Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Management

Bachelor Thesis

Importance of risk management in small projects

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Department of Management

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BACHELOR THESIS ASSIGNMENT

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Economics and Management

Thesis title

Importance of risk management in small projects

Objectives of thesis

The aim of the thesis is to describe and develop the understanding and evaluate the significance of the risk management in small projects. The main goal is to analyze advantages and disadvantages of a project risk management. Greater understanding will contribute more successful management to minimize risk and anticipate its potential.

Methodology

The methodology of the research work is dependent on the topic. While quantitative method measures numerical data, qualitative method is used to collect data by interview and observations. The resources consist of both primary and secondary data.

The proposed extent of the thesis

30-40

Keywords

Risk management, project management, risk, small projects

Recommended information sources

De Ceuster, Luc, 2010, Focus on Earned Value, 1st edition, Prague
De Ceuster, Luc, 2010, Focus on Risk Management,1st edition, Prague
Sid Blaha, Zdenek, Pecena, Magda, 2010, Advanced measurement techniques for market and operational risk, Prague

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Declaration

I hereby declare that this bachelor thesis titled “Importance of risk management in small projects” is my own work and that all the sources I have used and quoted mentioned at the end of the thesis.

Prague, March 16, 2015 ……..

Bilguun Ganbold

Acknowledgement

I would like to express my sincere gratitude to my supervisor Richard Selby, Ph.D. for his guidance and suggestions during the writing of this thesis. I also would like to thank "Mongol Ibex Cashmere" LLC staff for their contribution to this work.

I want to thank my family and my friends for their endless support and encouragement throughout my studies.

Summary

The presented bachelor thesis deals with project risk management. It explains the importance of the risk management in small project and studies the process of risks management within the company.

The first part of the thesis describes and explains basic understanding of risk management process of the project. Possible techniques and tools are also included in this part. Practical part of my research is focused on the issue of the selected company and its' risk management process.

The collected research data were analyzed through qualitative and quantitative analysis. Obtained results of the analysis indicate how identified risks could be evaluated and to which risks the project team should focus their attention in order to implement the project successfully. It also considers the importance to determine where and when the project team should make effective efforts to keep up the project on schedule.

Key words:

Risk, risk analysis, project, project risk management, risk management process

Souhrn

Tato bakalářská práce se zabývá řízením rizik projektů. Vysvětluje význam řízení rizik v malých projektů a studuje proces řízení rizik v rámci společnosti. První část práce popisuje a vysvětluje základní znalost procesu řízení rizik projektu. Možné metody jsou také zahrnuty v této části. Praktická část mého výzkumu je zaměřena na problematiku vybrané společnosti a její procesu řízení rizik. Získaná data výzkumu byly analyzovány pomocí kvalitativní a kvantitativní analýzy. Získané výsledky analýzy ukazují, jak by bylo možné vyhodnotit identifikovaná rizika a rizika, které projektový tým by se měly zaměřit svou pozornost za účelem realizace projektu úspěšně. Domnívá se také, že je důležité určit, kde a kdy by měl projektový tým dát účinné úsilí, aby projekt byl podle plánu.

Klíčová slova:

Riziko, analýza rizik, projekt, řízení rizik projektu, proces řízení rizik

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1. Introduction

In our life we always face with the things like uncertainty and risk. They are certainly part of our life. Suddenly we could find ourselves in unexpected situations due to unforeseen circumstances and could be very hard to deal with them. Even if we have identified the possibilities, it could happen that we simply forgot some other possibilities or did not know some were important.

For the business sectors, in particular small and middle enterprises, their limited resources and financial possibilities create huge problems to overcome new projects. The main problem is that in many cases companies occasionally use risk management in their project due to lack of knowledge in this field, financial requirements of the process and it is often overlooked by the managers. Potential risks of the project could lead to negative consequences to its implementation and would likely drive it to failure. Also these risks could significantly influence to company's financial position and eventually may cause crucial affects to everyday operations. Therefore it is really important to consider management of risks to prevent potential risks of new projects, reduce the damage that could harm the company.

The research in this bachelor thesis is focused on project risk management process of small companies based on a case study of "Mongol Ibex Cashmere" LLC. The project of "Mongol Ibex Cashmere" LLC was chosen in order to investigate the company's awareness of risks and how they deal with it within the project. After studying the related literature, practical work and obtained results, researcher tried to provide relevant recommendations for the company.

2. Objectives and methodology

2.1 Aim and objectives

The overall aim of the thesis is to understand basic principles of project risk management and investigate how the risk management process conducted by “Mongol Ibex Cashmere” LLC in their project. Moreover by making analysis based on collected data, researcher tried to make suggestions and provide possible recommendations for the company to improve the current managing system of risks. Greater understanding will contribute more successful management to minimize risk and anticipate its potential.

In order to achieve the aim following research questions were made:

- What methods and tools used for project risk management?
- How do the risks assessed and managed in a case project?
- How important is risk management to the project success?

2.2 Research method

A combination of qualitative and quantitative method was chosen to support the research work and to achieve its objectives. Qualitative method is used for the purpose of the thesis by interview. Quantitative method is used for numerical data. Secondary data are used for the analysis throughout the research.

Interview

The main method that has chosen for this research is an interview. Interview is the most widely employed method in qualitative research. By using semi structured interview the respondents are free to answer questions in as much detail as they want and express their own view of the situation. From the interviewer point of view they can be more flexible by adjusting and changing the direction of the question. The interview method is used for collection of data for qualitative analysis in this research, which will help to determine the risk management process of a case company.

SWOT analysis

SWOT analysis is made to identify the market position of the selected company. SWOT analysis is one of the methods for identification of risks in the project. It is an analysis technique that examines through each of these viewpoints (SWOT) the project itself, project management processes, resources and the organization. It also helps broaden the perspective of where to look for risks.

PERT analysis

In this research is also used Program evaluation and review technique. This analysis will be useful to provide extensive planning of the project schedule. Basic principle of this analysis is to identify critical activities, the time required to complete the project and also to determine the probability of meeting deadlines of specific activities in the project.

Questionnaire

As one of the objectives in this research was to analyze the risk management process in a case company, a questionnaire method was selected in order to support and provide related data to main analysis.

2.3 Limitations

This research mainly focuses on how project risk management process carried out the within the organization and based on the theories and its tools described in the literature. There could possibly occur in the research several shortcomings and limitations due to lack of the researchers knowledge and practice in this particular field. Also by the request of the company, researcher was not able to get information about the project's cost and financial operations.

3. Theoretical framework

3.1 Project management

The project management approach is relatively modern. It is characterized by methods of restructuring management and adapting special management techniques, with the purpose of obtaining better control and use of existing resources. The concept behind project management is being applied in such diverse industries and organizations as defense, construction, pharmaceuticals, chemicals, banking, hospitals, accounting, advertising, law, state and local governments, and the United Nations. The project management approach requires a departure from the traditional business organizational form, which is basically vertical and which emphasizes a strong superior–subordinate relationship (Kerzner, 2009).

Portny (2007) defines project management as the process of guiding a project from its beginning through its performance to its closure. Project management includes three basic operations:

- Planning
- Organizing
- Controlling

Successfully performing these activities requires:

- Information: Accurate, timely, and complete data for the planning, performance monitoring, and final assessment
- Communication: Clear, open, and timely sharing of information with appropriate individuals and groups
- Commitment: Team members' personal promises to produce the agreed upon results on time and within budget

Good project management brings about step changes in performance. If projects are to deliver profitable outcomes, then it is as crucial to look outside traditional project environment as it is to look inside. Project management has much to do with identifying and managing the risks a project may face. Effective project management allows an organization to (Roberts, 2007):

- involve the right people at the right time for the right reasons to ensure that the best quality decisions are made
- encourage customers and suppliers to participate so that the result is mutually beneficial
- focus on the milestones of the endeavor to encourage a greater and common understanding of what will be delivered
- reappraise the justification for the initiative regularly, thereby reducing the risk of making a poor investment
- demonstrate how resources can be used as effectively as possible,
- emphasize the risks the project faces so that the likelihood of their occurring and their impact can be managed
- minimize the dangers of unmanaged "change"
- manage unforeseen problems sensibly and practically

3.2 Risk and uncertainty definition

The term "risk" has been offered by many different definitions by professional bodies, institutions and literatures. Any definition of risks and uncertainty is dependent on its nature and to what is applied.

Uncertainty and risk are always around us. In many cases, we just learned to live with these risks and we do not even think about them when we are doing our everyday activities. Uncertainty will always be there and we will have to live with it (De Ceuster, 2010).

To understand risk, it is useful firstly to understand the nature of uncertainty. Some situations are uncertain, because they are truly variable. Some situations are uncertain, because we do not know enough about the situation to make a rational assessment of the probability. Lots of uncertainties exist, but not all of them are relevant and need to be managed. We need to identify those uncertainties, that should they occur, would affect one or more project objectives. This is the definition of a risk now adopted by all the mainstream methods, bodies of knowledge, national and international standards relating to risk management (ICPM, 2008).

Hilson (2001) states that there are definite advantages in including both types of uncertainty together under a single heading of "risk" covering all uncertainties that can affect objectives. The only difference is in the nature of the effect. One category has potential effects which are negative, unwelcome, harmful, and adverse. These can be called "threats". The other group has positive, welcome, beneficial effects - these are "opportunities". Defining a risk as any uncertainty which can affect achievement of objectives either positively or negatively allows both opportunities and threats to be encompassed in a single definition.

According to Project Management Institute (PMBOK, 2008) risk is defined as "an uncertain event or condition that, if it occurs, has a positive or negative effect on a project objective". Project risk includes both threats to the project's objectives and opportunities to improve on those objectives. It has its origins in the uncertainty that is present in all projects. Known risks are those that have been identified and analyzed, and it may be possible to plan them. Unknown risks cannot be managed, although project managers may address them by applying a general contingency based on past experience with similar projects. Association for Project Management (BOK, 2000) defines risks are present in all projects, whatever their size or complexity and whatever industry or business sector. Risks exist as a consequence of uncertainty. In project management terms, risks are those factors that may cause a failure to meet the project's objectives and they may also be associated with opportunities.

Writers Chapman and Ward (2001) suggest that to emphasize the desirability of a balanced approach to opportunity and threat management, the term "uncertainty management" is increasingly used in preference to the more established terms "risk management" and "opportunity management". Uncertainty management is not just about managing perceived threats, opportunities and their implications. It is about identifying and managing all the many sources of uncertainty which give rise to and shape our perceptions of threats and opportunities. It implies exploring and understanding the origins of project uncertainty before seeking to manage it, with no preconceptions about what is desirable or undesirable. Key ideas are understanding where and why uncertainty is important in a given project context, and where it is not.

Project risk management is the art and science of identifying, assessing and responding to project risk throughout the life of a project and in best interests of its objectives (Wideman, 1992).

3.3 Risk management process

There are various numbers of risk management processes can be found in the literature. Most common risk management process is suggested by Project Management Institute by six stages of risk management processes (PMBOK, 2008):

- Risk planning
- Risk identification
- Qualitative analysis
- Quantitative analysis
- Risk responses
- Monitoring and controlling

These processes interact with each other and with the processes in the other knowledge areas. Each process generally occurs at least once in every project.

Similarly under the AS/NZS 4360:2004 standard, risk management process has five main stages interacting with consulting and monitoring processes. Those are establishment of the context by setting the scope for the rest of the risk management process, risk identification, risk analysis also including qualitative and quantitative analysis, risk evaluation and risk treatment. They state that management of risk is an integral part of the management process and risk management is a multifaceted process, appropriate aspects of which are often best carried out by a multi-disciplinary team. It is an iterative process of continual improvement.

Association of Project Management (2008) offers risk management process as following:

- Identification
- Assess (Qualitatively and Quantitatively)
- Assess (Estimate and Evaluate)
- Plan responses

- Implement responses

Chapman and Ward (2011) suggested 7 phases of project uncertainty management process based on their idea of uncertainty management:

- Define the project
- Focus the process
- Identify the relevant sources
- Structure all uncertainty
- Clarify ownership
- Quantify some uncertainty
- Evaluate relevant implications

Risk management contains the elements of identification, analysis and control. The focus of risk management must be on communication and, therefore understanding by each party of the issues and risks involved. Each party must begin the project with an understanding and respect for each other's objectives and risks such that a risk management "process" can be implemented (Saporita, 2006).

3.3.1 Risk planning

Risk management planning is the process of deciding how to approach and plan the risk management activities for a project. It is important to plan for the risk management processes that follow to ensure that the level, type, and visibility of risk management are commensurate with both the risk and importance of the project to the organization (PMI, 2000).

The risk management plan for a project summarizes the results of the risk management process. In particular, it describes the detailed risk treatment plans to be implemented to reduce and control risks, and it provides for continuing monitoring of the implementation (Cooper et al, 2005).

At this stage, we need to identify all potential risks that exist for our project, and we need to understand the probability of risk occurrence. We also want to know what the impact to the project or product outcome will be if the risk does happen. Not all risks are bad, and

not all risks have negative impacts, but you need to know about them nevertheless. All risks are caused by something and therefore have consequences. Those consequences will likely impact one or more of the triple constraints. The idea behind risk planning is that you identify all the risks and then evaluate and quantify the risks to come up with a plan to deal with or avert them. Risks come about for many reasons. Some are internal to the project, and some are external. Some risks you'll know about in advance and plan for during this process, others will occur unannounced during the project. The purpose for Risk Management Planning is to create a risk management plan, which describes how you will define, monitor, and control risks throughout the project (Heldman, 2002).

3.3.2 Risk identification

According to PMI (PMBOK, 2000) risk identification involves determining which risks might affect the project and documenting their characteristics. Risk identification is an iterative process. Barkley (2004) stated that risk identification should be part of the project planning process, not separated from it. Risks are identified in the development of the WBS and in estimating durations and resource needs. Kohlmeyer and Visser (2004) states that all possible risk events, including their causes, possible impact on the project, and the respective probability of occurrence.

Risk categories are a way to systematically identify risks and provide a foundation for understanding. When determining and identifying risks, the use of risk categories helps improve the process by giving everyone involved a common language or basis for describing risk. Risk categories should be identified during the next process and documented in this risk management plan. The following list includes the categories we might identify (Heldman et al. 2007):

- Technical, quality, or performance risks
- Project management risks
- Organizational risks
- External risks

Risk identification is the standardized process for identifying and characterizing the risks that may be present on the project. It is clear that we will treat threats differently from

opportunities. A threat has a negative effect on the project and we should try to avoid them or reduce the impact. Opportunities have a positive impact on the project and we will try to make them happen. The tools and techniques include documentation reviews, information gathering techniques like brainstorming and affinity, Delphi and Wide Brand Delphi techniques, interviewing, checklist analysis, assumption analysis and diagramming techniques like the cause and effect diagram, SWOT analysis and Pareto analysis (De Ceuster, 2010).

Typical risk variables in the project suggested by Jaafari (1999):

- Promotion risk
- Market risk
- Political risks
- Technical risks
- Financing risks
- Environmental risks
- Cost estimate risk
- Operating risk
- Organizational risk
- Integration risk
- Force majeure

3.3.3 Risk analysis definition

The AS/NZS 4360: 1999 Risk management standards consider that the objectives of analysis are to separate the minor acceptable risks from the major risks, and to provide data to assist in the evaluation and treatment of risks. Risk analysis involves consideration of the sources of risk, their consequences and the likelihood that those consequences may occur. Factors which affect consequences and likelihood may be identified. Risk is analyzed by combining estimates of consequences and likelihood in the context of existing control measures. Risk analysis helps us find out what can go wrong, what's most probable, and what has the greatest impact. The combination of an event's probability of

occurrence and severity of consequences determines priorities (Meredith and Mantel, 2009).

Risk analysis strives for deeper understanding of potential project problems. Techniques for doing this effectively may provide quantitative estimates and measures for each risk and qualitative information that places risks into ranges and categories. Qualitative techniques are easier to apply and generally require less effort. Qualitative risk assessment is often sufficient for rank-ordering risks, allowing you to select the most significant ones for application of the management techniques. Quantitative methods strive for greater precision, and they reveal more about each risk. These methods require more work, but, in addition to allowing you to sequence the risks from most to least significant, quantitative analysis also provide data you can use to assess overall project risk and to estimate schedule and budget reserves for risky projects (Kendrick, 2003).

Risk analysis begins with a detailed evaluation of the risks that have been identified and approved by decision-makers for further evaluation. The objective is to gather enough information about the risks to estimate the probability of occurrence and consequence of occurrence if the risk occurs and convert the resulting values to a corresponding risk level (Kerzner, 2009).

3.3.4 Qualitative analysis

Qualitative risk analysis is the process of assessing the impact and the likelihood of the identified risks. This process prioritizes risks according to their potential effect on the project objectives. Qualitative risk analysis is the one way to determine the importance of the addressing specific risks and guiding responses. The time-criticality of risk-related actions may magnify the importance of a risk. An evaluation of the quality of the available information also helps modify the assessment of the risk. Qualitative risk analysis requires that the probability and consequences of the risks be evaluated using established qualitative-analysis methods and tools (PMI, 2000).

Qualitative risk “qualifies” the risks that have been identified in the project. Specifically, qualitative risk analysis examines and prioritizes the risks based on their probability of occurring and the impact on the project if the risks did occur. Qualitative risk analysis is a

broad approach to ranking risks by priority, which then guides the risk reaction process (Phillips, 2004). One of the methods commonly used in qualitative risk assessment is the impact probability matrix. The two variables such matrices are in fact risk component. Actual technique of this method is the assignment of scores (values) for likelihood and impact of risk categories identified by the risk manager or project team members. The product of the two variables will give risk exposure (Iacob, 2014).

Probability is a numerical measurement of the likelihood of an outcome of some random process. Randomness is the effect of the chance and is a fundamental property of the system, even if we cannot directly measure it (Vose, 2008). The classic example is flipping a coin. There is a .50 probability of getting heads and 0.50 probability of getting tails on the flip. Note that the probability that an event will occur plus the probability that event will not occur always equals to 1.0. In this coin-flipping example, two responses added together equals to 1.0. Probability is expressed as a number from 0.0-which means there is no probability of event occurring-to 1.0-which means there is 100 percent certainty the risk will occur (Heldman et al. 2007).

Impact is the amount of pain or the amount of gain the risk event poses to the project. The risk impact scale can be a relative scale that assigns values such as high-medium-low or a numeric scale known as a cardinal scale. Cardinal scale values from 0.0 to 1.0 and can be stated in equal (linear) or unequal (nonlinear) increments (Heldman et al. 2007). Impact is usually measured in terms of duration or cost. Occasionally, performance has been used. Performance related impact assessment would be most used where time and cost were of lesser importance (Isaac, 1995).

3.3.5 Probability impact matrix

An alternative method for qualitative risk assessment involves placing risks on a two-dimensional matrix, where the rows and columns represent the categories of probability and impact. The matrices may be two-by-two, three-by-three, or larger. Risk matrices are generally square, but they may be rectangular with different numbers of categories for probability and impact (Kendrick, 2003). According to Phillips (2009) each identified risk is fed into a probability-impact matrix. The risks with higher probability and impact are a

more serious threat to the project objectives than the risks with lower impact and consequences. The risks that are threats to the project require quantitative analysis to determine the root of the risks, the methods to control the risks, and effective risk management. The scores within the probability-impact matrix can be referenced against the performing organization's policies for risk reaction. Based on the risk score, the performing organization can place the risk in differing categories to guide risk reaction. There are three common categories based on risk score:

- Red condition: high risk, these risks scores are high in impact and probability.
- Yellow condition: these risks are somewhat high in impact and probability.
- Green condition: risks with a green label are generally fairly low in impact, probability, or both.

This approach can be used for assessing threats and opportunities, although it is hard to visualize how a single Probability–Impact Matrix can clearly show both, since the ''Impact'' scale would need to reflect both positive and negative effects. Some practitioners overcome this by using two grids, with one for threats (negative impacts) and another for opportunities (positive impacts). In each case, high-probability/high-impact risks are prioritized, since these are either ''show-stopper threats'' which must be avoided if possible or ''golden opportunities'' which must be exploited if possible (Hillson, 2002).

3.3.6 Quantitative analysis

Quantitative risk analysis numerically estimates the probability that a project will meet its cost and time objectives. Quantitative analysis is based on a simultaneous evaluation of the impacts of all identified and quantified risks. Use of quantitative analysis, while very powerful, also can be misleading if not used properly (WSDOT, 2014).

Phillips (2009) emphasize that quantitative risk analysis attempts to numerically assess the probability and impact of the identified risks. Quantitative risk analysis also creates an overall risk score for the project. This method is more in-depth than qualitative risk analysis and relies on several different tools to accomplish its goal. Qualitative risk analysis typically precedes quantitative analysis. All or a portion of the identified risks in qualitative risk analysis can be examined in the quantitative analysis. The availability of

time and budget may also be a factor in the determination of which risks should pass through quantitative analysis. Quantitative analysis is a more time-consuming process, and is therefore also more expensive. There are several goals of quantitative risk analysis:

- to ascertain the likelihood of reaching project success
- to ascertain the likelihood of reaching a particular project objective
- to determine the risk exposure for the project
- to determine the likely amount of the contingency reserve needed for the project
- to determine the risks with the largest impact on the project
- to determine realistic time, cost, and scope targets

Quantitative risk assessment involves more effort than qualitative techniques, so it is common to do initial sorting and selection of risks qualitatively. This is not absolutely necessary, though, because each of the qualitative methods discussed has a quantitative analogue that can be used to sequence the list. The tables and matrices have their categories for probability and impact replaced by absolute numerical estimates. Quantitative techniques such as sensitivity analysis, more rigorous statistical methods, decision trees, and simulations provide further insight into project risk, and can also be used for overall project risk assessment (Kendrick, 2003). Techniques, such as Monte Carlo simulation, can be a powerful tool for analysis of project risk and uncertainty. This technique provides project forecasts with an overall outcome variance for estimated project cost and schedule. Probability theory allows us to look into the future and predict possible outcomes (WSDOT, 2014).

3.3.7 Risk response

Risk response development is a critical element in the risk management process that determines what action will be taken to address risk issues evaluated in the identification, qualification and quantification efforts. All information generated to date becomes crucial in determining what the organization's tolerance, the project tolerances and the customer culture. All risks have causes; sometimes, multiple risks within a given project arise from common cause. In developing risk responses, we should identify any common causes, as these causes may have common risk responses (Pritchard, 2015). If responses are not

implemented, then effort expended on other parts of the process will be mostly wasted. At best, projects would have a more sophisticated forecast of their fate. Decisions as to how to respond to risk are almost always characterized by choice, even if one of the choices is to accept the risk and thereby do nothing. But to exercise choice, it is first necessary to identify the options that are available. The purpose of describing different risk response strategies is to prompt an exploration of all possibilities. Risk response strategies can be viewed as being different types of decisions that can be made on the basis of risk analysis (Hopkinson, 2011).

According to PMI (2008) several risk response strategies are available. The strategy or mix of strategies most likely to be effective should be selected for each risk. Following strategies typically deal with threats or risks that may have negative impacts on project objectives if they occur:

- Avoid: involves changing the project management plan to eliminate the threat entirely. Project manager may also isolate the project objectives from risk's impact or change the objective that is jeopardy.
- Transfer: requires shifting some or all of the negative impact of threat, along with ownership of the response, to a third party. Transferring the risk simply gives another party responsibility for its management-it does not eliminate it.
- Mitigate: implies a reduction in the probability and/or impact of an adverse risk. Taking early action to reduce the probability and/or impact of a risk occurring on the project is often more effective than trying to repair the damage after the risk has occurred.
- Accept: this strategy is adopted because it is seldom possible to eliminate all threats from a project. This strategy indicates that the project team has decided not to change the plan to deal with risk, or is unable to identify any other suitable response strategy. The strategy can be either passive or active.

For opportunities, the strategies fall into these categories (Pritchard, 2015):

- Exploitation: organizations realize that the opportunities represent significant occasions to improve their project position. Exploitation is that

pursuit, which strives to ensure that the opportunity actually comes to pass and is fully realized.

- Sharing: in some instances organization may not be able to pursue the opportunity on its own. In such cases, sharing partnerships can help optimize the opportunity.
- Enhancement: increases the probability and/or impact of opportunities.
- Acceptance: also known as retention is the decision to acknowledge and accept the consequences in an opportunity event occurs.

3.3.8 Risk monitoring and control

The key task at this stage is the monitoring of risks included in residual risk analysis, risk response strategy and risk response plan. It must be verified that the risk response plan is adequately resources and effectively implemented. Other risks also need to be monitored regularly. Any significant changes in risk should be reported and assessed immediately (ICE, 2005).

Philips (2009) proposes that risks must be actively monitored and new risks must be responded to as they are discovered. Risk monitoring and control is the process of monitoring identified risks for signs that they may be occurring, controlling identified risks with the agreed responses, and looking for new risks that may creep into the project. Risk monitoring and control also is concerned with the documentation of the success or failure of risk response plans, and keeping records of metrics that signal risks are occurring, fading, or disappearing from the project. Risk monitoring and control is an active process that requires participation from the project manager, the project team, key stakeholders, and, in particular, risk owners within the project. As the project progresses, risk conditions may change and require new responses, additional planning, or the implementation of a contingency plan. There are several goals to risk monitoring and control:

- to confirm risk responses are implemented as planned
- to determine if risk responses are effective or if new responses are needed
- to determine the validity of the project assumptions

- to determine if risk exposure has changed, evolved, or declined due to trends in the project progression
- to monitor risk triggers
- to confirm policies and procedures happen as planned
- to monitor the project for new risks

4. Results and analysis

4.1 Case study

4.1.1 Company profile

“Mongol Ibex Cashmere” LLC is primary cashmere, wool and woolen material processing and manufacturing company which has been operating in Mongolia since 2008.

The company makes primary processing of 5-6 tons of raw material and supplies from 3 to 3.5 tons of processed cashmere to domestic and foreign markets monthly.

Company’s founders, engineers and technical workers are high experienced and skilled professionals in their field. They are the former branch directors, managers of the biggest cashmere manufacturing company in Mongolia “Gobi”. Also they are providing technical services for the companies such as “Gobi”, “Baruun Zuun Ikh” and study centers of several provinces in Mongolia. The manufacturing process consists of warehouses, sorting and carding departments. Raw materials are collected by representative agent straight from the provinces. The materials such as sheep, camel, yak and goat wools are processed according to the MNS38: 2000 standard. The company has 26 employees with 3 directors and 2 manufacturing branches in Ulaanbaatar.

4.1.2 Selected project

Our country has the possibility to increase the domestic production and manufacturing of woolen and cashmere products as well as decreasing unemployment by supporting and developing SME in this industry using the renewable natural resources such as wool.

As the country's economy is growing fast the attitude of consumers to the quality is changing and the observations shows that there is a high trend of the usage of eco products.

The woolen product manufacturing companies must act collectively to process the wealth of the country domestically. They must improve the communication, support each other by cooperating and produce the final product within the country.

In recent years, the company's customer orders of processed woolen yarns are rapidly increasing. Therefore the company's capacity of production is exceeding. In addition to the company's talented staff the productivity and quality of completed work depends on the capacity of the equipment. Increasing the number of equipment, employee will expand the company's capacity and will be able to reach current orders. Success of the company will depend on the consumers' satisfaction and their evaluation the company's work. To meet their expectations the company will need to supply high quality products.

The project's new factory construction location is situated in 32 khoroo of Songino Khairhan district in Ulaanbaatar. The company's current factory area is 758 square meters and the planned factory will have an area of 2156 square meters. The construction is including all the decorations, conditioning system as well as the plumbing system. The equipments will be bought from China, consisting of 3 hair sorting machines and spinning machine.

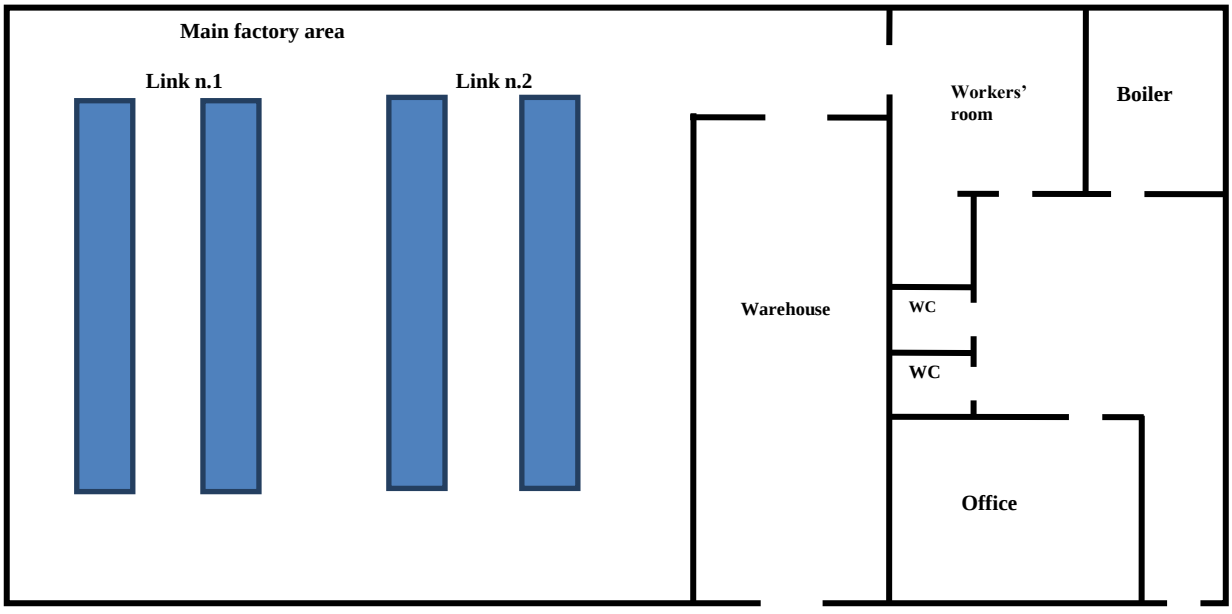

Figure 1: Existing factory building
Source: "Mongol Ibex Cashmere" LLC

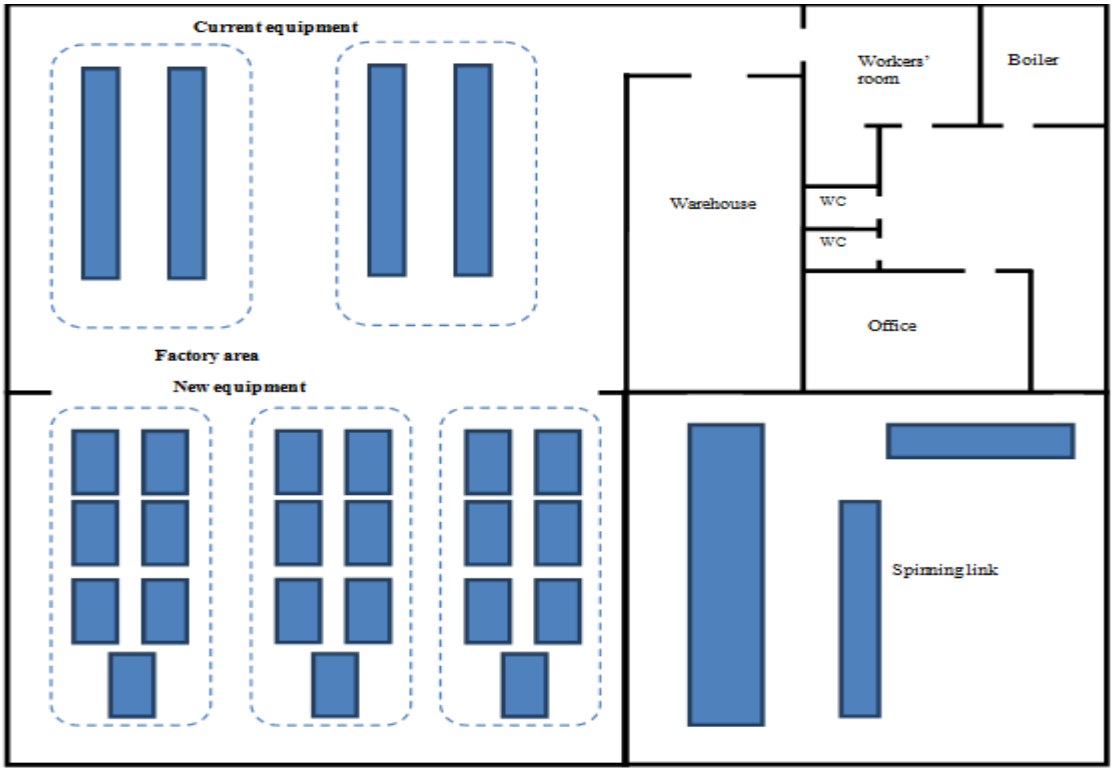

Figure 2: Planned factory building.

Source: "Mongol Ibex Cashmere" LLC

Project team

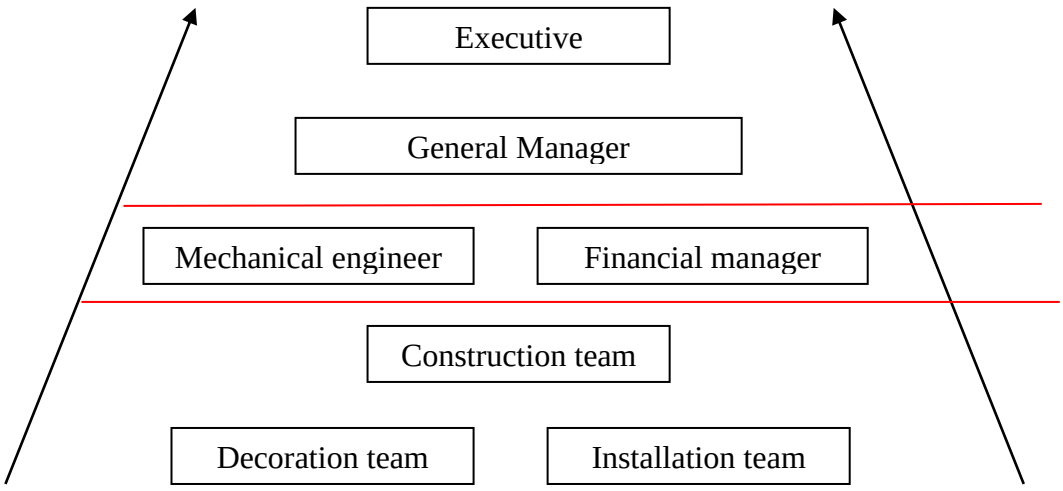

Chart 1: Project team of the company

Source: Author

4.1.3 Project risk management process of the project

As the executive and general manager of "Mongol Ibex Cashmere" LLC explained the current risk management process of the company considering the given project is mainly concerned about the continuous operation of the project. As they stated that three main types of risks could possibly occur during the project operation:

- Financial
- Technical
- External

The main priority for the company relating to project risk management is to identify potential and most probable risks and plan possible preliminary actions to identified risks.

Project risk management process of "Mongol Ibex Cashmere" is made in three stages:

- Risk identification - in this stage the project team discusses their experience of past projects and make the list of possible risks
- Risk evaluation and analysis – when all possible risks are listed, financial analysis are made, both internal and external, discussion technique is main tool for this stage
- Risk response – as executive stated that at this stage they should compare expected duration of the project with current time. Respond for the occurred risks as reducing or accepting the risks

All the decision making process of the project management made by executive with consultation of other members of the project. Also in the interview executive stated the concept of insurance. The executive of the company has different views about insurance. He affirms that it could cost large amount of money that could be used in production field, in another words for more profitable action, but also thinks that he could use insurance as risk transferring action. For human capital he strictly believes that his employees must be insured for temporary loss and unexpected accident.

Another very important aspect that general manager mentioned was the rights that the company has to have. It includes power, heating and plumbing rights. In order to build and run the factory the regional power, water and plumbing supply have to be sufficient and

enough, because of the factory's high usage of the previous mentioned resources may occur possible interruptions. In addition he stated that this process will take huge amount of time and should be started long before the beginning of the actual construction of the factory building.

4.1.4 Risk identification

According to respondents' answers for the risk identification method, they both agreed the experiences from previous projects most relied method to use. Another important factor to identify the risks is dependent on the project actors since the project including several other organizations like construction team, suppliers and contractors. It is really important to know their point of view to project participation and influence in early stage of the project.

The project team of the company while planning the scope, schedule and cost of the project they hold meeting. It is very important for the future success of the project when people with different backgrounds are looking at the problems from different perspective.

In addition to previous mentioned techniques the project team also tries to use risk breakdown strategy in order to organize and understand the concentrations of possible risks by categorizing them.

SWOT analysis of "Mongol Ibex Cashmere" LLC

Project risk identification, assessment, and management starts not with a project, but with business planning. Risks are typically identified in the broad business strategic planning and thinking that goes on to direct a company toward its potential markets and customers and toward appropriate products and services. The results of broad business planning provide the wherewithal for individual project risk assessment, which narrows down business risk into project risk. This translation is only possible if the business actually has a planning process-not necessarily a formal documented process but a way of thinking about the future of the company and its markets (Barkley, 2004).

Strengths

- The company offers good values to the customers, therefore has loyal customer with constant and increasing orders
- Has highly experienced and skilled employees
- Reliable and trusted distribution channels
- Highest quality of the products
- Sales channels to India, Bangladesh, Korea and China

Weaknesses

- The company has direct dependency on customers, because the manufacturing processes are mainly under orders
- The orders could decrease. Cashmere product tends to be a seasonal product
- Sales turnover could be slow, it could lead to some delays
- Dependency on the factory capacity

Opportunities

- The quality of the raw materials is extremely high, therefore the outcome will have high quality
- The industry has the opportunity of government support and encouragement
- Economy of the country is increasing
- Government is running the development policy for SME
- Tendency of organic products in the local market is growing

Threats

- Falling price of cashmere products in global market could influence the sales
- Large competitors could wipe out of the market the company if they will change their focus

Risk breakdown structure of the given project

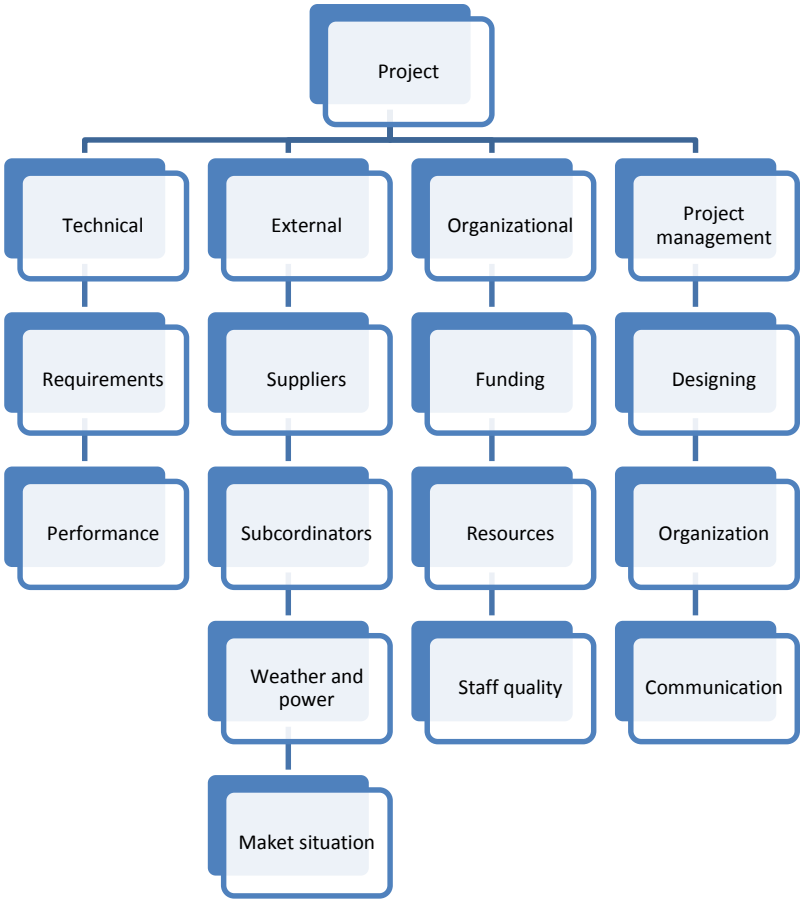

Chart 2: Risk breakdown structure of the company.
Source: Author

4.1.5 Risk evaluation and response

As mentioned before the financial risk is one of the important risks for the company. In the organization, financial risk depends on both internal and external factors. During the project process as the executive stated that the company plans to manage the internal financial factors. For the external factors that may influence to the project such as inflation, exchange rates and other factors company will try to predict the outcome of the changes and will make related decisions. For other risks that have identified the only tool company uses was discussion. The project team members have their own responsibilities and obligations related to their work and of course for the identification of its risk. With risk

occurs in one specific area of the project, related member should discuss risk with rest of the team.

Based on the interview for the identified risks will be implemented related responses.

Category	Title	Description	Response
Tech - nical	Requirements	Inadequate specification	Mitigate
	Performance	Productivity of work	Mitigate
External	Suppliers	Payment delays	Mitigate
	Subcontractors	Not finding the right contractors	Mitigate
	Weather and power interruptions	Delay in schedule	Accept
	Market situation	Change in exchange rate, inflation	Accept
Organiza- tional	Funding	Profit, bank loan	Mitigate
	Resources	Shortage of resources	Mitigate
	Staff quality	Productivity of work	Mitigate
Project management	Designing	Problems with planning and designing	Mitigate
	Organization	Lose control over project	Mitigate
	Communication	Lack of team work	Mitigate

Table 1: Risk response action of the company
Source: Author

4.2 Risk analysis

4.2.1 Qualitative analysis

Qualitative Risk Analysis involves determining what impact the identified risks will have on the project and the probability they'll occur. It also puts the risks in priority order according to their effect on the project objectives. Qualitative Risk Analysis should be performed throughout the project. Using Qualitative Risk Analysis methods allows you to determine the probability a risk will occur and to evaluate its consequences. This technique depends on the project type, data precision, and the scales of probability and impact (Heldman, 2002).

Probability impact matrix

Based on questionnaire respondent was asked to evaluate the probability and impact of previously identified risk list in risk breakdown structure. Probability and impact scale of following results are based on PMP Study Guide by Phillips, 2009.

Probability	Very low	Low	Moderate	High	Very high
Score	0.1	0.3	0.5	0.7	0.9

Impact	Very low	Low	Moderate	High	Very high
Score	0.05	0.10	0.20	0.40	0.80

Table 2: Probability and impact scale.
Source: Phillips (2009)

A probability-impact matrix, multiplies the value for the risk probability by the risk impact for a total risk score.

Level of risk = Probability x Impact

The scores within the probability-impact matrix can be referenced against the performing organization's policies for risk reaction. Based on the risk score, the performing organization can place the risk in differing categories to guide risk reaction. There are three common categories based on risk score:

- Red condition: High risk; these risks scores are high in impact and probability.
- Yellow condition: These risks are somewhat high in impact and probability.
- Green condition: Risks with a green label are generally fairly low in impact, probability, or both.

Risk Scores					
Probability					
0.9	0.05	0.09	0.18	0.36	0.72
0.7	0.04	0.07	0.14	0.28	0.56
0.5	0.03	0.05	0.10	0.20	0.40
0.3	0.02	0.03	0.06	0.12	0.24
0.1	0.01	0.01	0.02	0.04	0.08
	0.05	0.10	0.20	0.40	0.80
	Impact				

Table 4: Probability impact matrix scores
Source: Phillips (2009)

According to questionnaire following results are obtained:

Category	Title	Description	Phase	Probability	Impact		
					cost	time	quality
Technical	Requirements	Inadequate specification	Planning	0.1	0.4	0.8	0.4
	Performance	Productivity of work	Construction	0.3	0.2	0.4	0.1
External	Suppliers	Payment delays	Construction	0.1	0.1	0.4	0.2
	Subcontractors	Not finding the right contractors	Planning	0.3	0.05	0.1	0.2
	Weather and power interruptions	Delay in schedule	Construction	0.1	0.2	0.4	0.2
	Market situation	Change in exchange rate, inflation	All	0.5	0.4	0.1	0.4
Organizational	Funding	Profit, bank loan	Planning	0.3	0.2	0.4	0.2

	Resources	Shortage of resources	Construction	0.1	0.1	0.2	0.1
	Staff quality	Productivity of work	Operating	0.1	0.1	0.2	0.4
Project management	Designing	Problems with planning and designing	Planning	0.3	0.4	0.4	0.1
	Organization	Lose control over project	Operating	0.1	0.05	0.1	0.1
	Communication	Lack of team work	Operating	0.1	0.05	0.1	0.05

Table 5: Probability impact scores of the identified risks
Source: Author

Cost risk matrix

Risk Scores					
Probability					
0.9					
0.7					
0.5				Market situation	
0.3	Subcontractors		Performance Funding	Designing	
0.1	Organization Communication	Suppliers Resources	Weather Staff quality	Requirements	
	0.05	0.10	0.20	0.40	0.80
	Impact				

Table 6: Probability impact scores considering the cost of the project
Source: Author

Regarding the risk evaluation based on the questionnaire from the financial point of view the highest risk could occur in the project is the market situation. It could lead to additional

expenses throughout the project process. Also performance, funding and designing factors could influence to the cost of the project.

Time risk matrix

Risk Scores					
Probability					
0.9					
0.7					
0.5		Market situation			
0.3		Subcontractors		Performance Funding Designing	
0.1		Organization Communication	Resources Staff quality	Weather Suppliers	Requirements
	0.05	0.10	0.20	0.40	0.80
	Impact				

Table 6: Probability impact scores considering the time of the project
Source: Author

The planned schedule of the given project could be delayed and extended based on the factors such as, funding and designing. Although the middle level risks are not as harmful as high risks. The project team should pay attention to those risks by planning proper and useful tool to deal with it. Another important aspect of the schedule of the project is technical requirements.

Quality risk matrix

Risk Scores					
Probability					
0.9					
0.7					
0.5				Market situation	
0.3		Performance Designing	Funding Subcontractors		
0.1	Communication	Resources Organization	Weather Suppliers	Staff quality Requirements	
	0.05	0.10	0.20	0.40	0.80
	Impact				

Table 7: Probability impact scores considering the quality of the project
Source: Author

The highest scored risks according to quality of the project are market situation and funding. The project team concerned about the financial aspects that could lead to low quality of the project. From their point of view when the market is not stable and the low amount of money in planning phase, will directly affect to the quality. Staff quality will also be considered for this aspect. To find right subcontractors the company should also provide more effective shop around.

4.2.2 Quantitative analysis

The key aim of this quantitative analysis is to determine the probabilistic approach to the schedule of the given project. In this analysis researcher tried to emphasize the importance of the activities in the project, planned dates, resources and critical activities carried out including the possible risk happening durations throughout the project schedule.

To obtain the data of planned and expected duration of the project, as well as the activities, researcher made a questionnaire and document research of the case company. Based on collected data following analysis are made.

Work breakdown structure

In order to identify the activities of the PERT analysis, work breakdown structure of the given project has made.

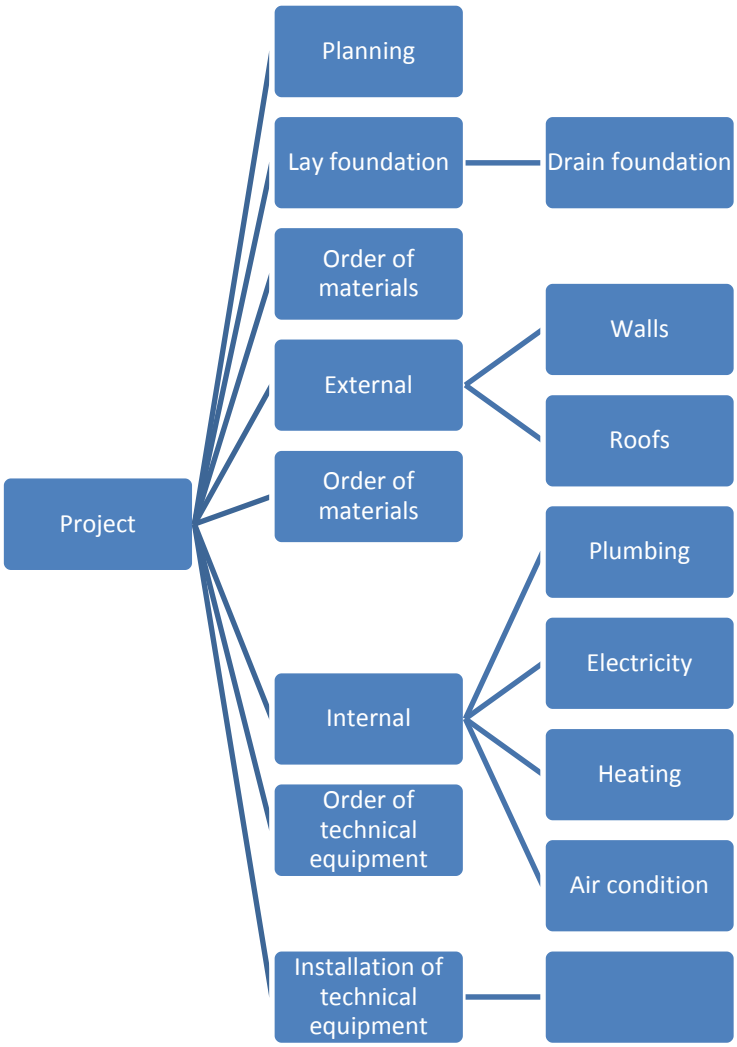

Chart 3: Work breakdown structure of the project
Source: Author

PERT analysis

PERP analysis will provide only the scheduling part of the project, but it will be very effective tool to understand the probabilistic approach to the project time of realization.

Following analysis made by studying several case studies, internet sources and risk management book by De Ceuster, 2010.

The technique replaces deterministic values for duration with a probabilistic approach whereby experts estimate an "optimistic" (a), "probable" (m) and "pessimistic" (b) duration of each task. Based on questionnaire and document review above mentioned durations are collected.

Task	Activity	Predecessor	Durations			Mean	Variance
			a	m	b		
A	Planning	-	50	60	80	61.7	25.0
B	Order of mat.	A	4	5	7	5.2	0.3
C	Lay foundation	A	7	10	14	10.2	1.4
D	External	B,C	37	44	50	43.8	4.7
E	Order of mat.	C	3	5	7	5.0	0.4
F	Order of tech.	D	35	37	44	37.8	2.3
G	Internal	D,E	37	40	44	40.2	1.4
H	Installation	F,G	7	10	13	10.0	1

Table 8: Mean and variance of the three point estimates
Source: Author

PERT in combination with the β-distribution gives following results for the expected value or mean and the variance:

$EV_\beta = (a+4m+b)/6$

$\sigma^2_\beta = ((b-a)/6)^2$

Determining the critical path of the project:

ES	D	EF
A		
LS	slack	LF

ES – Earliest start

EF – Earliest finish

LS – Latest start

LF – Latest finish

D – Mean = Expected time

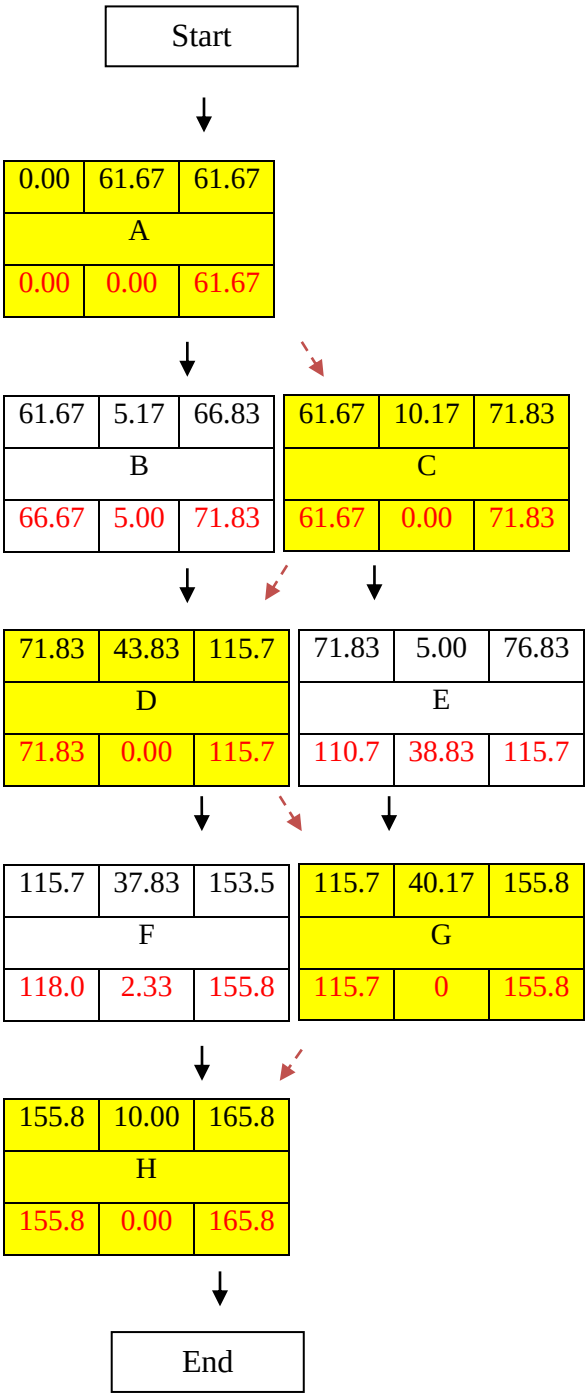

Chart 4: Critical path and expected duration
Source: Author

Forward and backward pass (Chinneck, 2000):

Make a forward pass through the diagram, calculating the earliest time (TE) for each event (node). In other words, what is the earliest time at which all of the activities entering a node will have finished? To find TE, look at all of the activities which enter a node. TE is the latest of the arrival times for entering arcs, i.e. TE = max [(TE of node at tail of arc) + (arc duration)] over all of the entering arcs. By definition, TE of the starting node is zero. Backward pass calculations are from Right to Left. Backward pass calculations are used to find latest occurrence times of events. For the last event, latest time = Earliest time. If there is more than one activity coming back in an event, in backward pass we take minimum value.

Make a backward pass through the diagram, calculating the latest time (TL) for each event (node). In other words, what is the latest time that the outflow activities can begin without causing a late arrival at the next node for one of those activities? To find TL, look at all of the activities which exit a node. TL is the earliest of the leaving times for the exiting arcs, i.e. TL = min [(TL of node at head of arc) − (arc duration)] over all of the exiting arcs. By definition, the TL of the ending node equals its TE.

Critical path:

The slack for an activity is the difference between its latest finish time and its earliest finish time. In symbols, Slack = LF – EF.

(Since LF – EF = ES – LS, either difference actually can be used to calculate slack.)

For example,

Slack for activity B = 71.83 – 66.83 = 5.

This indicates that activity B can be delayed up to 5 days.

Each activity with zero slack is on a critical path through the project network such that any delay along this path will delay project completion.

The critical path of the project: Start – A- C – D – G – H – End.

Probability:

Activities on Critical path	Mean	Variance
A	61.7	25
C	10.2	1.4
D	43.8	4.7
G	40.2	1.4
H	10	1
Project duration	165.8	33.4

Table 9: Related mean and variance of critical activities
Source: Author

The fact that activity times are random variables implies that the completion time for the project is also a random variable. That is, there is potential variability in the overall completion time. Even though the project has an expected completion time of approximately 166 days, there is no guarantee that it will actually be completed within these days. If by chance various activities take longer than their expected time, the project might not be completed within the desired schedule. In general, it would be useful to know the probability that the project will be completed within a specified time.

x – Probable days.

μ – 166 days (expected completion time)

σ – Standard deviation = square root of total variance of critical activities

Z score for a standard normal distribution = $(x - \mu)/ \sigma$

x	Z score	Probability
160	-1.0379	0.14
163	-0.5189	0.30
166	0	0.5
168	0.3459	0.63
170	0.6919	0.75

Table 10: Estimation of the probability
Source: Author

The results show us for instance, for approximately 170 days there will be 75 percent probability of finishing the project and for expected duration of 166 days there is 50 percent chance of delay and 50 percent chance of completing on that day or before. For the calculation of the results and estimation of Z distribution probability the researcher used Microsoft Excel functions, such as NORMSDIST.

A big advantage of PERT lies in its extensive planning. Network development and critical path analysis reveal interdependencies and problems that are not obvious with other planning methods. PERT therefore determines where the greatest effort should be made to keep a project on schedule. The second advantage of PERT is that one can determine the probability of meeting deadlines by development of alternative plans. If the decision maker is statistically sophisticated, he can examine the standard deviations and the probability of accomplishment data. If there exists a minimum of uncertainty, one may use the single-time approach, of course, while retaining the advantage of network analysis. PERT can also evaluate the effect of a deviation in the actual time required for an activity from what had been predicted. Many companies have taken a hard look at the usefulness of PERT on small projects.

PERT, unfortunately, is not without disadvantages. The complexity of PERT adds to implementation problems. There exist more data requirements for a PERT-organized reporting system than for most others. PERT, therefore, becomes expensive to maintain and is utilized most often on large, complex programs (Kerzner, 2009).

5. Discussion and conclusion

The aim of this research was to understand basic principles of project risk management process, how this process is implemented in the case company and to provide possible recommendations based on the analysis by using obtained data. On the basis of the aim of the thesis were formulated research questions.

To answer for the first question researcher provided literature studies of several guidelines, books, scientific articles of different authors, researchers and institutions were reviewed in order to get overview in the theoretical point of view and basic understanding in this field. The general idea and understanding of risk and its management process were illustrated in the theoretical part in this research.

The second question was about the case company and how they evaluate risk and manage in their project. Based on the interview respondents were aware with the terms of uncertainty and risk, they were able to identify potential risks of the project. Mainly based on their past experience, meeting and discussion of the members of project team during the planning stage. But, in the practice they roughly implemented its evaluation and analysis due to lack of knowledge of any method in this field. The main concern of the company were the financial and duration of the project that they made some financial analysis in the planning stage considering market situation and tried to set the expected time of the project. Finally, if possible risks occurred in any stage of the project, project members were responsible to identify them in their specified work and then by discussing with the rest of the team to obtain possible response.

Based on the theoretical studies, observed situation in the risk management process of "Mongol Ibex Cashmere" LLC and implemented analysis, researcher tried to make recommendations and suggestions for more effective and suitable risk management for the company. Considering the importance of the project for future benefits of it and profitability by expanding the factory, the company should take into account some serious risks that could occur and harm the successful implementation of the project. In the risk planning process the company should include more discussion, provide meetings and explain current situation of the process as well as the significance of the risks to every project member. Also they should consider the constraints of the project in order to seek

missing risks and prepare alternative solutions to it, such as the scope, schedule and budget of the project.

In the practice the company obviously missing the process of evaluating and analyzing risk that have identified. As the results of the analysis previously made in the research shows rankings, categories and probability of the duration of the project. By applying simple method probability impact matrix will allow the company to combine both probability and impact of the risks in same scale and make different strategies to deal with big and small sized risks. According to questionnaire survey, market situation was one of the biggest threats to project process, therefore in is in best interest to the company provide alternative options to minimize the effect of it. Also critical path method will give the opportunity to improve control over the duration by identifying critical activities. PERT analysis could provide a guidance of meeting the deadline without making wrong decisions to reduce the duration of some activities. Successful communication and teamwork between project members could be very effective for unexpected turn of any situations and respond faster to risks. Finally, project team should also control and monitor the whole process closely and be prepared as the status of the risk may also change and require new plans and responses. To meet the last question of the research and indicate the importance of the project risk management researcher provided above suggested recommendations.

In today's market for the small companies to implement new projects is very crucial. Without taking into account the risk management in the project could lead to unwanted consequences. Therefore, effective risk management process will allow the company to be prepared for such results. Using necessary strategies and tools for identification, planning, evaluation and response will contribute a great effect for achieving project objectives.

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APPENDIX

1. Interview questions

Could you please describe about your company?

How do you see your company's strengths and unique resources?

What makes your company's competitive advantage?

What could the company improve upon and avoid?

Are there any factors that could influence your operation and sales?

Are there any trends that might impact in the industry?

How do you see your competitors influence to the company?

Could you please describe your project and possible outcome of it?

Are you familiar and your staff with the term risk?

How do you see that potential risks could influence the project?

How do you identify possible risks?

How risk management carried out within the project?

What does the terms risk evaluation and response mean to you?

What do the terms controlling and monitoring risks mean to you?

2. Questionnaire survey

How would you evaluate the probability of occurring of following risks:

Probability	Very low	Low	Moderate	High	Very high
Score	0.1	0.3	0.5	0.7	0.9
Requirements					
Performance					
Suppliers					
Subcontractors					
Weather and power interruptions					
Market situation					
Funding					
Resources					
Staff quality					
Designing					
Organization					
Communication					

How would you evaluate the impact of following risks considering their cost, time and quality:

Cost impact	Very low	Low	Moderate	High	Very high
Score	0.05	0.10	0.20	0.40	0.80
Requirements					
Performance					
Suppliers					
Subcontractors					
Weather and power					
Market situation					
Funding					
Resources					
Staff quality					
Designing					
Organization					
Communication					

Time impact	Very low	Low	Moderate	High	Very high
Score	0.05	0.10	0.20	0.40	0.80
Requirements					
Performance					
Suppliers					
Subcontractors					
Weather and power					
Market situation					
Funding					
Resources					
Staff quality					
Designing					
Organization					
Communication					

Quality impact	Very low	Low	Moderate	High	Very high
Score	0.05	0.10	0.20	0.40	0.80
Requirements					
Performance					
Suppliers					
Subcontractors					
Weather and power					
Market situation					
Funding					
Resources					
Staff quality					
Designing					
Organization					
Communication					

Picture 1: Hair sorting process

Picture 2: Hair sorting machine link 1 and 2

Picture 3: Processed cashmere (outcome)

Picture 4: Project location