risks taken in consideration from them.
Qualitative and Quantitative analysises will help to create a relationship between the most important factors of construction planning and management such as time, quality and total costs. To understand how timing and quality's requirements affect the total cost and how risk analysis interfere to eliminate uncertainty related to cost estimating process.
Due to this comparison process, trying to understand which is the suitable method to maximise time and quality but in the same time to keep the cost of project under budget, which are some risk analysis to take in consideration.
Note: In case that is impossible to reach real information from German companies, because of sensitivity of the information and the policy of the companies, information for Albanian construction companies is going to be used, information such as (price and costs for entire construction or specific elements, duration and type of the contract, risk analysis that has been taken in consideration during phase of project planning).

7. *Literature*

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Signature of the Supervisor
12.12.17

Abstract

This master thesis deals with risk management and their impact during the implementation of the construction projects. It illustrates the risk management process and how the risk impact analyzes can affect the mitigation process of risks without affecting the scope of the project composed of three main components such as costs, time and quality.

It is well known the relationships between costs, time and quality and how they can influence each other during the realization of the construction projects, many construction projects have faced the accomplishment of one or two objectives but could not achieve all of them, for instance there are many construction project that are delivered according to the predetermined quality but in same time they face scheduling problems, delays or costs problems.

The main aim of this thesis is to find a relationship between risk impact analysis and the settled objectives of the project and how the understanding of this relationship can help to improve to determine the priorities among several objectives during the implantation of the project.

This thesis aims to emphasize the recognition of Risk assessment and management as a powerful tool for improving the process of delivering construction projects, minimizing the uncertainties and maximizing the opportunities that might be developed under certain circumstances.

A case study methodology approach was adopted to be able to achieve significant results that support the aim of this thesis, by elaborating two case studies and exploring the risk management techniques used by two companies in Albania, to understand how is defined the accurate strategy to support the accomplishment of the objective of the project.

A simple numerical method for risk impact quantitative approach is proposed, a method that easily can be applied during the risk management process, that might improve the techniques and the process of risk analysis and giving a proper weight to the expected impact that each identified risk might have on the scope of the project.

The focus of proposed method to define the weight of risk impact and risk probability of risks and expressing their impact on the possibility or ability to influence or change

the settled objectives such as costs, time and quality. A huge attention is paid to risk identification and analyze as the two main phases of the risk management, due to the outcome of these two phases is determined and developed the entire strategy of dealing, monitoring and controlling the risks.

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List of Abbreviations

CPM	Critical Path Method
GDP	Gross Domestic Product
PM	Project management
RBS	Risk Breakdown structure
RM	Risk Management

1. Introduction

Nowadays the dynamic of the economy in every sector is becoming more than ever demanding, the level of competition is very high, and the construction industry is not part of an exception. The construction industry is adapting to the changes and demanding of the economy, clients and organization approach to delivering a construction project is changing over time.

Private or public organizations, owners, clients are asking more than ever for a guaranteed success before deciding to invest or fund a project. This specific request is related to the past and gained experience in the construction industry, where the relationship between success and failure is extremely close. There is a difficult process to deliver a successful project in construction and in the other part, it is easy to list a project as a failure, because of the amount of the objectives and goal that a project should meet at the end.

A successful project, independently the type of the project or organization, is considered when is delivered according to predetermined budget, time and quality. The accomplishment of these three aspects, that compose the scope of the project, is a complex process because of the amount of the risks associated with any of these three components.

Construction projects are associated with risks, typology and the source can differ from country to country or organization to organization but there is a high probability that every type of project in construction has its own risks during the development.

The motivation for pursuing this study is to give an overview of how different risk affects a different aspect of the project by leading to unexpected changes to the scope and objectives of the project. Through different statistical analysis, it is easy to understand that companies which apply a proper risk management have a better performance than the organization who do not have an accurate strategy in dealing with and managing the risks.

Many organizations struggle to deliver their project according to the schedule, causing delays, which usually are associated with a cost overrun or other undesired actions such as claims, penalties, legal and technical problems etc.

This work will focus on treating a problematic approach that private organizations usually face when they create the risk management process, many cases not efficient, leading to delays and cost overrun. It is well known that construction projects involve different organizations, people and in many cases the participants do not share the same objectives or same approach to risks.

There is an increasing need to build an integrated risk management process, involving every stakeholder, to maintain the same approach and scope during the development of the project.

Organization for other industries such as manufacturing has embraced before the role and the importance of risk management, have created and established a fluid process and strategy on dealing and managing the risks by giving a specific focus to risk management team. Construction industry should improve the approach because the focus is on a budget, time, quality without trying to understand the sources of the risks that affect the accomplishment of the project scope.

1.1 Background

The construction sector has been the leader of the economy for many countries and giving a huge impact on the society such as being a sector that offers a great opportunity for jobs, for skilled and unskilled labors contributing in decreasing the level of unemployment.

According to INSTAT (2015), in Albania, the contribution and the impact of the construction sector is more crucial because of the weight of this sector in the overall GDP (Gross Domestic Product) being the third after service sector and agriculture. Based on INSTANT the construction sector composes 14,9 % of GDP.

Table 1 1 Economical components of Albania's GDP

Economy	GDP
Service Sector	47.3%
Agriculture Sector	18.3%

Construction	15.2%
Industry	9.8 %
Transport	9.4 %

Although the development and role of the construction sector in Albania's economy, the industry performance according to many experts is very poor, for many reasons such as political, legal and technical etc.

According to (KEÇI, 2017) reasons that many projects, specifically infrastructure project funded by the government, fail to achieve their scope because of the high political influence, limited funds and lack of experience to establish a risk management process to define accurate tool or technique that it fit the objectives of the project.

(Kartam N.A and Kartam S.A , 2001) report that the construction industry is exposed not only to the risks associated with construction process but also is exposed to the external risks such as political, economic (inflation) etc.

It is widely accepted that every construction project has a certain level of risk and uncertainty, independently the size of the project or the structure of the organization, but the impact that risk is somehow in a proportional relationship with the size of the project, for example in a large-scale project risks and their impact are higher than a small-scale project.

According to (PMBOK, 2008) the project management team should be able that through different tools, a technique to fulfill the demands and objectives of the project. Risk management is considered as an important phase during the project management process, to identify, analyze and to prepare a risk response plan for potential risks.

(Kerzner, 2009) believes that improving the process of risk management can lead to an optimization of delivering the project and in the same time can help to build a stable process without avoiding or changing the scope of the project, avoiding time and cost overrun or low quality.

1.2 Problem statement

It is not realistic to consider a construction project with no risk. The risk is present in most of the type of activities that comprehend a construction project. Based on

(Loosemore M, Raftery J, Reilly C and Higgon D, 2006) it is the presence of the risks that influence the non-accomplishment of objectives of the project leading to a poor performance regarding the triple constraint of cost, time and quality.

(Kerzner, 2009) enforce this idea that the presence of risks and uncertainties during the development of the project affect the objectives of the project, creating a complex situation and the decision-making process very difficult.

According to (DERVISHI, 2015), there is a considerable number of projects in Albania that are listed as a failure or they face different changes of the project objectives, resulting with time and cost overrun low quality. (DERVISHI, 2015) emphasizes that among many reasons of project scope failure can be listed as important the lack or poor experience on building a stable risk management process, many cases it is noticeable that risk response plan is based on reactive actions and decisions and not proactive.

This systematic approach of dealing with risks and uncertainties in a reactive way lead to cost and budget, time overrun, low quality and in the overall low performance of delivering the project.

(PMBOK, 2008) give the recommendation that risk management should be an integral part of project management process, as the only technique or tool that can help to identify, analyze and to prepare an accurate risk response plan to manage the risks.

Construction industry involves many risks and uncertainties comparing to other industries because of large number of people involved in the project, the number of funds required to be completed, legal and technical restrictions etc.

Although the higher probability of the presence of risks, construction industry it seems to a step behind other industries on the approach of dealing the risks, for example, manufacturing industry has already a risk management more efficient.

It is the duty of the participants in the construction industry such as client, contractors, designers and project managers to develop a risk management process that is led by the proactive approach, to avoid the changes or non-accomplishment of the project scope, avoiding cost and time overrun. According to (Kerzner, 2009) a risk management process can be improved only once the project management and other stakeholders face new challenges, by changing the approach, building a stable process, and involving all participant in this process.

This study will focus on this challenge, to identify the practices of risk management in the construction industry in Albania and to understand how is modeled in practice risk management and what are potential consequences related to cost, time and quality.

1.3 Aim and Objectives, research questions

1.3.1 Aim

The main aim of this study is to assess the impact of risk analysis and risk management practices in Albania to create a critical approach of the way of managing risks, to illustrate the benefits or consequences of risk management process related cost, time and quality.

1.3.2 Objectives

The settled objectives for this study are:

1- To give a clear explanation of how the implementation of risk assessment and analyze can affect the balance of three main objectives of a construction projects such as cost, time and quality.
2- To illustrate if risk analyzes can improve the process of finding the proper balance between costs, time and quality.
3- To illustrate the importance of associating the potential risks with the accurate impact and probability, risk exposure and how this influence on defining the right risk management strategy.

1.3.3 Research questions

To achieve the aim of this research were drawn the below questions:

1- Which are the most dominant factors that affect the balance of construction project objectives?
2- How the risk management methods and risk analysis affect project duration, quality, and total costs?
3- Who is the most common risks identification and assessment techniques and how they affect or change the determination of the objectives of the project?

4- How to minimize the uncertainties and maximize the opportunities during the realization of the construction projects.

1.4 Significance of Study

The scope of the project composed by triple constraints such as cost, time, quality can be achieved more efficiently with the implementation of an accurate risk management process. Risk and uncertainties are the main causes of the deviation from the objectives of the projects for that reason there is a need to provide a critical approach to various risk management practices.

This work seeks to provide practical cases of risk management, how efficient different techniques are, and what it will be an optimization technique that leads to a better result regarding costs, time and quality.

This work will help to understand how it developed a risk management strategy on construction projects in Albania, what is the impact of risk analyses in a construction project. To determine the weak points of the risk assessment and to define a clear relationship between these defects and the consequences that are applied in such cases.

This study can be a motivation for another researcher to focus on this area, to develop a clear strategy, to minimize the gap between theoretical and practical construction risk management.

1.5 Methodology

The methodology in conducting this study will consist in the quantitative method. Data will be collected through different textbooks, previous research work, internet, research paper also through interviews with project managers for practical case studies.

It will be gathered a specific information related to the scope of the project and the relationship between risk management and costs, time and quality. Through this theoretical part will lead in understanding the gap between theoretical and practical part of applying risk assessment.

1.6 Limitations of the study

Although the desire it is unrealistic to study and to focus on everything, for that reasons this work will consider as main objectives of the construction project only three aspects such as costs, time and quality. The other goals such as environmental and sustainability requirements, safety, technological such as the application of different software will not be considered during the development of this study.

Also, this study will not take in consideration the maintenance and operational phase of a construction project as it is considered a phase free of risks, or the level of risks is approximately is nearly zero and do not have an impact of pre-determined budget, schedule or quality of the project.

1.7 Structure of the report

This report of the research is conducted in 7 chapters as it is explained below:

Chapter 1: Introduction chapter contains general information about the problem statement, background, aim of the research and explain which the objectives and questions are respectively to be achieved and to be answered during the conduction of the research.

Chapter 2: This chapter provides an outlook of the literature review and theoretical background regarding the Project Management, explaining the definitions and concepts of project management and more in details focused on the scope of the project such as costs, time and quality.

Chapter 3: This chapter also is focused on providing a literature review and theoretical background regarding the Risk Management, explaining the most known and used techniques and methods of risks assessment, focusing more on the technique for risks identification and risk analysis as main phases of the risk management process.

Chapter 4: Provides information on the methodology used for completing the research, giving scientific support for the chosen approach, case study, and the significance of the case study methodology in research.

Chapter 5: This chapter contains information about the chosen case studies, detailed analysis of the case studies and the detailed explanation of the risk management process followed by the 2 companies, contain a summary of the findings and discussions

and comparison between the cases to find the differences and the similarities between them.

Chapter 6: Provides information about the Risk Impact Method proposed a technique that might improve the process of determining the proper weight of the impact or the risks exposure as key elements of defining the risk management strategy on keeping costs, time and quality under the predefined levels.

Chapter 7: This chapter contains information about the conclusions achieved from this research, containing future recommendations and limitations of the study.

The below Fig. 1.7 1 illustrates the stages that have been followed to conduct this research.

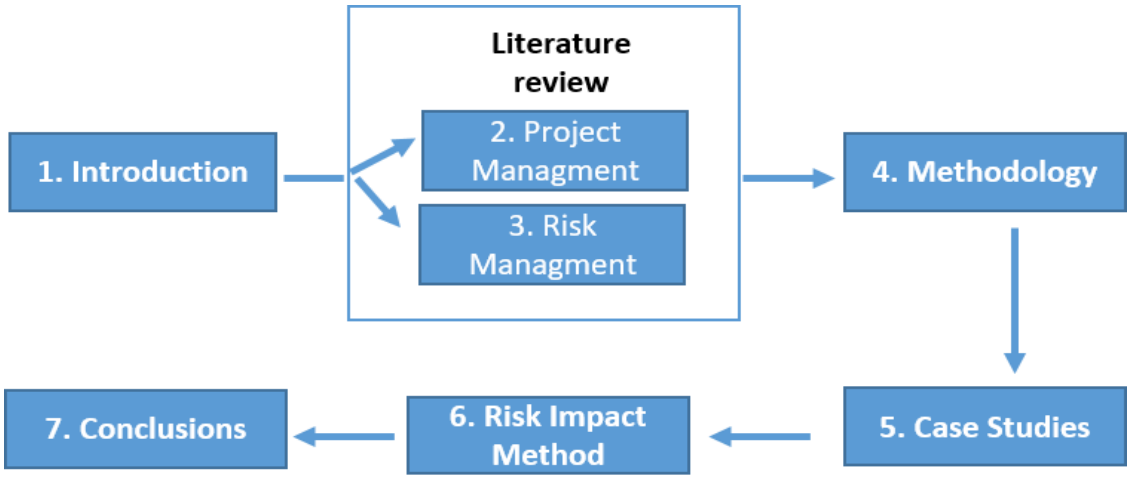

Figure 1.7 1 The outline of the master thesis

Source: Author's work

2 Project Management theoretical background

2.1 Project

According to (DIN 69 901, 2009)(German building standard and regulation), the project is defined as an intention, which his basic are extremely unique (anti-cyclical), his configuration is composed by a certain level of complexity, it has a definite point such as start and end, a predetermined budget and involves different organizations and people.

According to (PMBOK, 2008) “a project is a temporary endeavor undertaken to create e a unique product or service “, basically it represents the same idea that a project in construction industry is unique for several reasons, it has a specific period of implementations from initial point to the end, to the realization of the product or service.

(Kerzner, 2009) goes more deeply and believes that a project is a sum of different activities and tasks to be performed to achieve the objectives of the project and any activity or specifications has its own limitations such as time (start and end), limitations on human and non-human resources (people, money, equipment) etc.

Based on (Turner, 1992), a project should as an endeavor, to complete a unique goal or objective should be integrated in an efficient way people, economic resources, and materials within predetermined limitations such time and budget.

2.2 Project management

(PMBOK, 2008) defines project management as a process in which should be applied knowledge, leadership, and technical skills, usage of proper techniques for the accomplishment the scope of the project. (PMBOK, 2008) clearly distinguish different phases for this management such as imitation, plan, execution, control, and closing.

According to (DIN 69 901, 2009) (German building standard and regulation), project management is the collectivity of administrative tasks, administrative activities, techniques and instruments for the development of the project.

(Garold D, 2000) stated that project management is "*the art and science of coordinating people, equipment, materials, money. and schedules to complete a specified project on time and within approved cost* ".

A project to be successful or to deliver his final scope as desired requires a management process so-called "project management" and tasks for this process are completed by a specific team in the organization named Project management department.

Furthermore, every author believes that project management is a process of planning, organizing, supervising and following step by step through controlling and correcting (taking actions when something is not according to the plan) for a given time in order to complete objectives and the scope of the project.

2.3 Project performance scope

According to (Parvan, K, Rahmandad H and Haghani A, 2015), the most suitable definition for project performance is to measure the level of accomplishment of objectives settled, and this process involves a certain number of activities and tasks that should be satisfied during the development of the project.

(Chan P.C.A and Chan A.P.L , 2004) defines a successful project when are settled several standards during the feasibility and planning phase and the outcome of deliveries is according to the specification fixed at the beginning of the project.

(Kerzner, 2009) defines project success as the process of the accomplishment of any activities and tasks by following the fixed constraints of costs, time and quality. Also, (Kerzner, 2009) develops his idea that this definition has evolved nowadays, and other requirements should be taken in consideration such as acceptance of the provided service by the customer or end user, no changes of the workflow of the organizations and no changes of the corporate culture.

It is obvious that the level of success can differ for different organizations or people involved in the project, different participants in this process try to define and to set standards according to their needs or their possibilities. Success expectations for the project of the client are different from those of the contractor, and usually, it is created a gap between the level of required service and that provided.

(Chan P.C.A and Chan A.P.L , 2004) emphasize that it is not unknown situations when different participants in this process settle their own project object goals, and same time they develop they own strategy to measure the level of success or accomplishment for such objectives.

For example, the client usually is more interested in the allocated time and cost of the project, so they can have revenue as soon as possible, general contractor is interested to maximize his profit in a shorter time for the given price by providing the minimum level of agreed quality, architects and engineers are more concerned about the level of the quality paying less attention to time and budget.

According to (DIN 69 901, 2009) (German building standard and regulation) for each participant, there are different priorities for the objectives of the project.

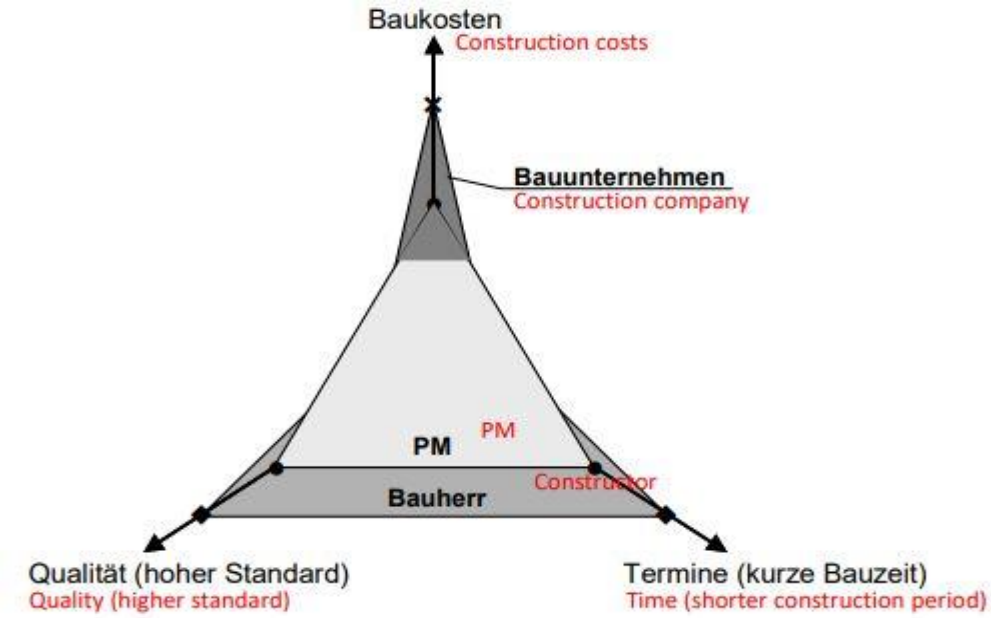

Figure 2.3 1 Costs, time and quality three main components of the scope of the project

Source DIN 69 901

In the fig.2.3.1 is illustrated the relationship between three main components of the scope of the project cost, time and quality, also it mentions the priority that three participants such as the client, contractor, and architects settle for the accomplishment of the project scope.

It is clearly defined that project scope cannot be realized in case that one of those components is not completely fulfilled. It is the duty of the project management team to build a proper balance between the level of the requirements and level of constructability or possibility, so in that way to find a medium way to understand difficulties and

demands of the contractor without neglecting the requests, possibilities, and desires of the client. Project success it depends on several factors, obviously the three main component are cost, time and budget but depending on type of the project, size, and type of the organization they can adopt the scope of the project according to their needs by adding extra elements such as the legal and technical requirements (most of the time such requirement are considered granted because they are mandatory by governmental authorities and national building codes), environmental performance or level of satisfaction of the end user.

Figure 2.3.2 presents a consolidated framework for measuring the success of construction projects.

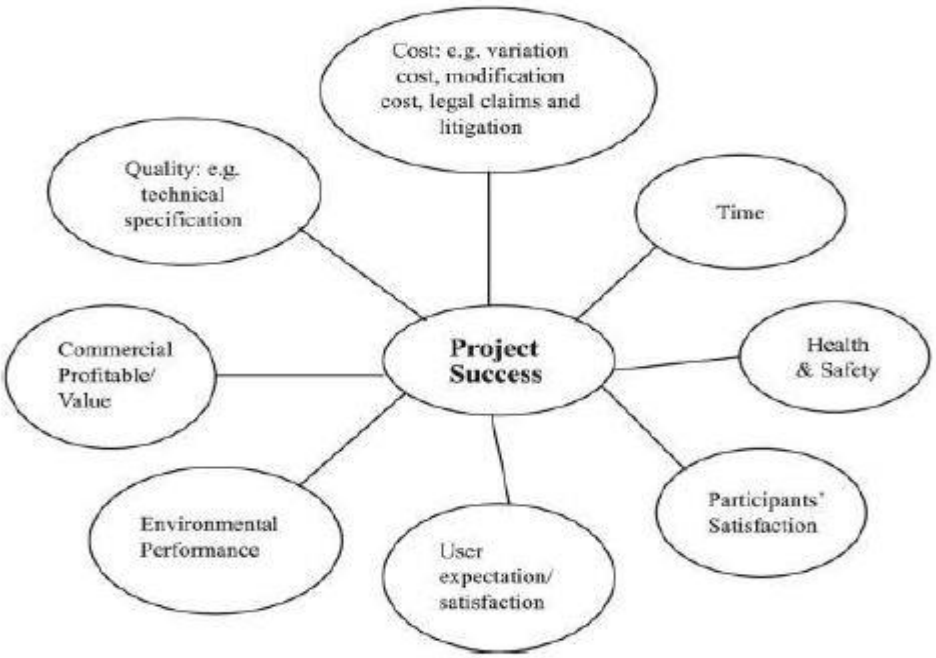

Figure 2.3 2 Framework to measure the success of construction projects

Although the number of factors that can be added for project scope and success, for time limitations and to realize the purpose of the research, project scope will be considered as an integration of three main components such cost, time and quality. The other possible requirements or goals are not taken into consideration during the development of this research.

Based on (Navarre C and Schaan J.L, 1990)that support the idea that the level of success for construction projects should be measured only by the level of these 3 main components:

1. Cost
2. Time
3. Quality

These three elements should be the main concern for the project management team for creating a proper balance during the development of the project because from this balance or relation it depends if a project will be successful or it will be listed as a failure.

2.3.1 Cost management

From first idea or feasibility study, the main consideration that defines the project or even that most of the decision to run a project or not it depends on the possible cost and budget that the project requires.

According to (Wysocki, 2009), the first decision that is made on the project is related to the cost or budget, and this consideration will be present during all the life cycle of the building.

According to (DIN 276 (06/93, 2009) cost planning is the entirety of all activities for cost valuation, cost control, and cost regulation. Cost planning accompanies continuously all the phases of the project realization including design and construction. It deals systematically with cause and effects of the costs.

A cost management plan or strategy is needed through all the phases of the project, only in that way the risk related to the cost can be avoided or minimized as much as possible, otherwise without a strict cost management process or strategy from win situations it can convert in a failure for the realization of the project.

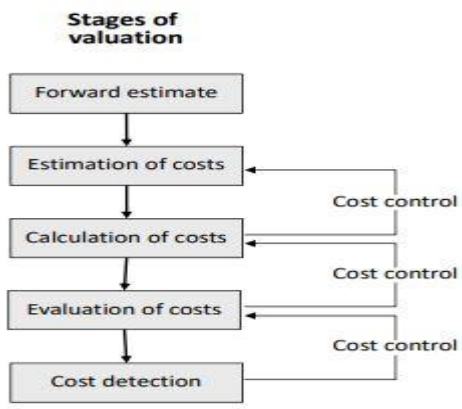

Figure 2.3.1 1 Stages of cost valuation

Estimation cost is a process that should be done simultaneously and continuously during the development of the project, from the first idea to the end of the construction, the main reason is that risks are associated with the money. The main reason why it is needed a detailed plan and execution regarding the cost is that the amount of required budget for the completion of the project can easily increase and will lead to non-accomplishment of the project scope and in many cases even to failure.

Estimation of the costs is the initial phase and it is a crucial importance because this is determined the required budget for the development of the project, also it is helpful in the cost control phase. Although, based on (DIN 276 (06/93, 2009), there is a difference of approximately 40% of the total costs in the estimation phase and cost detection phase as is illustrated in the Fig. 6

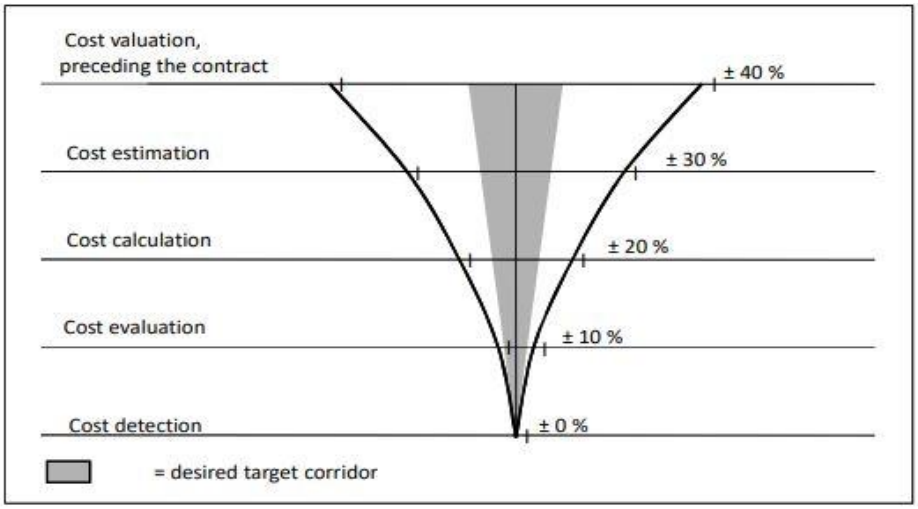

Figure 2.3.1 2 Difference of cost estimation in different phase of the project

(PMBOK, 2008) Estimation phase is crucial because this phase is made the decision to run the project or not and trying to find if it is profitable to run the project.

(Kerzner, 2009) believes that in cost management process a specific attention should go to the cost control regardless the size of the organization or companies, or regardless the size of the project because a failure in cost control automatically will lead to a failure on the project and in the case of large-scale projects it can lead even to the failure of the company.

According to (Kerzner, 2009)cost control is not only “monitoring”, but it is a more complex process, such as identifying possible deviations on cost, analyzing also keeping a record for cost data, also taking corrective actions can be made in this phase. Cost

control is the main phase in all cost management and control system (CMCS). Fig n7 illustrates the process of cost control during the operating phase when the project already started to run, and this process can be done even during the design phase.

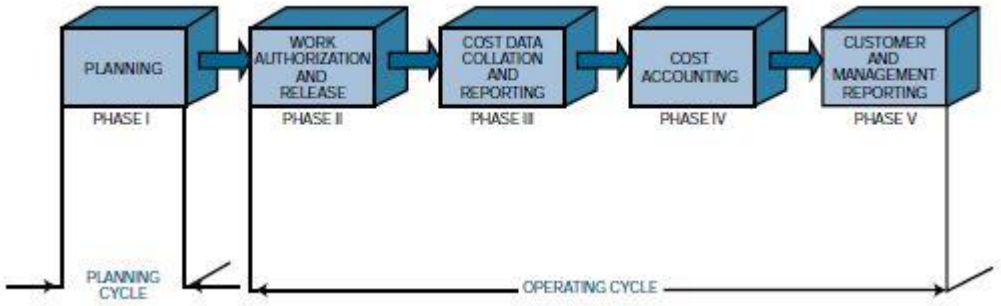

Figure 2.3.1 3 Cost control during the implantation of the project

According to (Nicholas J.M and Steyn H, 2008) cost estimation and cost control is a complicated process because of the information available in a different phase of the project. For that reason, the focus of project management team in cost management should be in the higher level, otherwise, cost overrun it will be unavoidable leading to non-accomplishment of project scope or to the failure of the project.

2.3.2 Time management

According to (Wysocki, 2009) setting time and a deadline or project duration is not an easy task, project duration can be specified by the client according to his needs and a change on that time frame, to reduce or increase this given period will affect other components of project scope such cost.

For example, a reduced time frame of the project by using more resources than needed will lead to an increase in the cost. On the other way, time extension also will lead to changes in project scope because usually, time extension happens because of non-proper management, leading to the contractual penalties.

(Turner, 2014) support the idea that time schedule is a process of defining what will be done and when will be done, also keeping record and monitoring when is done. This statement supports the importance of time management, to respect the dynamic of the project, which is composed by many activities and tasks and one delay in one specific task can lead to a domino effect for the next activity or task.

For that reason, (Turner, 2014) develop his idea more deeply by suggesting that time controlling, and time recording is crucial because only in that way the project management team will be able to find out any possible delay, or changes regarding planned schedule.

(Haidar, 2016) insist that time schedule should be accurate and realistic, also they need to meet the specific requirements of the client or to the other stakeholders such as contractors, or designer etc.

According to (Haidar, 2016) the scheduling should identify a clear logic and structure of sequences of activities, by creating a program delivery program and providing in the same time the right tool to manage this delivery program.

Based on (PMBOK, 2008) from the planning phase to control and monitor phase two are the most common tools for time management:

1- Critical Path Method
2- Float analysis

The Critical Path Method (CPM) can be defined as a tool that determines the dependencies between activities, determines their logical sequence and interrelationships. The main goal of the CPM is to determine the longest or shortest path for the completion of those activities.

For that reason, based on (Haidar, 2016) CPM is extremely useful for monitoring the progress and identifying the possible potential delays, which can affect the time delivery for the entire project.

2.3.3 Quality management

It is acceptable by everyone that definition and meaning of quality are different for different people. Generally, that is understood as a balance between the level of expectation and level of satisfaction accomplished after the service or product is delivered.

According to (Lester, 2014), the general definition of quality for activities such as manufacturing, processes, and services is the fulfillment of these aspects:

1- fulfilling the customer needs
2- appropriateness for use
3- fulfill the requirements

According to (Lester, 2014) in the construction industry, the definition of quality differs from manufacturing industry because in manufacturing the level of quality is spread on series of activities, on the other hand in the construction industry the level of quality delivered it is strictly related to the control management process. The quality in construction is a more complicated process and more difficult to be achieved because of nonrepetitive activities, the product is unique and the involvement of different organizations and people.

(Wysocki, 2009) in the construction industry, are expected to be delivered two types of quality:

1. Quality of the product: the quality deliverables from the project.
2. Quality of the process: the quality of the project management process itself.

Based on (Wysocki, 2009) the quality of a construction project is determined by the final product which should satisfy several aspects such as:

• fulfill the requirements and specification: the final product is according to the plan; the project is delivered according to predetermined budget and cost.

• fulfill the customer's requirements: the project output meets the requirements the customers had of it.

• Satisfies the customer or the end user: the project output and the outcome make customers feel satisfied.

2.4 Delays in construction projects

According to (Enshassi A, Al-Hallaq K and Mohamed S, 2006), the construction industry is becoming extremely demanding and complex for a certain number of reasons such as the complexity of construction process in itself, large number of people and organizations involved, and the dynamic of construction processes etc.

Based on (Hancher D.E and Rowings I.E, 1981) the completion of one construction project within the predetermined budget and cost, with the agreed level of quality requires a critical engineering judgment. (Odeh A.M and Battaineh H.T, 2002) reports that although all participants in a construction such as clients, contractors, or designer probably do not like or do not want to admit they have faced delays on their projects

leading to time extension of delivering or commissioning the project, and the consequences will be the increase in time and costs.

(Lester, 2014) emphasize that delays in the construction industry are the source for other complex problems such as cost overrun, time overrun and often is accompanied with extra problems such as claims for compensations, legal issues, liquidity problems.

The Construction delay may be defined as ―the time overrun either beyond completion date specified in a contract or beyond the project delivery date as agreed by parties‖ (Assaf A.S and Al-Heijji S , 2006).

In construction projects, delays are described as the time overruns either beyond completion date specified in a contract or beyond the date that the parties agreed upon for delivery of a given project (Assaf A.S and Al-Heijji S , 2006) .It is a project slipping over its planned schedule and is considered as a common issue in construction projects. Consequently, it is reported by (Assaf A.S and Al-Heijji S , 2006) that delays could be to a client as a loss of revenue through lack of production facilities and rent-able space or a dependence on present facilities. In some cases, to the contractor, delay means higher overhead cost because of the longer work period, higher material cost through inflation, and due to labor cost increases.

2.4.1 Basic classification of delays

There are many reasons and factors that can lead to a delay in a construction project, but according to (Kerzner, 2009) these factors can be assembled in two main groups, by understanding the causes of affecting these delays if are internal or external.

Internal causes are to be considered those that are derived from participants of construction projects such as client, contractor, designers or consultants.

External causes are to be considered those that are derived from other parts, that are not in control by participants such as natural disasters, political actions, material suppliers etc.

2.4.2 Methods of calculation of delays

According to (Haidar, 2016) there are two suitable methods for calculating or having a plan to manage the delays in a construction project, the first one is called the Gross Method and the second Net Method.

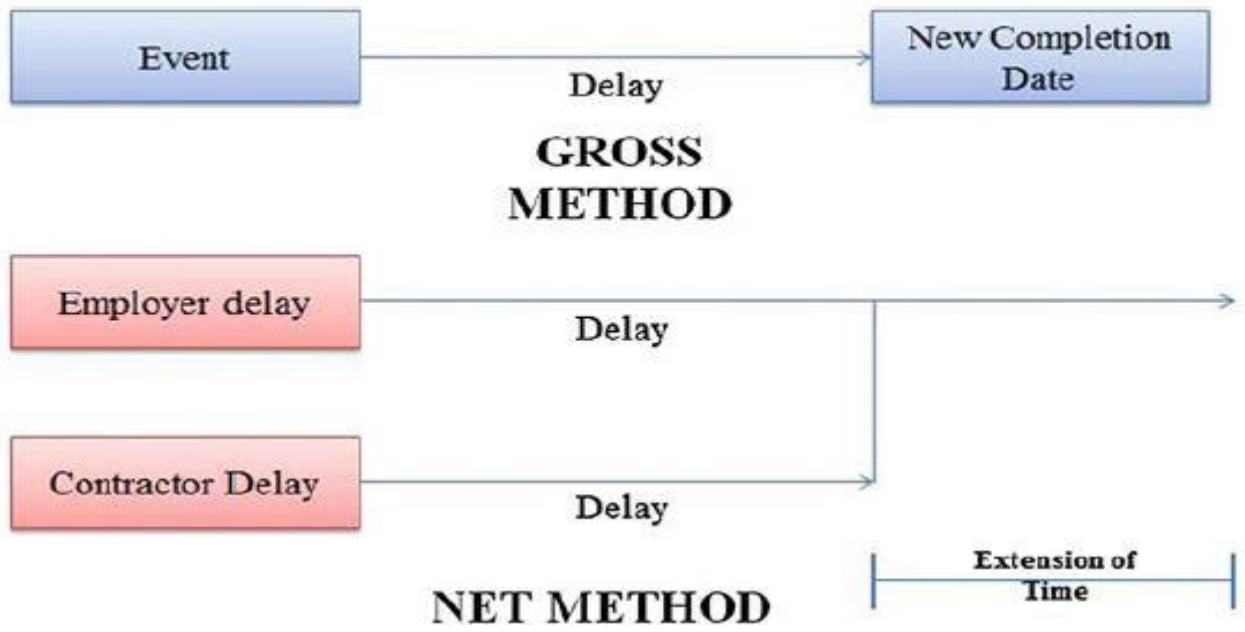

Figure 2.4.2 1 Methods of calculating the delays in construction projects

Gross Method according is most preferred for many academics because it gives an extension of time, which covers that period one event occurred caused the delay, and the extension should run from the beginning of that event. Basically, the management team should establish a new date for the completion of that activity.

Net Method is not considered to be fair enough according to many academics because it gives the contractor an extension of time equal to the time required to cover the additional work. Effectively, this means that if the contractor is six months in delay and is delayed by one further month due to a relevant event, the completion date would be extended from the original completion date to a month later, still leaving the contractor with five months of culpable delay and the threat of liquidated damages.

2.5 Identification of Risk Factors Causing Cost Overruns, Time Overruns and Quality Problems in Construction Projects

Referred to (Lock, 2013) there is a high probability that some of activities or tasks will not be completed according to their estimated duration or budget. Always based on

(Lock, 2013), to enforce his idea, the construction project is exposed to risks and they can affect the scope of the project. The nature of risks can be different from a different source, and the variety of risks factors can be classified as accidental, unexpected or unusual.

(Kerzner, 2009) believes that project risks are complex because of a large amount of relationship created during the development of the project, contractual and financial relationship, managerial, political and planning risks. But Kerzner (2009) support the importance of an accurate scheduling and cost management, and risk management plan based on the pre-estimation of possible risks can be extremely useful to minimize and to manage the risks. Risk identification is a process that cannot be stopped only in the planning process but should be done continuously and should accompany the project during the development of all phases, for only one simple reason such as risk presence can be in every task or activities of the project.

3. Risk Management theoretical background

3.1 Introduction

In this chapter will be given basic definitions about the risks that should be considered in construction projects, what are the possible risks that can be involved in construction and what might the right procedure to manage possible risks or to minimize their impact, or how decision-making procedure change when taking risks in consideration.

The procedure of making the right decision through different phases of one projects it is a stressful process, because in construction projects are involved different people with different scope during the project, such as the client usually seems to be more interested in time and the cost, the general contractor is more interested to maximize the profit in a shorter time for the given price by providing the minimum level of the quality and finally the designer (architect, engineers) are focused on the level of the quality provided.

Taking a decision is a process that requires a large information and techniques which should be implemented, in different scenarios that might occur during the phases of the project. It is the duty of project management team to develop a proper risk

management plan, to be able to minimize uncertainties and undesirable surprises on the project, to build a specific plan for a specific project because there are a certain plans and tools in general, need to be adapted according the scope of the specific project. It is well known that projects in the construction industry are unique because of the location, structure of the building, people involved in etc.

3.2 Definition of risks

Many authors and researchers tried to give a unified definition of risk and most of them agreed on that risk is the occurrence of uncertainties or unknown thinks during the realization of the project.

According to (PMBOK, 2008) , a risk is an uncertain event or condition, the occurrence of this event can have two possible effects negative or positive, in both cases, an identification of them should be planned.

Based on (Loosemore M, Raftery J, Reilly C and Higgon D, 2006) risk should be considered in many dimensions not only as uncertainty but the complexity of the risks should include other dimensions such as physical, social or economic.

(Oztas A and Okmen O, 2004) describe risk as a situation for which there are existing records and experience and based on that decision and prediction are made answering the question for the possible probability of occurring that risk.

However, (Kartam N.A and Kartam S.A , 2001) simplify this idea, by defining risk as the probability of occurrence of uncertainties and unplanned, or undesired events that might change the scope of the project.

(Kerzner, 2009) support the idea that risk should be defined as the probability of occurrence of one event, and the main consequence if this event happens, would not achieving the goals or lack of completeness of the project's scope.

(Kerzner, 2009) develop also the idea of giving a mathematical function of risk, his probability of occurring and what will be the impact if that risk occurs.

- The probability of that event to happen
- Impact in case of that event happening

So, risk can be mathematically modeled as a function of the probability of one event related also with the effect or impact, consequences.

R=f (probability, impact).

By defining this function, it gives a clear a relationship that bigger the probability or impact, increase the risk.

This type of relationship is illustrated in the Fig. 3.2 1, the higher the probability of occurring in one event and the larger is the impact a result of these two conditions the higher the risk will be for the realization of the project's scope.

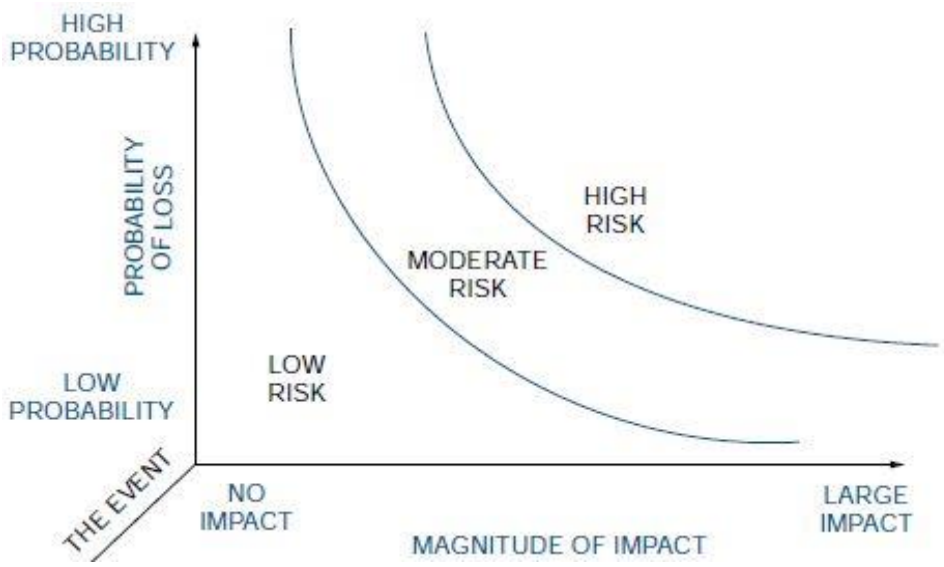

Figure 3.2 1 Relationship between the probability and magnitude of the impact of the risks Source Kerzner 2009

Based on the typology of consequences that might happen on the project, after risk occurring 2 main situations can be classified:

1. In case of positive effects on the project, these consequences are categorized as "opportunities".
2. In case of negative effects on the projects, these are categorized as "threats" or risks for the realization of the project. Their occurrence should be prevented, presence should be avoided or minimized as much as possible.

3.3 Risks, Uncertainties, Opportunities

According to (Hillson, 2002) the idea of dealing and managing in the same process threats and opportunities has derived from the idea to embrace certain positive effects of the risks and use them in favor of scope of the project.

(Hillson, 2002) has embraced the idea of grouping the risks in two main categories based on the expected effects on the scope of the project:

1 – opportunity is the group of those risks which is expected to have a positive impact on the overall objective of the project

2- threat is the second group of those risks which the expected impact or influence on the objective of the project is believed to be negative.

(PMBOK, 2008) has given an original definition for the risk, describing the risk as uncertain event or condition and this type of the event or condition might have a positive or negative impact or influence on the scope of the project.

On the other hand (Hillson, 2002) enforce the idea by explaining that there is no significant and qualitative difference between opportunities and risks because of the unknown nature and element of surprises that contain both of them, the 2 concepts are accompanied with certain level of uncertainty and both of them have the potential to influence and to cause changes to the scope of the project positively or negatively

3.4 Project Risk Management

According to (PMBOK, 2008) risk management is one of the main processes, that should be performed continuously from the feasibility study of the project to the end of the construction. The maintenance phase, part of the life cycle of the project, are excluded because the risks are determined very less.

(PMBOK, 2008) defined risk management as a process, which should be consistent and systematic and inside this process, there are several steps or phases that should be completed in a logical sequence such as identifying risks, analyzing the risks, and taking preventive or corrective actions for those risks, called risk response phase.

(Kerzner, 2009) support the idea that risk management team should not be separated from other project teams but should be involved and integrated with other teams and

processes such as design teams, cost and budget estimators, contractors and legal departments and other important issues for the realization of the scope.

The main idea is that more knowledge about the project and process this team possess it will result in a better risk management plan.

(Zou P.X.W, Zhang G and Wang J, 2007) represent risk management in the construction as a systematic method to be used for the identification, analysis and proper response plan to deal with consequences related with risk, only in that way the scope or goals of the projects can be achieved.

According to (Smith, N. J, Merna, T, and Jobling, P, 2006), every stakeholder of the projects should be aware of possible risks might be associated with the project, and risk management plan should be developed and reported in strategic documents, and what possible effects might occur to time, budget or quality of the projects.

Based on (PMBOK, 2008) risk management process can be divided into these phases:

1- Risk Identification considered as the phase where are determined what are the possible types of risks and when they can affect the development of the project.
2- Risk Quantification considered as the phase when an estimation or evaluation is done based on the qualitative and quantitative approach of several possible risks.
3- Risk Response Development is the following step after an accurate analysis is done, by determining a proper strategy on the way how to handle or deal in case of possible occurrence of the undesired event so-called risks.
4- Risk Response Control is the final phase of risk management by establishing a clear strategy and a protocol of responding and dealing the risks during the development of the project.

3.5 Construction risk management

According to (Garold D, 2000) in the construction industry, generally, the risk is defined as an unpredicted event that will influence the scope of the project, more specifically the three main aspects of the projects such as budget, time and quality.

Based on (Haidar, 2016) the construction industry is not having a good performance for dealing with risks and the risks management system has not been properly efficient because many projects are not able to achieve their target such budget and time, leading to time and cost overrun. This deviation in achieving the objectives of the project will lead to dissatisfaction of all participants involved in the project for example clients, contractors, public authorities or the end user.

Referring to (Smith, N. J, Merna, T, and Jobling, P, 2006) all participants involved in the project should have an overall risk management plan and a policy should be included in the strategic documents and illustrated also to the quality management system. According to (Smith, N. J, Merna, T, and Jobling, P, 2006) for the owners of the project risks are related to ownership and risk financing, client and contractor risks are associated more with the development of the project and the types of risks that can affect this process.

It is the nature and the complexity of construction project that define the importance of RM strategy, more types of possible risks or uncertainties are involved during the process of creating RM more protected will be the development of the project.

(Lester, 2014) report that the process of identifying and analyzing it becomes easier and more accurate if the experience, portfolio risk associated with all participants, a critical thinking on the objectives of the project are taken in consideration. Based on (Lester, 2014) many risks can be identified in construction projects independently the size and scope of the projects.

According to (Zou P.X.W, Zhang G and Wang J, 2007), to create a proper RM plan is needed to create and to keep a balance of time, cost quality, and based on that to determine which are the risks that can affect that balance, only in that way the RM can be efficient.

3.5.1 Risk probability in construction projects

Dealing with the risks is an important process that cannot be understood or completed if the mathematical concepts of probability are not involved. (Smith, N. J, Merna, T, and Jobling, P, 2006) believe that implementations of probability concepts are a necessity during the development of risk assessment of risks in construction projects.

According to (Nicholas J.M and Steyn H, 2008) estimating the probability of risks and their effects specifically those related to costs and time are subject of more complex process, because an estimation of the consequences is needed in case of occurrence of the risks. (Kerzner, 2009) report that many times estimation of those consequences is not subject of only mathematical and statistical calculation but is more of a logic consequences analysis such as “if this happens, then…”.

According to (Kerzner, 2009) for defining the probability of potential risks in construction projects is needed accurate combination between objective and subjective judgement and intuitive estimation with numerical and mathematical estimations, only in this way the output will be realistic and profitable for improving the process and helpful on achieving the objectives and scope of the project.

3.6 Benefits of construction risk management

According to (Smith, N. J, Merna, T, and Jobling, P, 2006), RMP should not be rigid but should have the ability to be modified, adapted and developed during entire the project, in that way the identification and response for the risks will be efficient in maximum. Benefits from RM are not only to protect the scope of the project from the possible deviation but also to protect all participants such as owner, client, contractor etc.

(Turner, 2014) believes risk management give a large effort of understanding the possible consequences and creating a plan how to eliminate or avoid them, or creating a consequence logic “if this happens, then this should be done”

RM is another useful tool which can help to increase the level of control over the project, should be a problem solver for many processes during the development of the project, (Garold D, 2000)

According to (Garold D, 2000) and (Kerzner, 2009), the main benefits of RM are;

 Maximize the efficiency: participants and project management team can easily identify the risks and manage them, to avoid their influence during the development of the project.

 Risk analysis applied during tendering and warding phase can lead to a realistic price for both parts such as the client and the general contractor.

 Application of RM plan or strategies increase the probabilities of listing the project to a successful one.

 Application of RM improves the decision-making process leading to an optimal decision that can support the scope of the project.

 Recognizing the possible risks or problems is the first step of resolving those, so RM is useful in creating a proactive management, avoiding reactive decisions or actions.

 A good RM and keeping records will be useful creating a sufficient experience for future projects for the organization

 RM can be a good tool to improve communication and coordination between different teams and actors on the project, many times it helps to create a proper equilibrium between requirements and demands.

3.6 Risk Identification

(Loosemore M, Raftery J, Reilly C and Higgon D, 2006) believes that the initial action that is taken during risk management goes through informality which can be performed in many ways, which mostly depend on the type of organization and the project management team. Initially, there is no need to determine a strict method for determining to pursue risk identification, it is the phase of gathering information as much as possible.

According to (PMBOK, 2008) risk management can be more effective if there is a detailed information about the causes of the risks, and an allocation before facing the problems will result in a more efficient way of dealing those risks. Based on (PMBOK, 2008) an RM plan should not be considered only as a problem solver in advance but should contain information on how to deal with unexpected problems or threats during the development of the project.

Based on (Kerzner, 2009) risk identification should contain elements such as the source of the risk, hazard and peril probability also the exposure to the risk and for any of those concern should compile a plan how to avoid them.

(Haidar, 2016) support the idea that an accurate RM strategy can lead not only to avoid or eliminate the possible risks, by protecting the scope of the project, can lead also to

a possible profitability by transferring the risk in opportunities such as economic or environmental.

According to (PMBOK, 2008) main goal of identifying the risks is to create a ranking list with possible risk and ranking them based on the level of the influence or impact on the scope of the project. (PMBOK, 2008) gives the recommendation that the suitable method for risk identification should be based on the knowledge and experience of project management team for that specific method also should be a benefit for improving the processes of the project. The risk identification should end with a list that contains information with potential problems also all the project management team should be conscious of possible problems.

Most common and efficient techniques of risk identifications are:

1- **Brainstorming**: According to APM (2004), this is a most commonly used method for risk identification. The practicality of this technique consists in gathering together all participants of the project, to identify and to analyze the possible risk on the project.
2- **The Delphi Technique**: This technique consists in doing several questionnaires, the target is qualified and experienced individuals on risk management. Through this questionnaire, these individuals are asked to list and identify potential risks also to calculate the possible effect on the project. The answer will be examined and through them, a list of possible risks should be created. According to (Haidar, 2016), this procedure should be consistent until the risk management team reach a final opinion and strategy. (Chapman, 1997) does not consider this technique efficient because of the time needed to develop the questionnaire also it results to be more expensive than the Brainstorming.
3- **Interviews**: According to this technique interviews are needed to be completed, the target to interview will be individuals within a considerable experience on dealing risks, how to list the potential risks for a specific project and what type of strategy should be appropriate to be implemented. Many academics find this technique as time-consuming, the questions should be structured to have a professional output. According to (Chapman, 1997) confusion on the questions should be avoided otherwise it will lead on wrong directions, and for consequence, the list of potential risks will not be appropriate.

4- **Outputs from Risk-oriented Analysis**: For this techniques fault tree analysis and event tree analysis can be used, starting from top to down to identify and determine the possible threats, risks, an event that can have an impact during the development of the project.
5- **Risk Register**: It consists in creating a document where to record all the needed information gathered with one of the above techniques.

According to (Smith, N. J, Merna, T, and Jobling, P, 2006), the document contains information for each possible risk, potential causes and their impacts on the scope of the project.

The above table illustrates one list of possible risks that might happen during the development of the project. The list is created by collecting information from different authors.

(Smith et al. 2006; Potts, 2008; Lester, 2007)

Table 3.6 1 Categories of risks

Risk categories	
Groups	Risks
Monetary	Financial
	Economical
	Investment
Political	Political
	Legal
Environmental	Environmental
	Natural, Physical
Technical	Technical
Project	Contractual, client

	Project Objectives
	Planning, Scheduling
	Construction
	Design
	Quality
Project	Operational
	Organizational
Human	Labor, Stakeholder
	Human factors
	Cultural
Market	Market
Safety	Safety
	Security, crime
Materials	Resources
	Logistics

3.7 Risk Assessment and analysis

Risk identification is followed by the Risk Analysis, this is the phase where the collected information should be examined and will be the subject of a critical analysis.

(Kerzner, 2009) describes risk analysis as a selection process of risks that are supposed to have the highest level of influence or impact on all the risks listed in the identification phase.

According to (Loosemore M, Raftery J, Reilly C and Higgon D, 2006), there is no need to distinguish or to separate risk assessment and risk analysis, but to have an accurate

result and flow process those should be done on the same time by considering as a unique process.

Risk analysis can be developed based on two methods:

1- Qualitative approach
2- Quantitative approach

Based on (Wysocki, 2009) the qualitative method is a descriptive way to list the potential risks and the ranking start from the highest level of impact to the scope of the project to the lowest level of impact. Regarding the quantitative method is based on empirical data, numerical estimations to determine the identified risks that can have the highest influence on the objectives of the project.

Referring to (Turner, 1992) the organizations use more the qualitative approach because if it is quite easier, also contain descriptive information that is supposed to be more flexible versus the complexity of the quantitative approach.

According to (Zou P.X.W, Zhang G and Wang J, 2007) there are experiences where semi-quantitative analysis is applied, this method consists of mixing the numerical estimation with descriptive information of identified risks.

(Kerzner, 2009) believes that selecting the appropriate method, should not be problematic, the organizations should select that method in which the project management team has gained some experience and the output should be reliable no matter of the scope of the project or type of the risks. The selection of the right technique should be based on experience, expertise and the availability of proper computer software to have reliable process and outputs (Kerzner, 2009)

Based on a survey conducted by (Lock, 2013)there are many reasons that should be taken into consideration before deciding on the appropriate method to implement for risk assessment. (Lock, 2013) concluded his idea within a list of potential reasons to be considered before selecting the method, some of them are:

 the level of the cost required to implement the method.

 the number of resources and time required to apply a specific method

 the level of adaption that method can offer regarding the needs of the organization

 level of simplicity or complexity of the method

 level of experience or expertise of the staff with that specific method

 Reliability and credibility

3.7.1 Qualitative methods

This method is the most common and useful method for risk analysis of the identified risks. According to Smith (1999), this method contains important information such as the probability of the occurrence, causes of the risk, risk ownership.

1. **Probability-Impact (P-I) Grids** - is a technique used to conduct a qualitative approach of the risk assessment, the technique takes in consideration two main aspects on the risk assessment process such as the probability of occurrence and the level of risk impact on the project

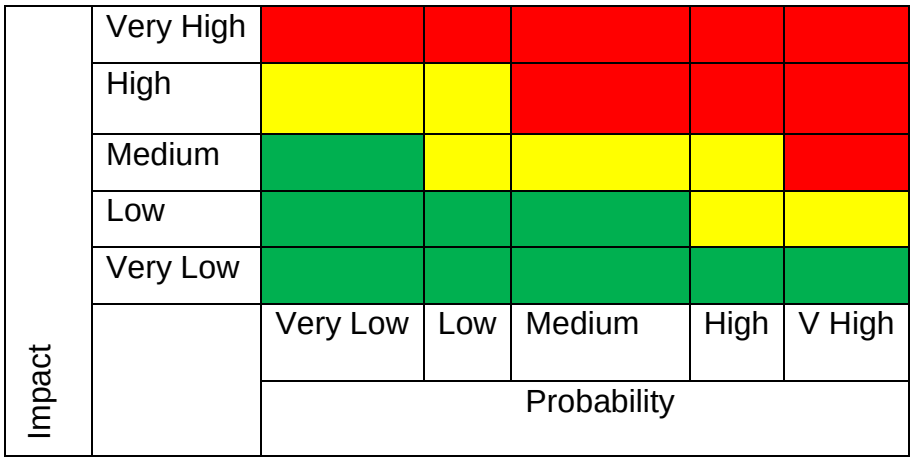

Figure 3.7.1 1 Probability Impact Matrix

3.7.2 Quantitative methods

The quantitative method requires more complex data and experience to be performed, and a balance between the effort required and benefits should be conducted before selecting the right method.

According to (PMBOK, 2008), the quantitative method is usually needed for the medium and large-scale project because of a large number of numerical estimations needed to have a reliable output, and the main goal of this method is to estimate the impact of risks related to the scope of the project. Based on (Kerzner, 2009) to conduct a quantitative analysis the most suitable techniques are:

1. **Scenario technique - Monte Carlo simulation**

Monte Carlo is a statistical method based on simulation to estimate the risks and their impacts. Based on (Kerzner, 2009) this method is useful because of the ability to generate different scenarios based on different estimations of risks. (Kerzner, 2009) explains that main goal of the Monte Carlo simulation is to create different scenarios of probability distributions for potential risks, transforming this series of probabilities in realistic and information in a final numerical result that represents the impacts of risks related to time, cost and performance of the project. Based on (Kerzner, 2009) the Monte Carlo can be more efficient if it is performed through a software such as Risk Simulator software, also by Microsoft Excel but the reliability of the output will be limited.

2. Modeling technique - Sensitivity analysis

Sensitivity analysis consists in establishing a detailed list of risk events which are supposed to have the highest level of impact. Based on (Kerzner, 2009) the listed events and their impact should be measured according to their impact on the objectives of the project. This technique requires to create a relationship based on the level of uncertainty of a specific risk the higher is the level of sensitivity regarding the scope and objectives of the project.

According to (Smith, N. J, Merna, T, and Jobling, P, 2006), this technique requires repetitive calculation of the possible effect on the scope of the project, the outcome should be examined several times until the result is realistic and it fit the objectives of the project. (Smith, N. J, Merna, T, and Jobling, P, 2006) enforce his idea that the results will be more accurate in case that this technique is carried out from the initial phases so critical issues can be solved during the development of the project.

3. Diagramming technique/Decision tree

According to Heldman (2005), this technique is recommended to be used when some among the identified risks have extremely impacts on two main aspects of the scope of a project such as time and cost. Based on the nature of decisions the decisions trees can be divided into two types: 1. Fault Tree Analysis 2. Event Tree Analysis

According to (Kerzner, 2009), the difference between them is that the first one deals with the probability of potential risks and their impact based on numerical estimation, the second deals more with uncertainties or undesired events and their impacts on the objectives of the projects, on descriptive ways.

3.8 Risk response and monitoring

3.8.1 Risk response

According to (PMBOK, 2008), risk response plan is a crucial phase on RMP, and the bases of risk response consist in defining corrective actions how to manage or deal the identified and assessed potential risks, by acting according to a strict protocol. (PMBOK, 2008) defines three main components of risk response: avoidance, mitigation, acceptance. (Kerzner, 2009) reports that risk response is described in a better and efficient way when it is composed by 4 elements:

1- Avoidance is the process of eliminating the risks or mainly to eliminate the causes or to avoid the causes of that specific risk. Once the cause is avoided the probability of that threat to be present during the development of the project is on the lowest level. In this approach, according to (Kerzner, 2009), different types of alternatives or scenarios should be taken into consideration after avoiding one specific risk. (Kerzner, 2009) reports that this approach may require changing in planning or design concepts, or changes related to the requirements or demands, or practicalities that may reduce or avoid the impact of that specific risk.

2- Mitigation/Control is the process of reducing the monetary value of a risk by eliminating the occurrence of the event that can cause problems. Based on (Kerzner, 2009) in this approach transferring the risk ownership is a known process, to reduce the probability or impact of that specific risk.

3- Acceptance is the process of accepting the consequences of the occurrence of the risks, the project management team after a critical analysis of risks define that the occurrence of such risks does not have a huge impact on the objectives of the project. According to (Kerzner, 2009) on the acceptance approach should embrace a situation of adaption and wait to see the result. In this approach reserves on a budget, time and other resources should be available.

4- The transfer is the process of transferring the risk ownership to the third parties by reducing the probability or impact of the project scope. Based on (Lock, 2013) the risk should be transferred to other parties that are able or have some experience in dealing with or managing those types of risks.

3.8.2 Monitoring

According to (Chapman, 1997), monitoring is the final phase of RMP, in this phase all information about identified risk is collected and monitored. Based on (PMBOK, 2008) a critical thinking and professional behavior during this phase helps in finding new possible risks, keeping records and creating an experience for the organization in dealing and managing risks.

Referring to (PMBOK, 2008) that the main goal of monitoring and controlling phase to monitor the status of the risks and corrective actions are to be taken, in case of occurrence the events, according to the predetermined protocol on risk response plan.

Based on (PMBOK, 2008) to process an accurate monitoring phase the proper tools or techniques to be taken into consideration for usage are:

 Risk reassessment – this is the process of reidentification of new possible risks.

 Monitoring the status of the risks and their effect on achieving the objectives of the project

 Updating continuously the register of risks

3.9 Developing a Risk Breakdown Structure

According to (Haidar, 2016), Risk Breakdown structure is a useful technique for the project management team to manage and to control the status of the risks and the status of the objectives of the project. The main goal of Risk Breakdown Structure is creating a list with potential risk sources, and this list is ranked from a higher level of potential to the lowest, to create an accurate structure and guideline of risk management process.

Based on (Garold D, 2000) WBS van be very useful during the planning and estimation of activities for the project management team, also he defines RBS as a technique of listing the potential risks based on their source, by understanding the source of the risks the probability of solving or avoiding the impact of the risk.

(Kerzner, 2009), to enforce the need for developing a Risk Breakdown structure, gives a list of many reasons for the benefits of developing RBS. These reasons are listed below:

 RBS improve the controlling process

 It gives coherence and consistency to the risk management process, by structuring the process and giving specific information for specific activities by assigning also the responsibility of each participant.

 Improve the process of estimation and control for each risk

4 Research Methodology

In this chapter will be a description of data collection and research methodology explanation about the process of conducting this study.

Being able to define the objective of the study, setting the initial goal, is the first phase of this process, in the second phases there is a need to explain the methodology adopted to have some important findings and to fit according to the scope or objectives of this study.

According to Oxford Dictionary research is defined as a systematic investigation to reach new facts and new conclusions for a specific topic.

Based on (Bryman, 1989) research is a systematic process of investigation to improve and fill the old knowledge also to generate new facts and conclusions.

(Naoum, 1998) defines two types of strategy for developing a research, these two types are qualitative and quantitative methods. Quantitative methods consist in gathering facts and collecting data and trying to create a relationship how these facts are represented in the theoretical background or previously executed.

Regarding the Qualitative method (Naoum, 1998) explain that this method is more subjective because it depends on gathering facts based on the previous and practical experience of the people, developed through questionnaire and the answers provided are based on personal feelings or experience.

This research will embrace the quantitative method to define which are more potential risks that affect the scope of the construction project, through the real case in Albania. After gathering all available facts and relevant information related to the risk management approach, a discussion of the consequences of this approach will be developed to understand the impact of those risks into triple constraints of the project.

4.1 Research Strategy and Design

(Robson, 2002) explain that research design is the process of transforming the hypothesis and the research questions into a research process or projects.

(Robson, 2002) enforce this idea that to be able to answer the research questions should be developed a clear strategy or process of adapting and organizing the facts, developing a critical analysis to achieve realistic and significant findings.

As already mentioned this research will adopt a quantitative method, the research will be conducted according to the following phases:

1- A critical review of the theoretical part to determine the possible gaps between theoretical knowledge and practice.
2- The next phase will consist of gathering information and facts related to specific real case studies and potential issues and the current situation in a construction project in Albania and especially for the risk management process.
3- The validation of a real case study in Albania, gathering facts and important data related to the specific project by conducting interviews with project managers and consultants.

Development of the case studies will be based on understanding the practice and experience of risk management, defining the main goal of the stakeholders from the risk analysis.

This research will be based on defining the difference, attitude, and experience of the expectation and the interests of the client, contractors and project managers from risk analysis and how the chosen technique affects the triple constraints of the project.

(Naoum, 1998)) explain that the research design should be structured in that way to be helpful to the main goal, to be able to answer the research questions. Naomi (1998) report that conducting the research through individual interviews have these advantages:

a- The answer can be more structured and appropriate related to the research
b- The response rate is expected to be relatively high
c- The content of the answer can be more realistic and helpful

4.2 Research Process

The initial phase of this process is composed by an observation, with some data to understand different causes or sources that have a huge impact on the objectives of the project, for example, delays, causes and reasons of cost overrun etc.

Gathering those data from the observation will allow generating the hypothesis to direct the research and to develop a structured process of defining possible reasons that cause this phenomenon.

Generating hypothesis will be followed by the process of collecting relevant data, to be able to support the phenomenon with concrete facts, to emphasize the critical situation and the important need that this phenomenon must be studied and developed.

The consecutive phase will consist in analyzing the gathered data in more details, to identify potential causes or sources that have an impact on developing the phenomenon and eliminating the irrelevant data, which do not have a real impact.

In this research practice will be linked with the theoretical part, to understand the difference or gaps between theoretical recommendations and real practices.

4.3 Literature Review

The first phase of the research will be composed of a critical literature review to understand the differences and gaps between existing knowledge and practices, this phase will help also to create a comparison between the theoretical part and how realistic and reasonable the proposed research can be, to control the viability (thus avoiding repetition). According to (Naoum, 1998), this critical review helps to develop a structured process and an appropriate research methodology that can be helpful to answer or to have some important findings at the end of the research.

First part of Literature review is helpful to understand the project management theory, by understanding the main objectives of the construction project, main three aspects that compose the scope of the project and the second part is related to risk management methods and techniques, to understand how this aspect is correlated and linked together during the development of project management strategy.

A literature review is developed after a careful review of textbooks, guidelines, research articles, previous research on this subject, journals, or electronically and these

theoretical data gives the opportunity to a create a comparison process between theoretical knowledge and the data gathered from the implementation of real cases.

4.4 Design and Administration of the Case Studies

Based on (Mark Saunders, 2009) case study technique can be very helpful and lead the research on that direction to have realistic findings and in many cases require a combination of different data such as interviews and documentary reviews. Case study technique allows the combination of many data and to compare such data with the theoretical background.

(Mark Saunders, 2009) explain that a case study is a valid form of research and the intention of the case study it is not to explore and to study the entire organization but the focus of should be on a specific topic or a specific problem to be discussed and analyzed.

The decision of conducting the research through case study technique requires a specific consideration and validation of these elements:

1- Available time to conduct the investigation
2- The reliability and accessibility of documentation and information
3- Possibility to conduct interviews and gathering feedback from the participants
4- The number of cases taken into consideration

To conduct a research with case study there is a need for an explanation for the selection of the case studies and arguments to support the choices and how they will help to develop the research.

Related to the statement above mentioned, it was selected two cases study, two large-scale projects from two organization that are considered relatively large in size in Albania. A comparison of two cases will be developed, to understand the benefits and weak points of each method or approach applied from this organizations.

To support the data collection and to increase the reliability of the research interviews with project managers of the organizations are developed. The project's managers are directly involved in the projects taken as case studies, so based on their experience and strategy and the information provided will be structured the process of analyzing the data. The interviews are very important because they give an essential feedback

related to the approach or behavior of project managers related to risk management also this approach help to achieve the scope of the project.

Interviews were structured on that way to emphasize which are most present risks during the development of the project, and what is their effect on construction project related time, costs and quality. During the interviews the project managers explained the method of dealing or managing with different risks, controlling and monitoring technique applied to minimize the effects and decision-making process of the owner based on different situations and how this process affects the entire development of the project.

The interviews were helpful to understand the approach of client and owners related to the scope of the project by defining the main goals desired to be achieved and is this reflected on the risk management strategy or not.

The selection of the projects and companies was made based on the accessibility and availability of the information and documentation, the reputation of the companies in the market, turnover, management team and mainly operation to this organizations is in the national market also another important reason was the willingness to provide all the information and support needed to conduct this part of the research.

4.6 Data Collection

Referring to (Naoum, 1998) a researcher should be able to use and to understand accurate data and to measure the liability of those data in that way the findings and conclusion can be realistic.

As already mentioned above, the data used for conducting this research was collected from textbooks, journals, publications and via the internet and those theoretical data were compared and analyzed with the factual data provided from the project managers of the two case studies.

Even the amounts of theoretical potential risks or uncertainties related to cost and time overrun during the development of the project, the interviewers were invited to answer specifically based on their experience and to mention and list only the potential risks or issue really faced during the development of the project, or problems that might have been faced during the development and implementation of risks management strategy.

After the interviews, with a list of potential risks, list of objectives asked to achieve for the project and list of real problems that might have been present during the development of the project was given to the project managers.

4.7 Data Analysis

This phase of study consists of the ability of the researcher to organize the data, to create a professional and critical analysis to explain and to achieve important findings. The organization of analyzing should be clear, easy to understand and giving a consequent approach to the readers relating to the research. During the development of the data analysis should be avoided the presentation with many empirical data without a strong and clear linkage or relationship, the amount of data should support the idea of a relationship and not vice versa. Based on (Mark Saunders, 2009) there is a need to create a process of reevaluation of the results so during the analysis should be the conduct of a review of results to understand and to define the optimal result.

The basis of the data analysis in this research consists in ranking the severity of causes and risks that cause changes to the scope of the project of two cases, ranking several fact and reasons that led the extension to the schedule or delays, and through this ranking to create a relationship between causes and consequences.

4.8 Validation and Reliability

According to (Naoum, 1998) demonstration of the validity of the research and outcome, it is a crucial process during the development of the research and the readers should have a clear impact that approach and the method used is appropriate to achieve realistic conclusions and findings.

In case that is guaranteed and proved a certain level of validity of the research method than the findings and conclusion can describe the current situation or the reality in a better way, and the findings will have a higher impact in improving the knowledge.

For that reason, to secure the validity the interviews were conducted through meetings face to face with two project managers of the organizations to receive a realistic feedback and that it is suitable to the goal of the research.

(Bryman, 1989)report that reliability is another important aspect of the research and this is accomplished when the research is repeated many times in the same conditions the results would be the same. In this research, reliability is accomplished because the people involved in the interviews were involved in the development of projects, which were taken in consideration as case studies, specifically in the role of project manager within the responsibility to develop the risk management strategy.

5 Case study

Presentation of these two case studies will be helpful to develop a deep knowledge related to the practice with dealing and managing the risks in real construction projects in Albania, to list the major risks that affect the performance of the project and what are the strategies that project managers apply before and during the construction phase to reduce the impact of risks, and how efficient results these strategies on preventing time and cost overrun or low level of provided quality.

5.1 Case Study A

5.1.1 Company profile and project details

This case study is related with the construction of a multi-story residential building by Mane TCI, a leading company in the construction market in Albania.

Table 5.1 1 Company profile Case study A

Name of the Company	Mane TCI
Founded	2002, Part of Balfin Group
Core business	Construction& Real Estate Development
Nr of employee Administration& Technical Department	121
Commercial Buildings projects	TEG (shopping mall), QTU (Shopping mall)
Residential Buildings projects	Rolling Hills Luxury Residences, Ambassador 1, Ambassador 2, Ambassador 3

Affiliation	Street “Dervish Hima” Floor 8, Ap.61, Tirana, Albania

Ambassador 3 is the project that is taken as a case study for this thesis, this project includes the development of residential buildings located in the center of the capital city, Tirana, Albania. The project consists in the construction of 20 floors for residential purpose, 1 floor for commercial activities and 4 underground floors for parking purpose. The estimated time of construction was 30 months but, it took 36 months to be constructed, so overall this project faced a delay of 6 months, below table, contain some descriptive data of the projects.

Ambassador 3 is a reinforced concrete structure and structural and seismic analysis are made according to the National Building Code and Eurocode, EC-2

Table 5.1 2 Ambassodor 3 Project description

Project	Ambassador 3
Typology	Residential
Investment cost	17,390,832 Euro
Gross Construction Area	32,300 m2
Residential	20 floors
Commercial	1 floor
Parking	4 underground floors
Construction Time	2006-2009

Project management team involved in this project was compound by 6 people, sharing the responsibilities in different levels such as strategic, technical and periodic inspections and progress reports assessments, to achieve technical and financial objectives of the project.

According to the information provided from the interviewer, the electrical engineer and site manager were not involved for this project during the feasibility study and design process because they were integrated into another project of the company, their involvement for this specific project start with the beginning of the construction phase.

Table 5.1 3 Information of Project management team involved on Project

No	Position	Responsibility	Work experience	Education Background
1	Project Manager	Running the project	7 years	MSc. Civil Engineering
2	Quantity surveyor	Cost and quantity	4 years	MSc. Civil Engineering
3	Site manager	Daily work on site	8 years	BSc. Civil Engineering
4	Structural Engineer	Update possible structural changes	2 years	MSc. Structural Engineering
5	Architect	Update possible architectural changes	3 years	MSc. Architecture
6	Electric Engineer	Electric system	4 years	MSc. Electrical Engineering

5.1.2 Risk Management Process

For this research is taken into consideration only the risks developed, created or managed during three phases of the project such as 1. Design phase 2. Tendering and awarding phase 3.

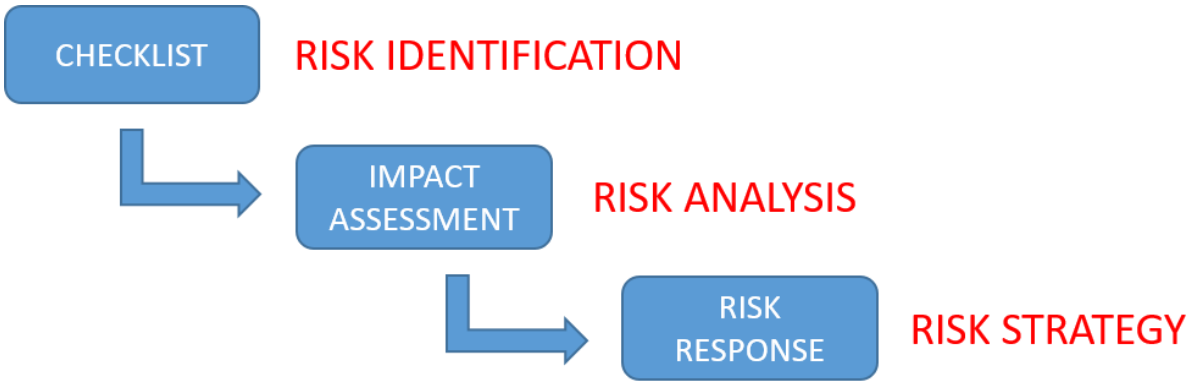

Figure 5.1.2 1 Risk management process in case study A

Source, Author's work

The design phase was developed in-house, construction phase was outsourced to a general contractor that according to the Project Manager, the general contractor was

chosen based on the experience because of proven and gained trust on previous projects or contractual relationships.

Based on the feedback from the Project Manager, for important projects that total amount of investment is relatively high the contractors and suppliers appointed should have experienced with the company at least one contractual relationship in previous projects and have a good evaluation record on the database of the company.

Project manager explains that the reason behind this choice is to avoid as much as possible uncertainties and negative surprises during the construction phase, also to avoid having contractual relationships with not known companies that do not have a stable liquidity during the run of the project. It is important to mention also that this rule also improve the tendering and awarding process because both parties already have knowledge and experience in what might be the general requirements and duties.

The negative impact of this rule is that the price to be expected is more expensive than open tendering and awarding process where unknown companies might offer a lower tendering price, but the risks and uncertainties can be in a higher level

5.1.3 Risk Identification, Checklist technique

According to the feedback received during the interview, the techniques used for risk identification in this project was Checklist technique is used as a technique for risk identification and assessment.

This procedure consists in creating a list with potential risks that might have a significant impact during the development of the project. Initially, this Checklist is created by the Project Manager based on his experience, an examination and discussion related to this Checklist was conducted by the Project Management team, to eliminate the risks considered with the lowest impact.

Final Checklist is developed and containing a response plan during the implementation of the project, this Checklist should be approved before starting the implementation by CEO of the company. Draft risk management strategy is supposed to have an attachment also with risk analysis and steps to be followed in the case of occurrence of one specific risk and the impact expected to have on the total budget of the project.

According to this procedure mainly is given focus to the impact related to the budget that those risks might have, and there is no a detailed procedure of risks analysis but

only determining the level of percentage of occurrence of that risk and what possible impact can have on the budget based on the experience of the team management on identifying and dealing with potential risks in construction project.

The table below illustrates the most common risk that the management team considered and faced during the development of this project.

Table 5.1 4 List of risks, identified and faced during the realization of the project

Project Performance	Risk factor	Frequency
Quality	Supply of defective materials	Frequent
	Working under harsh condition	Likely
	Improper construction methods	Remote
	Lack of protective equipment	Likely
	Poor communication involved parties	Frequent
	Unsuitable leadership style	Likely
Cost	Fluctuation of material prices	Frequent
	Health and safety issues	Likely
	Bribery and corruption	Frequent
	Material wastage	Remote
	Poor site and management and supervision	Likely
	Time overruns for diff. reasons	Likely
Time	Quality problems	Likely
	Low productivity	Frequent
	Improper Construction Methods	Likely
	Delayed in Payments	Frequent
	Poor site and management and supervision	Likely

Determining a short checklist with potential risks that might occur during the development of the project is that is the first step of the risk management process for this project. The second phase will consist on giving every potential risk listed a frequency of the level of occurrence, this frequency is divided in three main levels:

a- Frequent-meaning that there is a high probability of occurrence of the risk. If the risk is recorded to be present on the recorded similar projects within the value of 51-100% than that specific risk is appointed as Frequent risk.
b- Likely, meaning that there is a medium probability of occurrence of the risk. If the risk is recorded to be present on the recorded similar projects within the value of 21-50% than that specific risk is appointed as Likely risk
c- Remote, meaning that there is a small probability of occurrence of the risk. If the risk is recorded to be present on the recorded similar projects within the value of 0-20% than that specific risk is appointed as Remote risk.

5.1.4 Risk Analysis, Impact assessment technique

Appointing the frequency of each potential risk is the first phase of risk management process, the Project Manager explain that this shorten list also will face some more detailed analysis by trying to give a weight of their impact related to time, cost, quality and overall scope of the project.

Reason of conducting this analysis is to divide the risk based on their possible potential on affecting the objectives of the project, also this analysis improves of estimation cost process specifically improving the calculation of added budget needed to deal and to manage those risks.

This analysis also improves the level of knowledges and responsibility of each parties involved on the development of the project, by sharing the information and giving specific focus to high potential risks.

Impact assessment technique consist in grouping every potential risk listed on the above shorten Checklist, and each risk will face an analysis based on the impact that might have on the scope, cost, time.

The impact of each risk is categorized in three levels:

a- High, are appointed those risks which are considered that might have a high impact on the objective of the project, this strong influence of this risk might change the scope, cost, time or quality of the project. In case that risk also is associated with a frequency level, Frequent, this is the most undesired scenario that the project Management team try to avoid or to minimize because the

consequence of this risks can be very high, and the damages also might have a huge impact on time, cost and quality.

b- Moderate, are appointed those risks which are considered that might have a medium impact on the objective of the project, regarding the time and cost this impact is considered to have 5-20% changes from estimation or planned activity. This change might be increase or decrease, but in both cases is listed as potential threats, not as an opportunity.

c- Low, are appointed those risks which are considered that might have a minimal impact on the objective of the project. In case the occurrence of the those risks the final scope of the project, time, cost and quality will not face any significant change. The solution for these types of risks is to maintain their effects under control and not to give an opportunity to increase their impact on the project or otherwise the level of this risk will change from Low to Moderate Category.

Grouping these risks, is based on personal experience of the management team also based on the records that the company possess for these risks, the appointment of each risk is not based on proper statistical or probability calculations. Mostly is done based on internal experience of the company.

The table explain the coloring process of the risk based on their impact.

Table 5.1 5 Impact Assessment of identified risks

Impact Assessment			
	High	Moderate	Low
Scope	The risk will have a dramatic impact on the project scope	The risk will have a sizeable impact on the project scope	The risk will have a minimal impact on the project scope
Schedule	The risk will cause 20% or greater reduction in project duration	The risk will cause between 5-20% decrease in project duration	The risk will cause a 5% or less decrease in project duration
Cost	The risk will cause 20% or greater reduction in project cost	The risk will cause between 5-20% decrease in project cost	The risk will cause a 5% or less decrease in project cost

Quality	The risk will have a dramatic impact on the quality of product delivered	The risk will have a slight impact on the quality of the product delivered	The risk will have a minimal impact on the quality of the project

5.1.5 Risk Response strategy

Risk analysis and categorizing the risks based on their frequency and the possible impact that is believed to have on the objective of the project, the final step in risk management analysis will consist in creating on Risk response strategy.

Risk response strategy will consist on creating a guideline for actions required to be taken before and during the occurrence of the risks, this guideline is accompanied with an attachment that have detailed recommendations for each member of the management team how to deal or who to delegate the responsibilities in case of not having enough confidence for actions or measures needed to be taken.

Table 5.1 6 Risk management strategy to mitigate the influence of the risks

Project Performance	Risk factor	Frequency	Impact	Action	Description
Quality	Supply of defective materials	Frequent	High	Avoid	Ensure trusted are engaged in the supply of the materials. Periodic review of suppliers to enable the company, select good suppliers
Quality	Working under harsh condition	Likely	Moderate	Mitigate	Proper planning taken in consideration weather conditions to ensure the most appropriate conditions are provided for the work. This requires regular assessment of the conditions under which site teams work to ensure maximum performance is achieved always.

Quality	Improper construction methods	Remote	Low	Mitigate	To avoid the problem of improper construction methods, site managers and foreman should be given regular training to enable them to have current knowledge of practices in the industry and grant them the ability to identify wrong methods used by site management.
Quality	Lack of protective equipment	Likely	High	Mitigate	Construction companies should ensure adequate PPE is made available to workers at all times and also workers are given the required training on-site safety and the need to use protective equipment
Quality	Poor communication involved parties	Frequent	High	Mitigate	Good collaborations between involved parties (from clients, consultants, and contractors) should be encouraged on all projects to ensure a common good is pursued the project
Quality	Unsuitable leadership style	Likely	moderate	Mitigate	People put in charge of managing projects or sites should be given the required leadership training to ensure building construction projects precede based on good leadership. This has to take into account local specific factors likely to affect project performance
Cost	Fluctuation of material prices	Frequent	moderate	Transfer	As the problem of price fluctuation is outside the control of the project teams, procurement of materials for projects should be made well in advance of their use periods to prevent increased costs from material price increases.
Cost	Health and safety issues	Likely	High	Avoid	Health and safety issues should be given the needed consideration on projects as it has a high influence on project performance. Management teams on site should have appropriate training in health and safety which will help them pass on health and safety guides on site to workers. There should be periodic toolbox talks on health and safety at the project sites to ensure site teams are well equipped on health and safety issues

Cost	Bribery and corruption	Frequent	High	Avoid	Often the risks to construction organizations stem from the corrupt practices of which it has no knowledge, undertaken by its suppliers and customers. Due diligence and careful negotiations should be required to insulate construction organizations from the wrongdoing of others.
Cost	Material wastage	Remote	moderate	Mitigate	The issue of material wastage on projects can be managed by ensuring proper planning of material usage and also using the most appropriate methods of construction which will lead to low waste generation. This can also be checked by having good supervision of the activities of site workers.
Cost	Poor site and management and supervision	Likely	moderate	Mitigate	The issue of poor site management and supervision can be managed by ensuring management team on site are given the required training and also have the required technical know-how on the construction methods and technologies used on projects.
Cost	Time overruns for diff. reasons	Likely	moderate	Mitigate	As explained above
Time	Quality problems	Likely	moderate	Transfer	The issue of productivity at the construction site can be improved through the motivation of site teams and also instituting a very effective management team and style on projects.
Time	Low productivity	Frequent	High	Transfer	The issue of productivity at the construction site can be improved through the motivation of site teams and also instituting a very effective management team and style on projects.
Time	Improper Construction Methods	Remote	Low	Mitigate	To avoid the problem of improper construction methods, site managers and foreman should be given regular training to enable them to have current knowledge of practices in the industry and grant them the ability to identify wrong methods used by site management.

Time	Delayed in Payments	Frequent	High	Avoid	The influence of delayed payments can be managed by ensuring issues of payment are well documented at the start of projects. Clients should be encouraged to ensure payments arrangements made are executed according to plan. Contractors may also want to put in place a backup plan to ensure the cash flow of projects is not negatively affected by delayed payments.
Time	Poor site and management and supervision	Likely	moderate	Mitigate	The issue of poor site management and supervision can be managed by ensuring management team on site are given the required training and also have the required technical know-how on the construction methods and technologies used on projects

5.2 Case Study B

Case study B will consist on analyzing the Risk Management process implemented by Kontakt shpk, during the development of the Magnet project. This project consists in developing and constructing residential buildings located in Ndre Mjeda street, near center of Tirana, Albania.

5.2.1 Company profile and project details

Kontakt shpk is founded by the cooperation of two friends Fatmir Bekteshi and Avenir Kika, where they developed the first residential project in 1999 on the land owned by Kika's family. Nowadays, the company is owned only by Fatmir Bekteshi, and the company is specialized in developing and constructing residential buildings, developing and revitalizing the entire urban area in the capital city of Albania, Tirana.

Magnet is a successful example of implementing ambitious projects and taking a huge risk and developing a large area, with only one purpose creating residential space and units for service.

Table 5.2 1 Company profile Case study B

Name of the Company	Kontakt shpk
Founded	1999
Core business	Construction& Real Estate Development

Nr of employee Administration& Technical Department	94
Residential Buildings projects	Magnet, Ana, Siri, Mangalemi 21 etc
Affiliation	Frosina Plaku Str 40, 1023 Tirana, Albania

Magnet is a successful example of implementing ambitious projects and taking a huge risk and developing a large area, with only one purpose creating residential space and units for service.

The below table are some basic details of the project

Table 5.2 2 Basic descriptive data of Magnet project

Project	Magnet
Typology	Residential
Investment cost	47,260,134
Gross Construction Area	120,000 m2
Residential	7 buildings, 13 floors each building
Parking	Each building 1 underground parking floor
Construction Time	2011-2014

Project management team is compound with 8 people coming from different backgrounds, mostly with a Civil Engineering backgrounds but also architects are involved. Besides the Project Manager is involved the Financial Manager coming with a financial background and his responsibility consist of any potential development of the project that affects the budget of the project. According to the Project Manager, the presence of the Financial Manager in the team is helpful because allow the project manager to focus more on technical issues during the development of the project and mostly the cost controlling is completed by the Financial Manager.

Project management team involved on this project is explained in the table below

Table 5.2 3 Descriptive data of the project management team involved in Case B

No	Position	Responsibility	Work experience	Education Background
1	Project Manager	Running the project	12 years	MSc. Structural Engineering
2	Quantity surveyor	Cost and quantity	8 years	MSc. Civil Engineering
3	Financial Manager	Cost controlling	4 years	MSc. Finance and Administration
4	HSE manager	HSE rules implementations	3 years	MSc. Environmental and Resource Management
5	Site manager 2	Daily work on site	2 years	BSc. Civil Engineering
6	Structural Engineer	Update possible structural changes	5 years	MSc. Structural Engineering
7	Architect	Update possible architectural changes	3 years	MSc. Architecture
8	Draftsman	Update teams with architectural changes	2 years	MSc. Architecture

5.2.2 Risk Management Process

Similarly, to Case study A, the identification of risks is conducting by Checklist technique, the Project Manager explains that is the most common technique used in Albania and somehow is the technique that gives confidence to the project managers that identified risks are relevant to the project. The reason, why is difficult to conduct other technique such as Brainstorming or Delphi technique, is the lack of historical data, lack of reliable database and lack of the proper infrastructure to conduct a questionnaire or survey. Project manager explains that experience gained through years becomes a powerful tool for improving and increasing the intuition on identifying the risks before and during the implementation of the projects.

The process of risk management is illustrated in the below Fig. 5.2.2.1

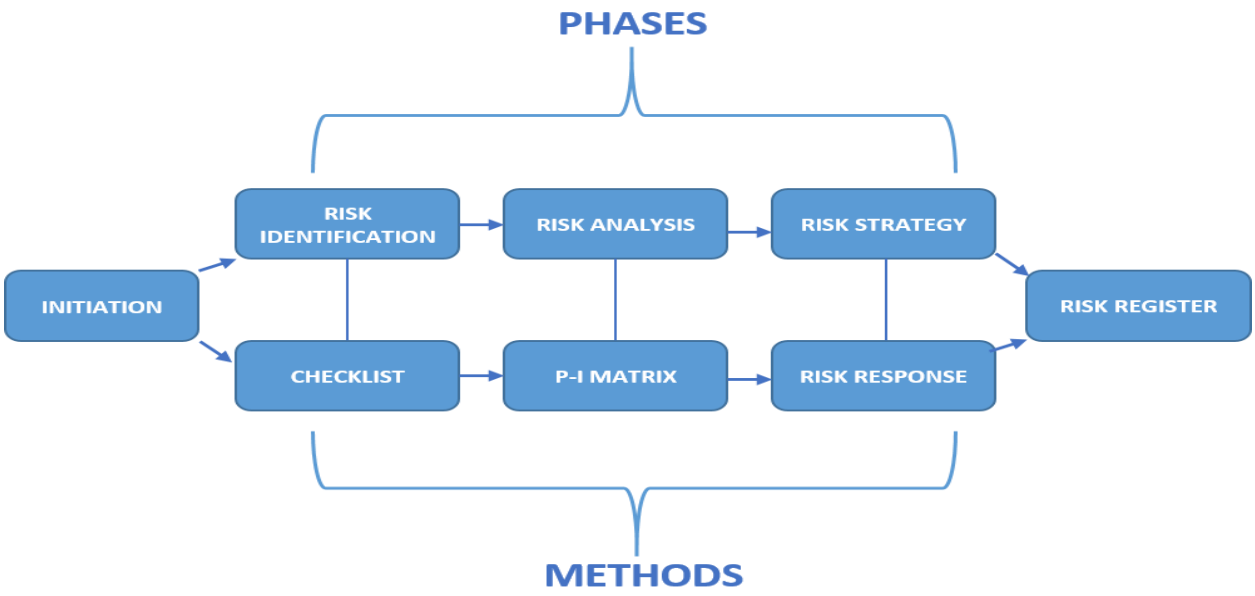

Figure 5.2.2 1 Risk management Process for the case study B

5.2.3 Risk identification

The project manager claims that the strategy of the company on focusing only in one typology of real estate development, mainly residential buildings is extremely helpful because it allows the teams to gain experience on the same typology of the projects and the risks faced on the previous project are monitored and controlled in a progressive way by achieving better results on the next project.

The company is positioned most of the cases in the position of the main developer for the project so according to the Project Manager is needed to define different risks in different phases of implementation of the project because on the potential of the occurrence of the risk the decisions might change.

Initially, based on the experience the management team possesses a Detailed list of potential risk, this list is generated based on the previous project completed by the company.

The table below explains the way that Project management is dividing potential risks based on the phase of their occurrence

Table 5.2 4 Categorizing risks based on the phase of the occurrence

The phase	Objectives	Type of risks	Description /Reasons of risk occurrence

of the project			
Design Phase	Decide project objective	Lack of coordination, communication, cooperation between parties	Parties involved do not share the same motivation, desire, and responsibilities
		Not enough resource	Number of people involved inappropriate
	Design	Not efficient solutions	Coming as a result of lack of communication, No clear understanding of the objectives of the project
		Periodic changes of design	Expected change because of the client
		Leadership do not take decisions on time	Decision process take more time than estimated
Tendering and Awarding	Contract documents preparations	Legal gap knowledge	legal department not being active in the design phase of the project
	Tendering process	Not finding the right contractor	the offers are not according to the expectations
		The contractor is not reliable	there is a need to check up all companies
	Selection	Negotiation process take more time	Negotiation between parties should be based on determined deadlines
Construction Phase	Monitor and control	The contractor has no proper experience and knowledge	Lack of experience on dealing certain level of complexity of the project
	Resource	Losing the control over the project	Not the right experience or tools on project controlling

	Man-agement	Delays in the construction schedule	Corrective actions not taken in time
		Contractors have a problem with payments	contractor does not have li-quidity
	Docu-menta-tion and man-agement	Errors in documentation	contractor should prepare the documents from the beginning
Commissioning Phase	Final in-spection and	Possible errors/ take more time to fix it	Possible errors or malfunction of the equipment and it take more time to fix it

5.2.4 Risk analysis

Regarding the risk analysis, the Project Manager explains that through the Probability-Impact matrix is given a specific weight to the potential of the risks mentioned in the above table. Through this technique, the management team can understand the impact and the consequence of a certain risk occurring.

Project Manager supports the idea that eliminating as much as possible problems and eliminating uncertainties will improve the monitoring and controlling process, the basis of this idea is trying to deliver a project with no errors.

This type of approach helps to increase the pressure on Project Management team and this pressure will be transferred to the contractor in the same time, in that way each member of parties involved will be more concerned related to the risks and acting on the proper time when a risk is affecting the scope of the project.

Based on the probability of occurrence of the risks, they will be divided in the group as the below Table 5.2 5 shows

Table 5.2 5 Categorizing risks according to the probability of the occurrence

Probability	Very Low	Low	Medium	High	Very High
Risk	0.1	0.3	0.5	0.7	0.9

According to the above table, each identified risk will be associated within a probability of occurrence, this it will be based on the experience, probability of occurrence of certain risk in the previous project and based on the estimation that the management team believes that risk can happen.

Determining the probability of each risk is the first step on risk analysis phase, the second step of risk analyze will consist that each identified risk will be given the estimated rate of the impact that might have on the final project scope such time, cost and quality.

Table 5.2 6 Categorizing risks based on the impact in the scope of the project

Identified Risk	**Project Objective**	**Very low 0.05**	**Low 0.1**	**Moderate 0.2**	**High 0.4**	**Very High 0.8**
Risk	**Cost**	Cost increase no significance	<10% cost increase	10-20% cost increase	20-40% cost increase	>40% cost increase
	Time	Time increase no significance	<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

The rate of impact is divided into 5 levels such as Very low (0.05), Low (0.10), Medium (0.02), High (0.4), Very High (0.8), this type of grouping is made for three main components of Cost, Time and Quality.

The above table contains and explains all information how is categorized each risk based on the expected rate of impact during implantation of the project.

To get a result, the process is not concluded with the Rate of the Impact table, but there are needed further calculations.

The rate of the Impact materialized in empirical numbers must be multiplied by the associated probability of occurrence for each respective risk. This will give a result that describes and materialize the potential of each risk

Table 5.2 7 Risk Probability-Impact Matrix

0.8	0.8	0.24	0.4	0.56	0.72
0.4	0.04	0.12	0.2	0.28	0.36
0.2	0.02	0.06	0.1	0.14	0.18
0.1	0.01	0.03	0.05	0.07	0.9
0.05	0.005	0.015	0.025	0.035	0.045
IMPACT / PROBABILITY	0.1	0.3	0.5	0.7	0.9

The result after multiplication of probability of occurrence within the respective rate of impact, the final output of risk analysis is organized on the table below.

Table 5.2 8 Risk probability and Impact on costs, time and quality

Identified Risk	**Project Objective**	**Probability**	**Impact**	**Matrix**
Lack of coordination, communication, cooperation between parties	Cost	0.7	0.2	0.14
	Time		0.2	0.14
	Quality		0.1	0.07

Not enough resource	Cost	0.5	0.1	0.05
	Time		0.4	0.2
	Quality		0.05	0.025
Not efficient solutions	Cost	0.7	0.8	0.56
	Time		0.8	0.56
	Quality		0.1	0.07
Periodic changes of design	Cost	0.5	0.1	0.05
	Time		0.8	0.4
	Quality		0.05	0.025
Leadership do not take decisions on time	Cost	0.5	0.2	0.1
	Time		0.8	0.4
	Quality		0.8	0.4
Legal gap knowledge	Cost	0.5	0.1	0.05
	Time		0.2	0.1
	Quality		0.05	0.025
Not finding the right contractor	Cost	0.5	0.2	0.1
	Time		0.4	0.2
	Quality		0.8	0.4
Reliability of contractor	Cost	0.1	0.4	0.04
	Time		0.8	0.08
	Quality		0.4	0.04
Negotiation process take more time	Cost	0.5	0.2	0.1
	Time		0.8	0.4
	Quality		0.1	0.05
Contractor has no proper experience and knowledge	Cost	0.1	0.4	0.04
	Time		0.8	0.08
	Quality		0.4	0.04
Losing the control over the project	Cost	0.1	0.4	0.04
	Time		0.4	0.04
	Quality		0.8	0.08
Delays in construction schedule	Cost	0.5	0.05	0.025
	Time		0.4	0.2
	Quality		0.2	0.1

Contractors has problem with payments	Cost	0.3	0.05	0.015
	Time		0.8	0.24
	Quality		0.4	0.12
Errors in documentation	Cost	0.1	0.05	0.005
	Time		0.8	0.08
	Quality		0.05	0.005
Possible errors/ take more time to fix it	Cost	0.3	0.2	0.06
	Time		0.8	0.24
	Quality		0.4	0.12

5.2.5 Risk response strategy

Risk response strategy consists of a simple plan of categorizing the risks in three main groups, 1. Unacceptable 2. Moderate 3. Acceptable. Based on the category in which a certain risk is situated there is a clear action to be taken and how to prevent the development of risk the rate of the impact during the implementation of the project.

The project manager believes that this grouping of risks has been relatively effective, and it fits more in practice than developing a complex matrix with certain rules to be strictly followed.

The below table explains based on the level of risk everyone knows the procedure, how to transfer the responsibility of taking a decision regarding the reaction to be provided to minimize the impact of the risk. It is meaningful to mention that for risks categorized as Unacceptable, those that have a huge impact on the scope of the project, even the Project Manager has no full power of decision making but must ask for a confirmation from Leadership of the company, such as the executive department located and situated more closely to the CEO of the company

Table 5.2 9 Risk response strategy

Risk response strategy				
Type of Risk	Type of Action	Emergency level	Decision	Description

Acceptable	Acceptable	Low	Project Manager	The solution and decision of this risks can be provided by PM
Moderate	Mitigate	Medium	Project Manager	The solution and decision of this risks can be provided by PM
Unacceptable	Avoid	High	CEO of Company	The decision for a proposed solution is to the CEO of Company

Project manager explains that this helpful also because reduce the pressure on him of taking important final decisions is up to the leadership of the company.

As final step to be conducted during the management of a certain risk is to register that risk on Risk Register of the Project, which is updated every time with typology of the risk, his final impact on the project, related to time, cost and quality and what type of action were taken in that time.

This procedure is very important for the company and the project management team because it is an important database, it improves the process of risk identification and analysis, entire risk management process will be on progress for the upcoming projects.

5.3 Results

In case A, it can be distinguished that the analyze of the risks have as a result an equilibrium between Cost and Quality, on the level of 35%, meaning that 35% of total risks will have an impact on Cost and Quality and less than 30% of the total amount of risks will have an impact on Time during the development of the project.

The above illustrates the expected impact of the total amount of risks listed in Check-list, and the percental division of them based which component of the project scope is affecting.

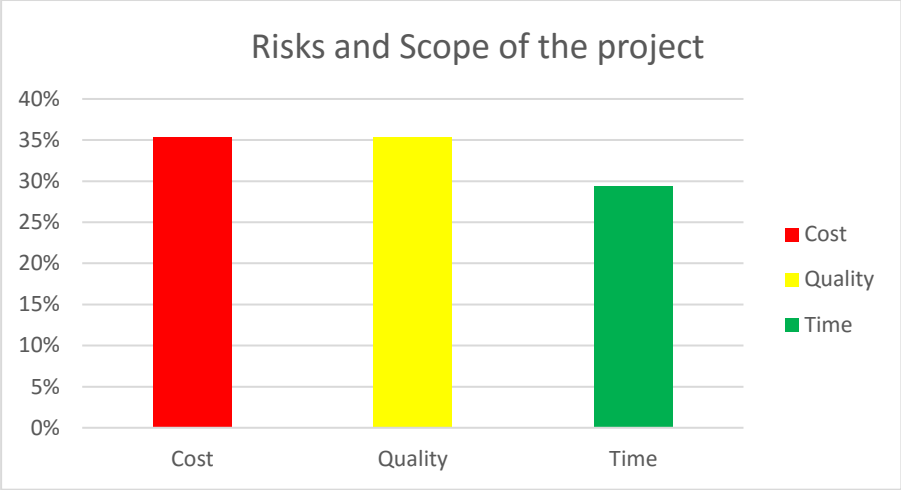

Figure 5.3 1 Percentage of risks affecting the scope of the project, Case study A

From the total amount of risks, in Case A there is an expectation that 41% of risks will have a level of impact considered as High, 47% are considered to have a Moderate impact and only 12% are considered to have a Low impact on the scope of the project. So, the level of mitigation of risks in Case A, during the risk response phase is nearly 88% and only 12% that can be neglected during the occurrence, otherwise, the scope of the project will face undesired changes.

This data is presented below Fig. 5.3.2

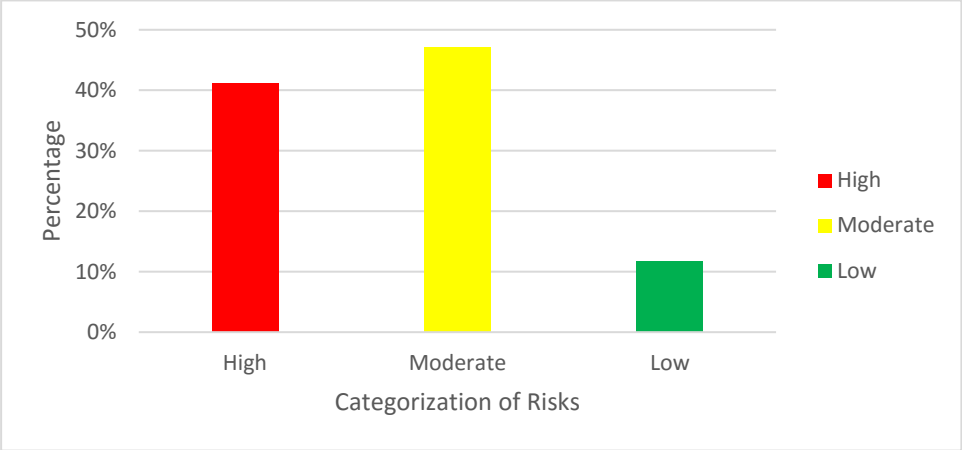

Figure 5.3 2 Expected level of Impact for identified risks, Case study A

As is it is shown in the below Fig. 5.3. 3 approximately 60% out 35% of total risks that are expected to affect the Cost the level of impact will be Moderate and the other 40 % will have a level of Impact considered High, leaving with 0% level of Impact considered as Low.

This show that regarding the Costs are no risks that can be neglected otherwise the project will face changes regarding this objective.

From 35% of total risks that affect the Quality of the project, it is expected that 50% of them will have a level of impact considered High, 33% will be on the Moderate Level and 17% on the Low Level.

Related to Time, the results are quite different from two other components, for instance regarding risks with the Low level of Impact there is an increase, reaching 20%, and there is a balance in 40% regarding the Moderate and High level of impact that might affect the time of the project.

This result enforces the idea the project management team is focused to not tolerate any risk that might affect Cost versus Time that is more predisposed to tolerate certain risk.

These results are presented in the below Fig. 5.3. 3

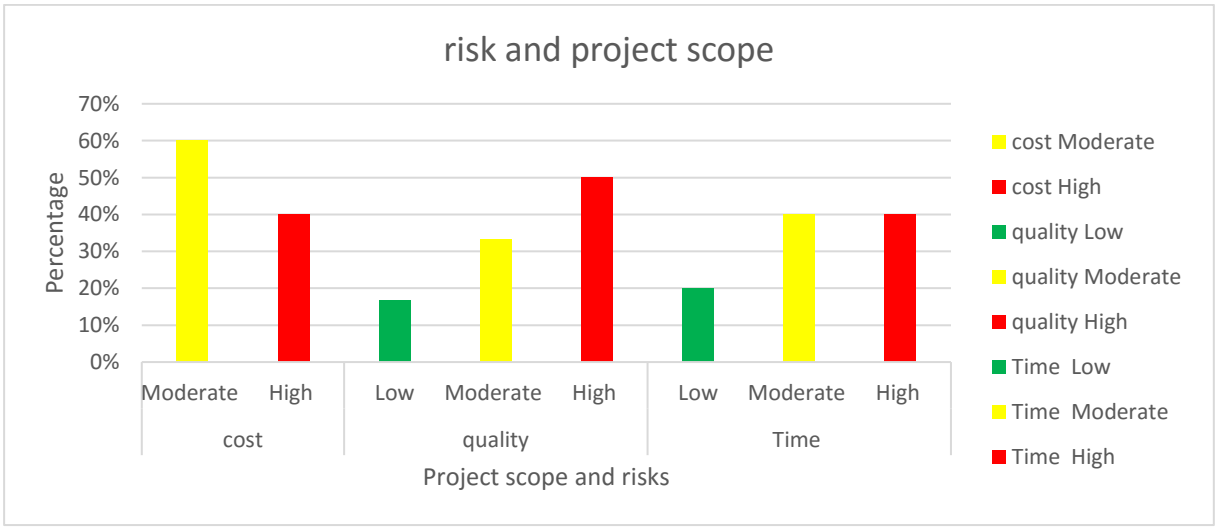

Figure 5.3 3 Impact of identified risks related to costs, time and quality, Case study A

Regarding the Case B, from the total amount of risks listed in Checklist 40% of them are resulting as risks with level of impact as Acceptable, 33% are considered as risks that might have a Moderate impact and 27% are list as risks with level of impact Unacceptable, as it is organized on the Fig. 5.3.4

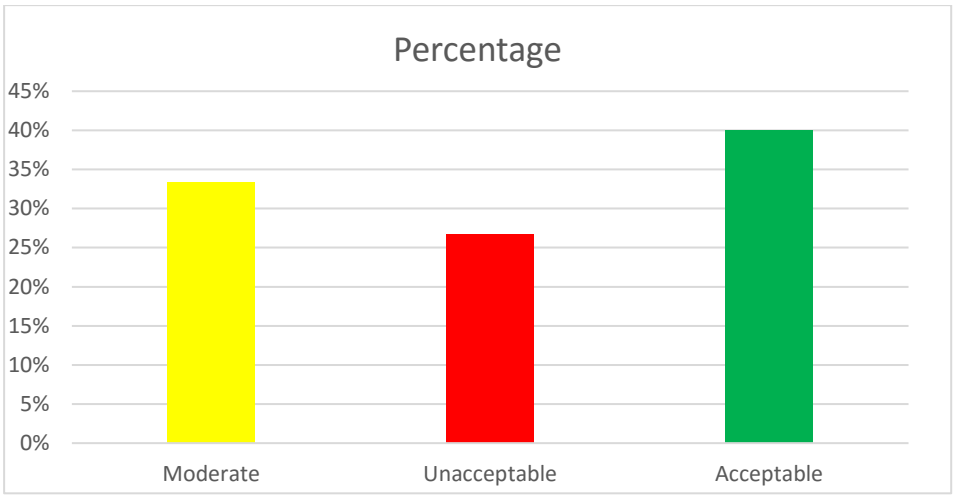

Figure 5.3 4 Level of Risk Impact for identified risks, Case study B

From total amount of risks expected to face the project, regarding the Cost, 50% of the risks are evaluated as Acceptable, with no impact on Cost, 30% is evaluated as Moderate, 20% are evaluated with a level of Impact as Unacceptable, this 20 % of risks have a huge potential to change the cost of the project.

The scenario is quite different regarding the Quality, there is a considerable increase of risks considered with a level of impact Acceptable reaching 60 %, and there is a balance between Moderate and Unacceptable risks 20%.

Only 10% is listed as Acceptable risks regarding the time of the project, 40 % of those risks are categorized as risks with the level of impact Moderate, and 50% are Unacceptable for the schedule of the project.

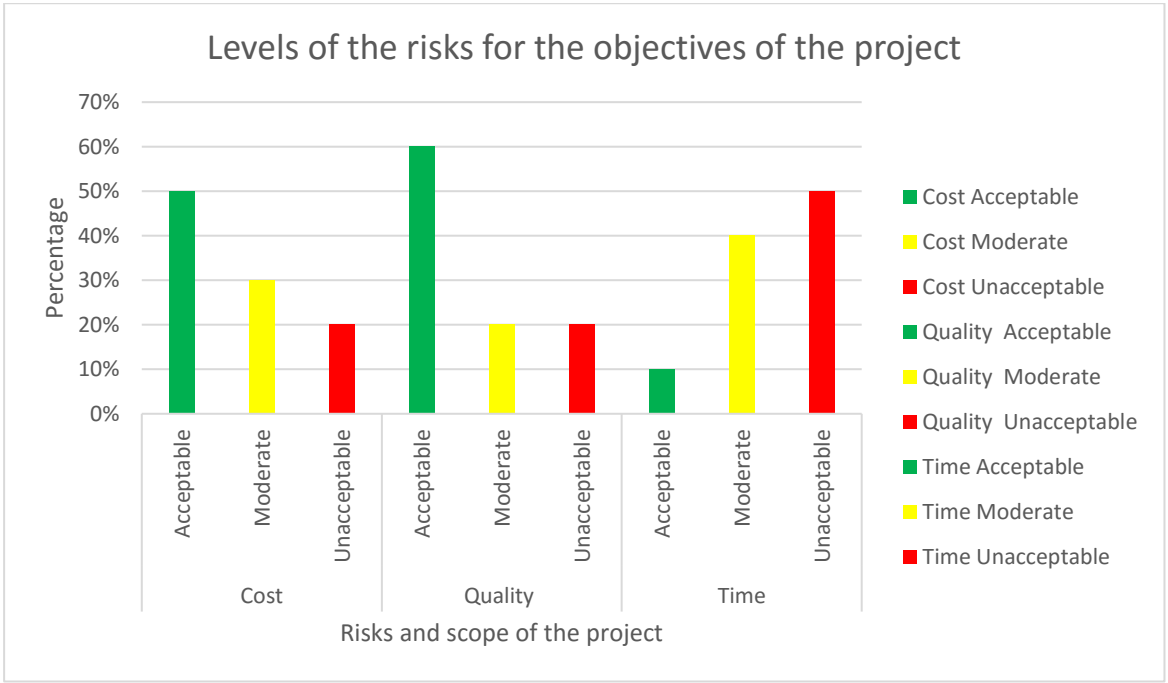

Figure 5.3 5 Impact of identified risks related to costs, time and quality, Case study B

5.4 Discussion and comparison of Case studies

The numerical results presented are extremely supportive of the idea that there is a difference between cases and mostly is because of the approach that is used to conduct the risk management.

In Case A, risk analyze is conducted mostly on the descriptive way with no effort from numerical analysis, in that way the approach of the project management team is conservative regarding the risks, by considering risks only as risk=danger=damage and the action to be taken is to avoid it. For that reason, from the total amount of risks, 88% is evaluated as potential problems for the development of the project as planned.

Case B, there is another approach, by embracing the P-I matrix, gave the project management team a concrete possibility to evaluate the real expected effect of the risk. There is an increase of Acceptable risks, the occurrence of those do not affect the scope of the project, 40%, and only 60% is the sum of Moderate and Unacceptable risks, with a difference of 28%.

The approach used in Case A, have as outcome the risks considered as High impact are on the level of 50% for Quality, 40% for Time and Cost, the situation is presented differently in case B, where the highest level of Unacceptable risks is related to Time, 50%, and Cost and Quality up to 20%.

Case A and B have illustrated the basis of risk management procedure conducted by two companies in Albania, risk management process itself is very important that based on the level of professionalism shown in the process more professional reliable will be the output.

To conduct the risk identification phase both of companies use the Checklist technique because this technique is extremely related to the experience of the companies and project management team.

In both companies, it is the same technique used the concept is different because in Case A the Checklist is conducted based on three main components of the project Cost, Time, Quality. Case A risks are grouped in three groups based on the expected effect on Cost, Time, and Quality without taking in consideration the phase of the project, also each risk is associated with the level of frequency that might occur, this level

of frequency is estimated based on the experience of the project management team and the internal database of the company.

Case B, on the other hand, it shows a detailed usage of Checklist, by listing each potential risk that the project might face during the development, and in this case, the risks are listed according to the phase of the project that might occur.

In case of B, there is no attempt to support the risks with other important inputs, but only the identification of the risk, identification of the phase that might occur during the development of the project.

Same as Case A, the Checklist is conducted based on the experience of the project management team and the internal database of the organization. Advantageous in Case B is that the company mainly operate with the same typology of projects, residential buildings.

Risk assessment in Case A is conducted by the technique known as Impact Assessment, where each listed risk is associated with the level of the impact. Based on the level of influence that is believed or expected to have on the project scope the levels of impact are divided Low, Moderate, High.

Case B, for risk analysis, embraced the technique of Probability-Impact Matrix, each listed risk is given a weight of probability of occurrence and one level of impact related to time, cost and quality. This procedure requires also numerical calculations and the final output for each risk is expressed on empirical data.

Regarding the Risk, the response strategy is very similar in both cases, by defining strict rules to be followed and assigning the responsibilities to everyone involved in the management of the project. Both cases show the importance of keeping a risk register because it is helpful for future projects.

5.5 Conclusion

The study of the above two case studies emphasises the importance of risk management during the development of the project management. The chosen approach to analyzing the risk affects the entire process of risk management and the solutions will depend on the risk analyze results.

Embracing a descriptive and intuitive approach on risk analyze will lead in the management of the risks in a conservative way by entitling the risks with their maximal potential and maximizing their effect, leading to an artificial increase of the pressure of the project management team.

This extra pressure will lead the project management team in a wrong direction by evaluating the risks with the high potential to damage the scope of the project.

Conducting the analyze of the case studies illustrates a gap between theoretical knowledge and practical application of the risk management process.

Risk identification is compiled mainly based on the internal database, without taking into consideration the external force that can drive the development of new external potential risk. The fact that Checklist is done mainly on the internal database and the weight of probability or impact is given according to the experience limits the integration of risk management process and create the opportunity to expose the project under new external risks that might occur because of actual political, economic and environmental situation of the country or changes to the construction companies.

There is a strong concept or mentality of defining the risks only as a danger than cause difficulties on the implementation of the project and there is no approach to certain risks an opportunity to improve the implementation process and maximizing the accomplishment of the objectives.

Risk management process is mostly considered as a process of controlling and monitoring during the construction phase, by considering zero risks or very few risks in design or tendering phase. This concept leads to an approach in a reactive way in case of occurrence of risks before construction phase, project management team should embrace the proactive approach for the entire life cycle of the project, specifically design, tendering and construction phase.

6 Risk analyze, Risk Impact method

This chapter will deal with analyzing a proposed method to define properly the impact of each risk that might occur during the development of the project. The analyze of cases studies in chapter 5 shows that there is a significant gap in associating the proper impact of listed risks during the risk qualitative and quantitative analysis. This

chapter will deal with a simple and efficient method of defining risk probability and risk impact based on numerical and statistical calculations.

6.1 Absolute and normalized probabilities of risks

During the development of the project the risks can affect the project by creating an unfavorable situation and the consequences can be with a high impact on the settled objectives for the project. The analyze of two cases studies gave the idea that on reality in practice there is no a conduction of a detailed analysis of the impact that identified risks might have on the project.

Risk analyze process was conducting but somehow there was no clear answer about what the impact on costs might be, what can be the potential risks to the scheduling and quality and most important the risk analyze conducting on two case studies was not able to express the supposed impact in concrete numbers or probabilities calculations.

To conduct this phase of the study and illustrates with numerical applications the usage of this numerical approach will be selected 5 risks discussed in the Case B, listed during the risk identification process. The method can be used for each risk identified no matter the phase of project implementation. The risk chosen for developing this numerical approach are:

1. Lack of coordination, communication, cooperation between parties
2. Not efficient solutions
3. Periodic changes of design
4. Delays in the construction schedule
5. Contractors have a problem with payments

For the probability of the occurrence will be used the same numerical value identified in the Case B, as the probability of occurrence of the risks is mainly based on the experience and it varies from project to project, and it needs a large database to appoint a realistic value.

Table 6.1 1 Identified risks and their respective probability of occurrence

Risk	Probability of occurrence
Lack of coordination, communication, cooperation between parties	0.7
Not efficient solutions	0.7
Periodic changes of design	0.5
Delays in construction schedule	0.5
Contractors have a problem with payments	0.3

Determining the probability of each risk for the above risks is the first step of this analyze, to be able to emphasize the real impact and the real weight of each risk it is needed to conduct the normalization of the probability.

The sum of absolute probability for the listed risks is the sum of the probability of each risk: 0.7+0.7+0.5+0.5+0.3=2.7

Table 6.1 2 Normalized Probability of risks

Risk	Absolute probability	Normalized Probability
Lack of coordination, communication, cooperation between parties	0.7	0.259259259
Not efficient solutions	0.7	0.259259259
Periodic changes of design	0.5	0.185185185
Delays in construction schedule	0.5	0.185185185
Contractors has problem with payments	0.3	0.111111111
	∑ 2.7	∑ 1

Normalized probabilities can be achieved by the process of dividing the associated probability of the risks with the total sum of the absolute probabilities of all risks listed (see the above table)

As can notice the sum of all normalized probabilities is 1, and the normalized probabilities are needed to calculate the risk exposure.

6.2 Risk Impact- Quantitative approach

Three main objectives to achieve during the accomplishment of the project such as costs, time and quality are strongly correlated together and the non-accomplishment of one can affect the other component.

The priority of those is settled mainly by needs and requirements of the clients, the purpose of the project and other extra factors, for conducting a proper risk impact there is a necessity to define the priority of these components from start to the end of the project, settling of the priorities will help the process of giving an accurate impact of each risk related to time, costs and quality.

For this study, the priorities of costs, time, quality will be divided into 4 main variants, but this can vary and change according to the needs of each project phase or organization.

The listing process of the priorities needs a long process of discussion with every stakeholder engaged in the development of the project because these priorities reflect directly the interest and requirement of the stakeholders. Although a priority s given on the objectives of the project is not recommended to define a certain objective within the level of 0%, so to not to be taken in consideration, because of the interrelation that exists between these objectives and the neglection of one objective can lead to new potential unknown effects.

Variant 1

In this variant, it is given priority of the costs, expressed in percentage (50%) and time and quality share the same level of priority (25%).

Table 6.2 1 Normalized Impact, costs has the priority

Project objective	Priority (Abs %)	Normalized Influence
Cost	50%	0.5
Time	25%	0.25
Quality	25%	0.25
	∑ 100%	∑ 1

Variant 2

In this variant, it is given priority of the time, expressed in percentage (50%) and cost and quality share the same level of priority (25%).

Table 6.2 2 Normalized Impact of risks, time has the priority

Project objective	Priority (Abs %)	Normalized Influence
Cost	25%	0.25
Time	50%	0.50
Quality	25%	0.25
	∑ 100%	∑ 1

Variant 3

In this variant, it is given priority of the quality, expressed in percentage (50%) and cost and time share the same level of priority (25%).

Table 6.2 3 Normalized Impact of risks, Quality has the priority

Project objective	Priority (Abs %)	Normalized Influence
Cost	25%	0.25
Time	25%	0.25
Quality	50%	0.50
	∑ 100%	∑ 1

Variant 4

In this variant all three components costs, time and quality share the same level of priority 1/3 or 33, (33%). This variant avoids any preference between time, costs, and quality and they share the same level of impact on the achievement of the scope of the project, meaning that stakeholders have the same interest all components to be achieved in the same level.

Table 6.2 4 Normalized Impact of risks, Cost, time, quality share same level of priority

Project objective	Priority (Abs %)	Normalized Influence
Cost	33,33 %	0.33
Time	33,33 %	0.33
Quality	33,33 %	0.33
	∑ 100%	∑ 1

Defining the priority and finding the interdependency among the objectives of the projects, cost, time and quality for each of these three components there is a need to determine the impact of each identified risk. After defining the absolute impact of each risk, and the units regarding the time can be expressed in days, weeks or months or for the quality in percentage the successive step will consist in finding the normalized impact same procedure used for the normalization of the probability.

Impact on Costs

Giving the weight of the absolute impact is done based on the experience, database of the previous project, situations of the construction market of the country and other external factors.

Table 6.2 5 Absolute impact and Normalized probability of risks related to costs of the project

No	Risk	Absolute Impact (Euro)	Normalized Probability
R01	Lack of coordination, communication, cooperation between parties	€ 10,000	0.12987013
R02	Not efficient solutions	€ 25,000	0.324675325
R03	Periodic changes of design	€ 12,000	0.155844156
R04	Delays in construction schedule	€ 8,000	0.103896104
R05	Contractors has problem with payments	€ 22,000	0.285714286
		∑ 77000 €	∑ 1

Impact on Time

Giving the weight of the absolute impact is done based on the experience, database of the previous project, situations of the construction market of the country and other external factors.

Table 6.2 6 Absolute impact and Normalized probability of risks related to time of the project

No	Risk	Absolute Impact (Days)	Normalized Probability

R01	Lack of coordination, communication, cooperation between parties	21 Days	0.181034483
R02	Not efficient solutions	5 Days	0.043103448
R03	Periodic changes of design	15 Days	0.129310345
R04	Delays in the construction schedule	30 Days	0.25862069
R05	Contractors have a problem with payments	45 Days	0.387931034
		∑ 116	∑ 1

Impact on Quality

Giving the weight of the absolute impact is done based on the experience, database of the previous project, situations of the construction market of the country and other external factors.

Table 6.2 7 Absolute impact and Normalized probability of risks related to quality of the project

No	Risk	Absolute Impact (%)	Normalized Probability
R01	Lack of coordination, communication, cooperation between parties	20 %	0.2
R02	Not efficient solutions	35 %	0.35
R03	Periodic changes of design	20 %	0.2
R04	Delays in construction schedule	10 %	0.1
R05	Contractors has problem with payments	15 %	0.15
		100 %	1

The final normalized final risk impact for every listed risk no matter the phase of the project will be obtained by combining the normalized impacts of costs, time and quality with the normalized impact of each risk taken in consideration according to costs, time and quality.

Calculating normalized risk impact, Variant 1, where the priority is given to the costs (50%) and the time and quality share the same level of impact 25%.

Table 6.2 8 Normalized Risk impact of risks related to costs of the project

No	Risk	Costs		Time		Quality	Risk Impact
R01	Lack of coordination, communication, cooperation between parties	0.1289x0.5	+	0.1810x0.25	+	0.20x0.25	0.16019369
R02	Not efficient solutions	0.3246x0.5	+	0.0431x0.25	+	0.35x0.25	0.26061352
R03	Periodic changes of design	0.1558x0.5	+	0.1293x0.25	+	0.20x0.25	0.16024966
R04	Delays in construction schedule	0.1038x0.5	+	0.2586x0.25	+	0.10x0.25	0.14160322
R05	Contractors has problem with payments	0.2857x0.5	+	0.3879x0.25	+	0.15x0.25	0.2773399
							∑ 1

Normalized risk impact for Variant 2, where the priority is given to the time (50%) and the costs and quality share the same level of impact 25%.

Table 6.2 9 Normalized Risk impact of risks related to time of the project

No	Risk	Costs		Time		Quality	Risk Impact
R01	Lack of coordination, communication, cooperation between parties	0.1289x0.5	+	0.1810x0.5	+	0.20x0.25	0.17298477
R02	Not efficient solutions	0.3246x0.5	+	0.0431x0.5	+	0.35x0.25	0.19022056
R03	Periodic changes of design	0.1558x0.5	+	0.1293x0.5	+	0.20x0.25	0.15361621
R04	Delays in construction schedule	0.1038x0.5	+	0.2586x0.5	+	0.10x0.25	0.18028437
R05	Contractors has problem with payments	0.2857x0.5	+	0.3879x0.5	+	0.15x0.25	0.30289409
							∑ 1

Normalized risk impact for Variant3, where the priority is given to the quality (50%), the costs and time share the same level of impact 25%.

Table 6.2 10 Normalized Risk impact of risks related to quality of the project

No	Risk	Costs		Time		Quality	Risk Impact
R01	Lack of coordination, communication, cooperation between parties	0.1289x0.25	+	0.1810x0.25	+	0.20x0.5	0.17772615
R02	Not efficient solutions	0.3246x0.25	+	0.0431x0.25	+	0.35x0.5	0.26694469
R03	Periodic changes of design	0.1558x0.25	+	0.1293x0.25	+	0.20x0.5	0.17128863
R04	Delays in construction schedule	0.1038x0.25	+	0.2586x0.25	+	0.10x0.5	0.1406292
R05	Contractors has problem with payments	0.2857x0.5	+	0.3879x0.25	+	0.15x0.5	0.24341133
							∑ 1

Normalized Risk Impact for variant 4, where there is no preference about the priority and costs, time and quality share the same level of priority (33%)

Table 6.2 11 Normalized Risk impact of risks related to costs, time, quality on same level of priority

No	Risk	Costs		Time		Quality	Risk Impact
R01	Lack of coordination, communication, cooperation between parties	0.1289x0.333	+	0.1810x0.333	+	0.20x0.333	0.17028451
R02	Not efficient solutions	0.3246x0.333	+	0.0431x0.333	+	0.35x0.333	0.23923567
R03	Periodic changes of design	0.1558x0.333	+	0.1293x0.333	+	0.20x0.333	0.161702
R04	Delays in construction schedule	0.1038x0.333	+	0.2586x0.333	+	0.10x0.333	0.15415685
R05	Contractors has problem with payments	0.2857x0.333	+	0.3879x0.333	+	0.15x0.333	0.27452099
							∑ 1

6.3 Risk Exposure-Quantitative Approach

Calculating the risk probability and risk impact for each identified risk combined within the priorities settled to be achieved will lead to the possibility of calculating risk exposure. Risk exposure is calculated as a product of risk probability with the respective risk impact. The determination of the risk exposure and placing them to the right interrelationships among the phases of the project or settled priorities of the project can make possible of creating a list of risk priority.

Ranking risks according to the risk exposure is extremely helpful in identifying the right strategy of mitigation of risks, to minimize the risks and so-called dangerous consequences or to maximize the possible opportunities that might be developed under certain circumstances.

Table 6.3 1 Risk Exposure, Priority list of Risks when priority is given to Costs

Priority to Costs						
No	Risk	Risk Impact	Risk Probability	Risk Exposure	Priority list	Ranked Risks Impact
R01	Lack of coordination, communication, cooperation between parties	0.16	0.25926	0.042	2	5
R02	Not efficient solutions	0.261	0.25926	0.068	1	2
R03	Periodic changes of design	0.16	0.18519	0.03	4	3
R04	Delays in construction schedule	0.142	0.18519	0.026	5	4
R05	Contractors has problem with payments	0.277	0.11111	0.031	3	1

The above table illustrates that there is a significant difference between the ranked risk impact and ranked risk exposure and mainly this is due to the risk probability which has a significant influence on the overall exposure of the risks. According to the calculations when the costs are set as the priority the risk, not efficient solutions is ranked as first in the risks exposure but regarding his impact is ranked second.

The risk R01 is ranked in the position 5 in the ranked list of risk impact but on the risk, exposure list is ranked the position 2 due to the high probability of occurrence, even his impact is low related to the costs.

Table 6.3 2 Risk Exposure, Priority list of Risks when priority is given to Time

Priority to Time						
No	Risk	Risk Impact	Risk Probability	Risk exposure	Priority list	Ranked Risks Impact
R01	Lack of coordination, communication, cooperation between parties	0.173	0.25926	0.045	2	4
R02	Not efficient solutions	0.19	0.25926	0.049	1	2
R03	Periodic changes of design	0.154	0.18519	0.028	5	5
R04	Delays in construction schedule	0.18	0.18519	0.033	4	3
R05	Contractors has problem with payments	0.303	0.11111	0.034	3	1

In the Variant 2, where Time has the priority among the objectives of the project there is change on the priority list of risks, specifically R03 and R04 have changed the position with each other, where the R04 (Delays in construction schedule) has more influence on the accomplishment of Time objective during the implementation of the project.

Table 6.3 3 Risk Exposure, Priority list of Risks when priority is given to Quality

Priority to Quality						
No	Risk	Risk Impact	Risk Probability	Risk Exposure	Priority list	Ranked risk impact
R01	Lack of coordination, communication, cooperation between parties	0.178	0.25926	0.046	2	3
R02	Not efficient solutionns	0.267	0.25926	0.069	1	1
R03	Periodic changes of design	0.171	0.18519	0.032	3	4

R04	Delays in construction schedule	0.141	0.18519	0.026	5	5
R05	Contractors has problem with payments	0.243	0.11111	0.027	4	2

In the Variant 3, where Quality has the priority among the objectives of the project, there is a significant change in the priority list of the risks and the risks listed on 3 first positions are related more to phases before the construction phase in design and conceptual development, risks which are more related coordination, communication and providing the best solution that fits the needs of the client.

Table 6.3 4 Risk Exposure, Priority list of Risks when Costs, time, quality share same level of priority

Costs, time, Quality same level of priority						
No	Risk	Risk Impact	Risk Probability	Risk Exposure	Priority list	Ranked risk Impact
R01	Lack of coordination, communication, cooperation between parties	0.17	0.25926	0.044	2	3
R02	Not efficient solutions	0.239	0.25926	0.062	1	2
R03	Periodic changes of design	0.162	0.18519	0.03	4	4
R04	Delays in construction schedule	0.154	0.18519	0.029	5	5
R05	Contractors has problem with payments	0.275	0.11111	0.031	3	1

In the Variant 4, where the priority is shared on the same level 33% for each component the priority list of risk is led by R02, Not efficient solutions, which has the higher risk and risk probability in the same time. When there is a balance of priorities of objective the importance of risk probability becomes more determinative on ranking the risks.

6.2 Conclusion

Numerical application of Risk Impact Method was extremely useful to understand several concepts and how the entire process is affected by using this approach.

Firstly, is important to mention that using this technique give the project management team a powerful tool to associates the identified risks within the accurate weight of risk impact not only to decide about the level of expected impact based on the experience.

The proposed Risk Impact method require a specific and clear process of identifying and setting the objective of the project from the first phase of the project and based on the settled priorities will be developed the risk management process.

Through the numerical application of this method was clearly identified the priority list which is conducted based on the estimation of risk exposure of each identified and analyzed risk, it changes dramatically according to the priorities settled to be achieved on the accomplishment of the project.

It cannot be expected the same priority list of risks when is settled a specific priority and the level of satisfaction for a project for instance, in case that is settled that priority as main objective of the project will be the cost the priority list of risks will change and differ from the case that is settled as objective a balance between three main components such as costs, time and quality.

Creating and developing a priority list of identified risks is helpful because it will affect the process of developing the risk management process and influence the entire process and the approach to be embraced for managing, monitoring and controlling the risks.

7 Conclusion and recommendations

7.1 Introduction

The purpose of this research was to investigate how the implementation of risk impact analyze can affect the balance of the objective of the project such as costs, time and quality. This study gives a critical overview of theoretical knowledge and illustrate the practical usage and application of risks management techniques in Albania through the analyze of the 2 case studies.

The analysis and the illustration of 2 case studies shows the gap between theoretical knowledge and practical applications, for that reason a simple Risk Impact Method

based on the quantitative approach is proposed to give the proper weight of risk impact during the risk assessment process.

7.2 Conclusions

Developing and conducting this study was useful to achieve significant conclusions and ideas for the construction industry, scope of the project, risk management process and relationships created between risk analysis and scope of the projects such as time, costs, and quality.

Completing this study, it helped to enforce some ideas, concepts also to have more detailed and scientific observation and investigation to the construction industry in Albania and risks management processes applied in practice, a summary of conclusions achieved are:

There is significant gap between theoretical knowledge and practical applications. From the beginning it was expected to have a gap between theory and practice, but the illustration from the cases studies it shows that theoretical recommendations are applied in a low level, by choosing a reactive approach in the risk management process.

During the process of dealing with potential risks, is always present the idea of considering the risks only as threats, excluding the idea that effect of a certain risk can be a good opportunity to improve and to maximize the achievement of the scope of the project. Project Management team have a conservative approach, mainly to minimize and to keep under control the damages and not embracing the proactive approach to enhance an opportunity that might be developed during the realization of the project.

Risk identification and risk impact analysis process is conducted more based on the personal experience of the project management team and the first input of risks identification is based on the internal databases of the companies, not reflecting the real situation of the construction industry, the real situations of the construction market or potential rate of inflation that the economy is facing.

Using the experience and the internal database as main and the only tool to identify the potential risks keep the project exposed to the external drive force that might

develop the new, unpredicted risks that might influence the accomplishment of the scope of the project, or might change the balance between costs, time and quality.

The reality shows that there is an insufficient attention on the risk analysis process, risk probability and risk impact to define proper weight of influence that a certain risk might have on costs, time, quality. This lack of attention or decision to not conduct a proper statistical and probability analysis led to the conservative approach, by giving an artificial increase of risk probability and risk impact of each identified risks, this artificial increasement will not reflect the reality in same time will increase artificially the pressure on the project management team during the daily tasks of managing the project.

There is a specific focus given to the costs, as main priority of the projects and neglecting other objectives such as time and quality, specifically in Albania, this approach is more developed due to low costs of resources, but there is a necessity to change this approach and to embrace the idea that should be defined a proper balance of objectives to deliver a successful project.

Risk impact method is extremely helpful on giving the proper weight regarding the risk impact and risk exposure of each identified and analyzed risk and this technique can be applied to forecast a realistic impact and this impact can be expressed in numerical value. The possibility of having reliable numerical values to estimate the risk exposure for different scenarios based on the settled priorities of the scope of the project can led to better approach and strategies to manage the risks.

Priority list of risk impact it changes significantly related to the priority that is decided from start of the project, meaning that in case that costs is dominant as priority among the objectives of the projects will have different priority list of risk impact when time or quality is dominant as priority, or there is a shared equal balance of priority among costs, time and quality.

Priority list of risks is helpful to understand the impact of each risks, related to costs, time and quality and give the possibility to conduct the analysis of different scenarios and choosing the appropriate one based on priority given to the objective of the project.

Defining the dominance or balance between components such costs, time and quality must be conducted from the start and must be consistent during the entire implementation phase of the project because the decision made on the priorities among the

objectives affect the risks management process, the strategy and the approach of monitoring and controlling risks and the accomplishment of scope of the project.

7.3 Recommendations

Through this sub-chapter some recommendations are given to improve the Construction Risk management practice to achieve better results regarding the scope of the project:

1- Risks Management process should be developed under proactive approach and not only in a reactive way to deal with potential risks
2- The concept for risks should change, risks can be opportunity in same time that might have positive effects on the scope of the project. Differently from theory in practice risks are always considered as danger, that can damage the project and this conservative way should change.
3- Risk assessment is extremely important on building a strategy of dealing and managing the risks, that affect the strategy of delivering the project for that reason that process needs a specific attention and the outcome should be based on reliable mathematical data.
4- Higher is the percentage of security and confidence on assessing a certain risk, more accurate and secure it will be solution to mitigate that risk and lower will be the pressure on the project management team regarding the accomplishment of the objectives of the projects.
5- Defining clearly and in advance the priorities among objectives such as costs, time, quality it helps and improves the process of risks identification and analysis and affect the process of choosing the right strategy on mitigating the potential risks.

Declaration of Authorship

I hereby declare that the attached Master's thesis was completed independently and without the prohibited assistance of third parties, and that no sources or assistance were used other than those listed. All passages whose content or wording originates from another publication have been marked as such. Neither this thesis nor any variant of it has previously been submitted to an examining authority or published.

Date

Signature of the student

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