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Barriers of identifying early warning signals in Projects

NTNU – Trondheim
Norwegian University of
Science and Technology

MASTER THESIS
Spring 2014
for stud. techn. Nasim Ghanizadeh Poshtekooh

Enhancement of early warning responses in order to prevent failure in projects

The concept of early warning in projects, which was first discussed by Ansoff (1975), mainly argues that even unexpected discontinuities are indicated by some warning signals. Many authors have criticized or supported this idea, but in general this concept is underrepresented in the literature. Despite this fact, according to Nikander (2002), the project management literature does include some statements which are possible to be interpreted as examples of early warnings.

Some of the approaches which have been mentioned in the literature as early warning sources include risk analysis, stakeholder analysis, performance measurement, project health check, etc. These approaches allows project managers or organizations to take timely actions in response to indicators of poor performance and increase the likelihood of project success

Although these methods exist and are applied in many cases which lead to identification of early warning signs, there are still failures occurring. This can be due to avoidance of responding properly to the signs or overlooking the early warning signs.

The goal of the research is to examine the reason why there are aversions towards accepting the seriousness of some early warning signs and taking actions on time in order to prevent failure and investigate on both process-related and physiological issues which should be enhanced in order to react properly to early warning signs.

In this project, the candidates should undertake the following tasks:

1. Literature review of relevant topics, e.g., the concept of early warning, early warning identification process, etc.
2. Analyze the reasons of skepticism towards acceptation of early warning signs.
3. Investigate on how responses to early warning signs can be enhanced in order to prevent failure.

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Date	Our reference
2014.01.14	SHK/KEDA

The assignment solution must be based on any standards and practical guidelines that already exist and are recommended. This should be done in close cooperation with supervisors and any other responsibilities involved in the assignment. In addition it has to be an active interaction between all parties.

Within three weeks after the date of the task handout, a pre-study report shall be prepared. The report shall cover the following:

- An analysis of the work task's content with specific emphasis of the areas where new knowledge has to be gained.
- A description of the work packages that shall be performed. This description shall lead to a clear definition of the scope and extent of the total task to be performed.
- A time schedule for the project. The plan shall comprise a Gantt diagram with specification of the individual work packages, their scheduled start and end dates and a specification of project milestones.

The pre-study report is a part of the total task reporting. It shall be included in the final report. Progress reports made during the project period shall also be included in the final report.

The report should be edited as a research report with a summary, table of contents, conclusion, list of reference, list of literature etc. The text should be clear and concise, and include the necessary references to figures, tables, and diagrams. It is also important that exact references are given to any external source used in the text.

Equipment and software developed during the project is a part of the fulfilment of the task. Unless outside parties have exclusive property rights or the equipment is physically non-moveable, it should be handed in along with the final report. Suitable documentation for the correct use of such material is also required as part of the final report.

The student must cover travel expenses, telecommunication, and copying unless otherwise agreed.

If the candidate encounters unforeseen difficulties in the work, and if these difficulties warrant a reformation of the task, these problems should immediately be addressed to the Department.

The assignment text shall be enclosed and be placed immediately after the title page.

Deadline: 10 June 2014.

Master Thesis Spring 2014 for stud. techn. Nasim Ghanizadeh Poshtekooh

Date
2014.01.14

Our reference
SHK/KEDA

Two bound copies of the final report and one electronic (pdf-format) version are required according to the routines given in DAIM. Please see http://www.ntnu.edu/ivt/master-s-thesis-regulations regarding master thesis regulations and practical information, inclusive how to use DAIM.

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AND QUALITY ENGINEERING**

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Dedication

I would like to dedicate this Mater Thesis to My family, my lovely sister "Negin" who thought me there is only one important thing in life and it is "Love", my mother "Beheshteh" who taught me to never lose hope in the face of difficulties and not to be disappointed over failures and my father "Farzad" for all of his kindness and support.

Acknowledgement

Abstract

Despite of development in project management methods and tools for ensuring projects success, still large numbers of projects are experiencing failure or turbulent situations. Today life highly depends on projects' results and due to many numbers of competitors in the market, managing projects proactively has become an important success factor in project management. Managing projects proactively demands methods which help managers to address issues early enough and correct the situation in an appropriate time before the problems surface. This provides plenty of time available for implementing corrective actions. Some approaches have been developed for identification of early warning signals such as risk analysis, performance measurement, cause and effect analysis, and etc. Although these methods exist and are applied in many cases for identifying the early warnings, still failures are occurring and many signals are missing. This can be due to being misdirected by wrong guidelines, plans and issues related to scanners and environmental scanning methods and tools or the nature of project. Purpose of this master thesis is identifying those barriers of identification of early warning signals. The researcher's focus is given on issues related to environmental scanning, project governance and complexity. She also studied two case projects (Asker-Sandvika rail track and National Opera house). Finally she came into the conclusion that environmental scanning can have a very important effect on identification of early warning signals, wrong and incomplete methods of environmental scanning can be a barrier for identification of all of the relevant signals. As governance provides guidelines for the whole work, inaccuracy in its definition and lack of flexibility in such guideline would lead to inappropriate methods of project control and finally missing many early warnings. Complex nature of projects also requires appropriate methods of leadership and management which can deal with issues related to complexity. Finally the researcher concluded that governance of the project has the most important role in providing plans and procedures for identification of early warnings, as governance provides procedures for the whole work. Therefore governance of project need to be defined correctly from the first place and be able to be adapted to the changes in the environment, so it can provide correct procedures for identifying the signals. It can also lead to better environmental scanning and being able to deal with issues related to complexity.

List of Abbreviations

RCA   Root Cause Analysis

PMBOK   Project Management Body of Knowledge

EVM   Earned Value Management

PV   Planned Value

EV   Earned Value

AC   Actual Cost

R   Receiver

S   Sender

PM   Project Manager

CSF   Critical Success Factor

JBV   Jernbaneverket

KS2   Kvalitetssikring

CTC   Centralized Traffic Control

HUT   Helsinki University of Technology

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CHAPTER 1

INTRODUCTION

1. Introduction

Despite of development and improvement in today's project management methods and tools, still large numbers of projects are registered with poor performance (Locatelli, Mancini, & Romano, 2013). As Ansoff (1980) claimed, there are some weak signals which can be identified at early stages of projects, otherwise they will get stronger in time. The signals, which are called early warning signs by Nikander (2002), help management in anticipating problems and implementing actions in order to prevent the future surprising problems from materialization. In other words, identifying early warning signs contributes in pro-active management of projects, which is highly in demand in today project world. The issue is that the signals usually are not taken into account at the time of detection and become stronger in time (Nikander, 2002). Therefore, the surprising events appear and lead to large amount of losses, rework, and finally project failure. So, addressing early warning signs early enough and implementing actions toward them before their full impact contributes in achiving project success. So far, some tools and techniques have been developed for identifying early warning signs and pro-active management of projects such as risk analysis (Haji-Kazemi, Andersen, & Krane, 2013), project assessment (Andersen & Fagerhaug, 2002; Haji-Kazemi et al., 2013), decision support model of early warnings (Nikander, 2002), performance measurement system (Andersen & Fagerhaug, 2002; Haji-Kazemi et al., 2013), root-cause analysis (Ghanizadeh, 2013; Haji-Kazemi et al., 2013) and so on. Despite of development of these tools and their use in many projects for identifying early warning signals still large numbers of the signals are missing (Locatelli et al., 2013). So, it seems there are some barriers in identification of those early warnnig signals. For example, according to Roth and Kleiner (1998), a purpose of project's assessment is identifying early warnnig signs but these tools have some limitations in addressing all kind of warnings. According to Terry Williams, Klakegg, Walker, Andersen, and Magnussen (2012), there is a lack of literature about why projects do or do not perform as it had been expected. The lack of literatures with direct focus on barriers of identifying early warning signs (despite of available tools), giving rise to the following research questions guiding this study:

Why, despite of available tools for identifying early warning signs, large number of signals are missing? What are main reasons for missing the signals? And how these problems can be solved?

In order to answer these research questions, I have chosen the most relevant literature to these topics and got some hints from them. Nikanders (2002), in his dissertation argued the

importance of environmental scanning in identification of early warning signals. Environment is very uncertain and dynamic, and contains many early warning signs of future opportunitie, therefore an environmental scanning gives practioners a better insight about future state and can lead to a better strategic decision making. According to Ansoff (1980), as environmental scanning is expensive and time consuming, the use of filters in selecting the most relevant signals seems appropriate. When filtering, whether a message being included or excluded is highly dependant on the filters, humans (as the most important sensors which are deciding upon the data and the signals), and many other relvant issues. For example, the issues related to optimism bias can have an effect on missig many early warning signals. So, in these thesis, the effects of environmnetal scannings, filters, and human related topics (such as optimism bias) taken as hints from Nikander's dissetation (2002) are going to be focused.

In addition, Terry Williams et al. (2012), conducted a research about some important issues in projects which helps in identifying early warning signs. So, I got some hints from these authors' work and will focus on those issues as well in order to examine their effect on identifying early warning signs. According to these authors, establishing an appropriate project governance at early stages of projects is very important in identifying early warning signs that may appear later in projects. Root of many problems in projects is the decisions had been made in the front-end stages of the projects. Therefore, "governance framework" can contain good practices for identification of early warning signs.

The nature of project can also have effect on identifying the signals or not, such as "the issue of complexity". In complex projects identifying the outputs of specific inputs is not an easy task, because in a complex system issues are interconnected and interdependent. A complex system is made of many parts and its behavior is uncertain. In such complex systems causality is less clear and by looking at the signals identifying the future problems is not an easy task. Both internal complexity such as technology and interfaces, and external complexity such as stakeholder relations make the ability to identify early warnings more difficult. So, in complex projects identifying all relevant early warnings is not easily possible. Also, too heavy processes in identifying early warning signs may be a reason for not being able to uncover the signals (Terry Williams et al., 2012). Therefore in this thesis the effect of governanace and complexity is going to be assessd as well.

The following figure indicated the areas of focus in this master thesis.
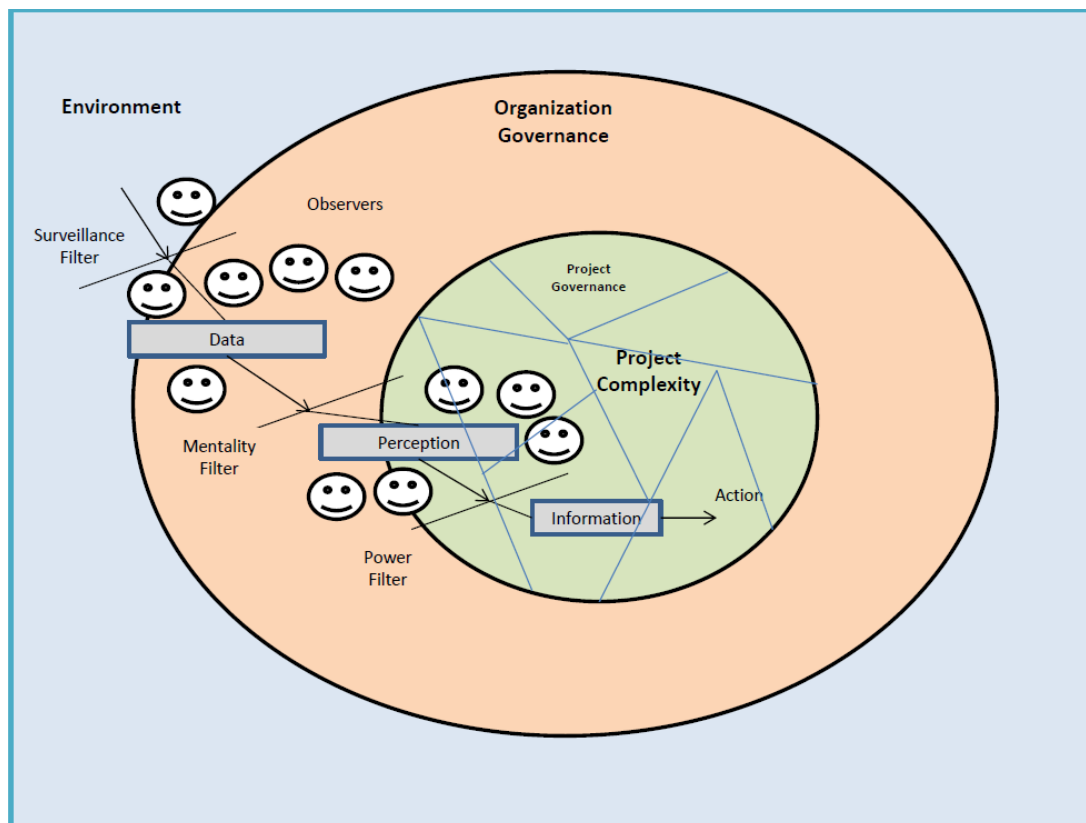
1-1. Areas of focus in research

CHAPTER 2

RESEARCH METHODOLOGY

2. Research Methodology

2.1 Problem formulation

Working on the topic of "Root-Cause Analysis (RCA) as a method for identifying and acting on early warning signs in projects" as my specialization project topic (Ghanizadeh, 2013) resulted in a need for more research about early warning signs of projects. As Locatelli et al. (2013) claimed, despite of available tools for identifying early warning signs of projects still large number of warnings are missing and still projects are experiencing failures and turbulent situation. This indicates that there is a need for more research about the reasons of missing early warning signs in projects.

At first the topic of "Enhancement of early warning responses in order to prevent failure in projects" was suggested for this thesis work. This topic required researching about avoidance of responding properly to the signs or overlooking the early warning signs. The goal of the research was finding the reasons of aversions towards accepting the seriousness of early warning signs and taking actions toward them. But it seems before being able to act on them, a lot of warnings are missed in industries and there are many problems in recognizing signals on time. Therefore it was decided to change the topic to "Barriers of identifying early warning signs in projects", in order to examine the reasons of missing the signals in projects. This topic was chosen because it was felt there are more serious problems in identifying signals before acting on them and implementing responses.

So, the following figure indicates how the researcher came into the idea of choosing this topic:

Specialization project topic: Root-cause analysis as a method for identifying early warning signs in projects

Despite of available tools such as Root-cause analysis, risk analysis, etc. large number of signals are missing in industries

Thesis topic: Barriers of identifying early warning signs in projects
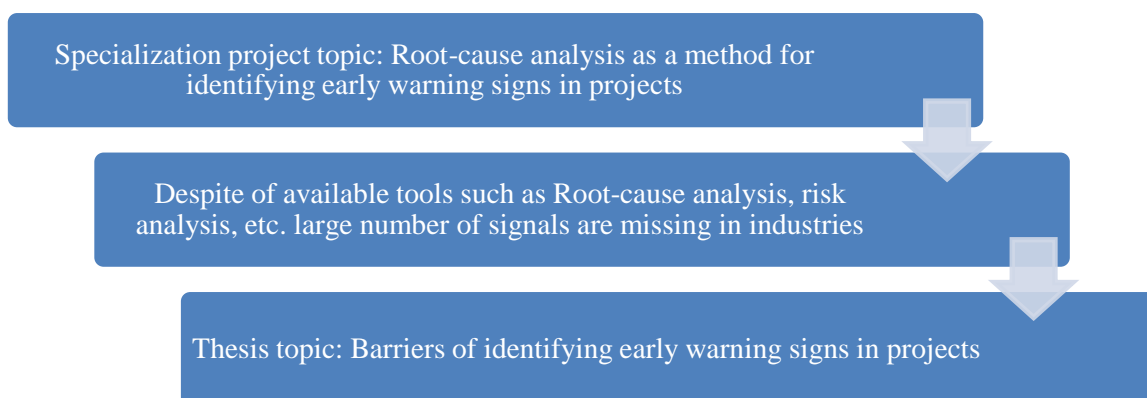
2-1. Selection of thesis topic

2.2 Research type

According to Kothari (2004) in an "analytical" research, the researcher would use different facts and information that already exist and then analyze them in order to make a critical evaluation of those material. Considering this definition, the type of this master thesis is considered as an analytical research, as the researcher has used available materials about early warning signs and related topics in order to be able coming into conclusions by analyzing and evaluating those materials.

In addition, this research is "qualitative" in nature. "Qualitative research is a research strategy emphasizes on words rather than quantification in the collection of data and analysis of it" (Hammersley, 2013). As the topic of this research reveals, in order to understand the barriers of identification of early warning signs in projects, the best way would be analyzing available materials and cases qualitatively and using in path interviews for the purpose. In this qualitative research it was tried to understand experts' feeling or their thoughts about the reason of missing those signals in two case projects as well.

Furthermore, this research is "conclusion oriented" in nature. In such research, the researcher is free to pick up a problem, redesign the enquiry as he proceeds and is prepared to conceptualize as he wishes (Kothari, 2004). In this thesis also there had been freedom in choosing concepts which were found in different literature in order to examining their effect on identification of early warning signs. Therefore, a pre-study of available relevant literature helped the researcher to choose some concepts such as Environmental scanning, project governance, and project complexity for more research. The researcher went through these concepts and tried to conclude the thesis around them.

2.3 Research design

According to Kothari (2004) the aim of research design is to facilitate conducting a research. He defined research designs as "advanced planning of the methods to be adapted from collecting the relevant data and techniques to be used in their analysis and keeping in view the objective of the research". Formulating a problem for more precise investigation or developing the working hypothesis from an operational point of view is the most important purpose of research design (Kothari, 2004). One of the most fruitful and simple method of formulating a research problem and developing findings is the method of literature and case study. In this thesis, the method of literature review has been chosen for reviewing the already

done materials (Books, articles, case studies, and so on) about early warning signs of projects and related concepts, in order to be able to formulate the research problems and develop findings. A pre-study of already done literature on early warnings gave some hints about the barriers of identifying early warnings and some keywords and concepts were chosen for more concentration (such as early warnings, weak signals, environmental scanning, governance, complexity, success factor and so on), then for each concept the most relevant literature were searched and selected for more study.

After making a comprehensive list of relevant literature, the researcher defined the scope of thesis by making a schedule for the whole work. This step resulted in a plan for developing the hypotheses in mind.

Then, the searcher developed the research and collected required qualitative data by a comprehensive literature study, found some possible barriers of identification of early warnings through literatures, studied two case projects, analyzed them according to findings from literature and finally she tried to discuss all of the most relevant barriers. This step helped the researcher to cover research questions and finalize the report.
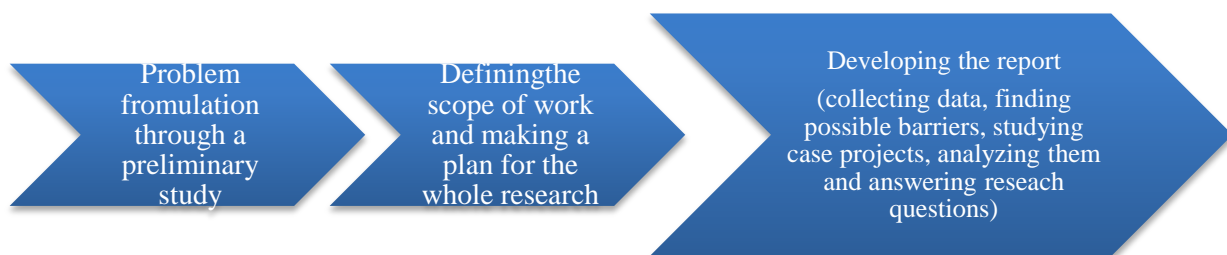
2-2. Research design

2.4 Method of research

Methods and techniques of research refer to those methods researcher uses in performing research operations. The objective of a research is arriving at a solution for a specific problem, therefore available data and the unknown aspects of the problem need to be related to each other in order to make a solution possible (Kothari, 2004).

In this thesis the method of literature review of different sources has been used in order to gather enough qualitative data and develop ideas related to research questions. As there was a lack of literature which directly discusses barriers of identifying early warning signs, a few number of materials provided the basis for developing more ideas about the possible barriers.

The researcher decided to do more research around topics such as Environmental scanning; project governance, project complexity and some other sub-topics (such as issues related to filtering early warnings, communication barriers, optimism bias and so on) which can be included in each of those three groups, as she felt these topics are more relevant to the barriers of identifying early warning signs. Therefore, a comprehensive literature review about each of these key words and relevant topics was done and required qualitative data were collected. This literature review helped the researcher to develop findings around each mentioned topic and their relevancy to barriers of identifying signals. After the literature review, the researcher analyzed two challenging projects (Asker-Sandvika double track and Opera house). These projects' data was gathered through interviewing each project experts and studying some available published/unpublished papers/reports for each project. This post mortem analysis of the case projects provided valuable data which gave the researcher opportunities for discussing the data gathered. Finally the researcher was able to conclude the research, answer researcher questions and give suggestions for future studies.
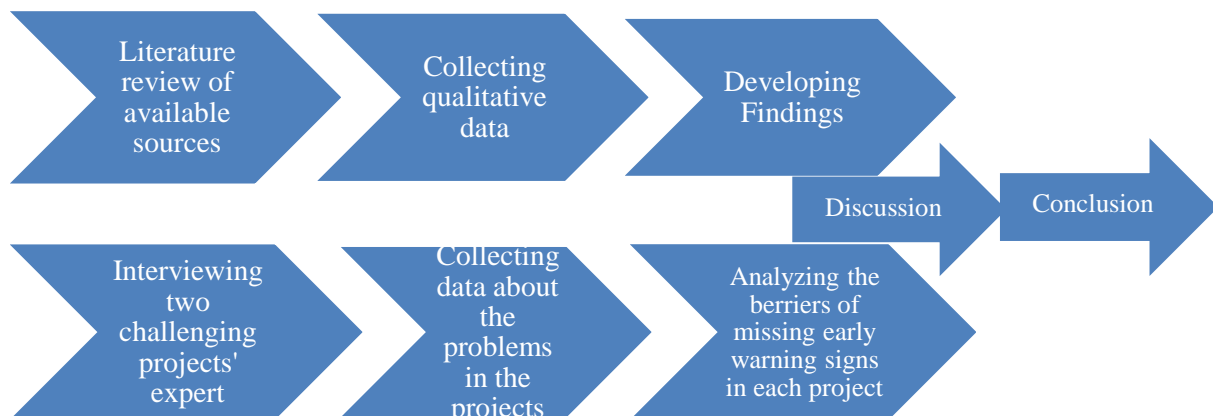
2-3. Method of research

2.5 Limitation of research

One of the limitations of this research is that there is not so much literature published on the concept of early warning signs. A few available material gave the researcher some ideas about focusing around other concepts such as project governance, project complexity, environmental scanning and so on as the possible barriers of identifying early warning signs, but material which directly talk about barriers are missing. In addition, due to time limitations, author has not been able to perform a study on projects in-progress, therefore two case studies were chosen in construction industry for a post mortem analysis (Asker-Sandvika

double track and National Opera house), clarifying the purpose of this research and being able to answer the research questions. In addition, most of the available materials about the two case Norwegian projects were in Norwegian language and as the researcher cannot speak Norwegian she had been faced with many challenges when translating those materials online. Although this thesis is not focusing on any specific industry, but both of those case projects were in construction industry. Barriers of identifying early warning signals discussed in this thesis can be related to any industry.

2.6 References and software

For seeking references and articles the following valid data-bases have been utilized:

- Bibsys, NTNU library (Books, e-books, Articles, theses, etc.)
- Science direct
- Project management institute
- Scopus
- Google Scholar
- Unpublished reports for case projects
- Etc.

2.7 Research Objective

As the topic of this thesis reveals, the main objective of this research is finding the barriers of identifying early warning signs in projects. No previous work has been identified which specifically and clearly discusses the barriers of recognizing the signals. Therefore, this research aims at taking steps toward fulfilling the gap in research about barriers of identifying early warning signs. After studying some related literature, two case studies will be analyzed; all of these data will help the researcher for coming into some conclusions and answering research questions.

2.8 Research questions

In this study, it is tried to answer the following research questions:

(1) Despite of available tools for identifying early warning signs, still large numbers of the signals are not detected, what are the possible reasons?

(2) What is the root of causes for missing early warning signs?

(3) How the problem of missing early warnings can be solved?

2.9 Report Structure

This thesis report consists of the following chapters. Figure 2-4 indicates the structure of the research, different chapters and the relationship among them. Following a brief description of each chapter's concept is given.

- **Chapter one** gives a short introduction of the problem background, problem formulation, and the thesis objectives

- **Chapter two** explains the research methodology including problem formulation, type of research, research design, method of research, limitations of research, references and software, research objectives, research questions and report structure.

- **Chapter three** gives a comprehensive literature review about possible barriers of identifying early warning signs in projects, concepts such as environmental scanning, project governance, and project complexity were studied in details in order to get some preparations for analyzing case studies in later chapters and concluding this research.

- **Chapter four** has been dedicated to two case studies (Asker-Sandvika double track and National Opera house) and analysis through barriers of identifying early warning signs of each of them.

- **Chapter five** discusses about the literature review, the case studies and their analyses and would answer the research questions.

- **Chapter six** concludes and sums up the findings and the results.

- **Chapter seven** includes the sources used to prepare the thesis

- **Chapter eight** contains a list of appendix

CHAPTER 1 : INTRODUCTION

CHAPTER 2 : METHODOLOGY

CHAPTER 3 : LITERATURE REVIEW

ENVIRONMENTAL SCANNING

GOVERNANACE

COMPLEXITY

CHAPTER 4 : CASE STUDY

ASKER-SANDVIKA RAILWAY LINE PROJECT

OPERA HOUSE PROJECT

ANALYSIS

ANALYSIS

CHAPTER 5 : DISCUSSION

CHAPTER 6 : CONCLUSION
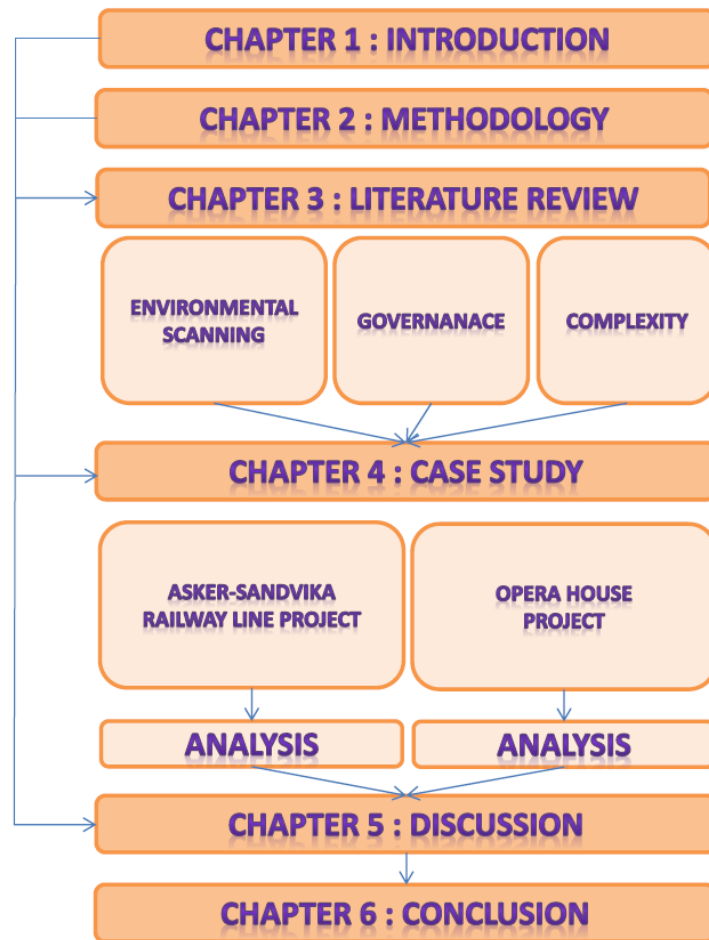
2-4. Report structure

CHAPTER 3

LITERATURE REVIEW

3. Literature Review

In this chapter a comprehensive literature review around topics such as "early warning signs", "environmental scanning", "governance" and "project complexity" has been given. The reason for choosing these keywords is that a preliminary study through available materials about early warnings gave the researcher this feeling that problems of identifying the signals is relevant to the mentioned issues. So the researcher found more literature about each concept and tried to test their relevancy to identification of early warning signals qualitatively. Following figure indicates those areas that are studied through literature.
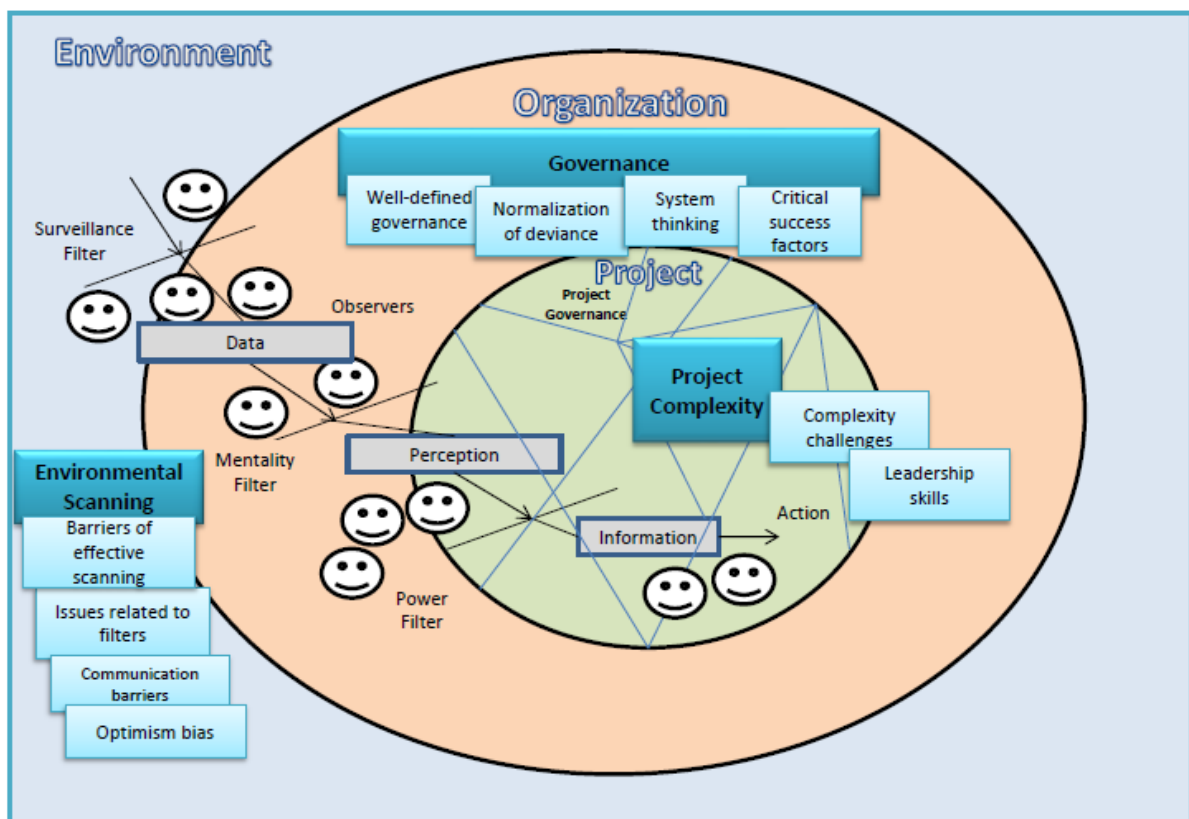
3-1. Areas of focus in the literature review

3.1 Early warning signs

This section is dedicated to the concept of early warnings signals. At first the concept of early warning is introduced, it is followed by a brief introduction of some available approaches for identification of early warning signals in projects and processes for identifying the signals. In each project there are some signals alarming future probable problems, therefore identifying these signals early enough seems to be very beneficial in projects before experiencing surprising events. If the signals are identified on time there might be plenty of time available for implementing preventive actions in order to avoid the potential future problems from materializing. Therefore this chapter aims in introducing these concepts and mentioning the importance of identifying the signals early enough.

According to PMBOK (2008), project is defined as "a temporary endeavor undertaken to create a unique product, service, or result.". Projects are a very important part of human life, any development in humans life depends on a project. Management by control of performance, extrapolation and anticipation used to be adequate when changes in the environment were slow (Igor. Ansoff & McDonnell, 1990). But today, Projects have become more complex and implementing them requires more speed and accuracy. Increase in the number of competitors force firms to speed up in implementing projects since a small delay in implementation may give the market share to competitors. In situations like this methods are increasing in order to finalize projects faster than before. So, the need to implement projects quickly forces firms to react to project problems as early as possible in order to secure projects from problems and delays which may appear in the future (Nanus, 1975). In other words, as Ansoff (1984) claimed proactive methods of project management including flexible/rapid responses are in demand. It shows the importance of addressing issues early enough and implementing preventive and corrective actions before it is too late. As today projects require to be conducted in less and less time because of economic and environmental pressures and rapid changes in the environment, project managers need to be able to anticipate future changes and be prepared for dealing with such discontinuities early enough (Nikander & Eloranta, 2001). According to Nikander and Eloranta (2001) conventional methods of project management, such as management by trends, are not anymore suitable for predicting future as these methods are informative in nature, and they inform discontinuities after the fact and when it is too late.

3.1.1 Definition

Authors have expressed different definitions for weak signals. Igor Ansoff was the first one who mentioned the concept of weak signal in the mid of 1970s (Nikander, 2002). His main purpose of introducing this concept was seeking for improvement in strategic planning methods that are not perfect enough. According to him any firm operating in uncertain environment requires to pay specific attention to weak signals before making strategic decisions (Igor. Ansoff & McDonnell, 1990). He also claimed that strategic surprises, such as the oil crisis in the early 1970s, do not appeared out of blue, it could be predicted by the aid of some signs called weak signals (Haji-Kazemi et al., 2013). The concept of weak signals was later developed for a project context by Nikander (2002) in his doctoral dissertation.

There are different terms for weak signals in literature such as early warnings, symptoms, early indicators, and pre-signals, but all of them have similar meanings (Nikander, 2002). Ansoff and McDonnell (1990) defined weak signal as "…imprecise early indications about impending impactful events…all that is known (of them) is that some threats and opportunities will undoubtedly arise, but their shape and nature and source are not yet known". According to Nikander (2002) "early warning sign is an observation, signal, message, or some other form of communication that is or can be seen as an expression, indication, proof, or sign of existence of some future or incipient positive or negative issue. It is a signal, an omen, or an indication of future developments". Godet and Degenhardt (1994) also defined early warning sign as "a factor of change hardly perceptible at present, but will constitute a strong trend in the future". According to Ilmola and Kuusi (2006) a weak signal is an unstructured information its implication at early stages is very hard to be defined. They also claimed that a weak signal alarms potential discontinuity, something that was not interpreted before in the organization. According to Kappelman, McKeeman, and Zhang (2006) an early warning is an event or indication that predicts and alerts possible or impending problems. In fact, the signals provide indications of manifesting risks and an assessment of project's desire to future problems and failures. Burt Nanus (1975) also believed that present contain harbingers of future, future will not suddenly spring up whole and apart from all the sources that preceded it, so it is possible to design an early warning system which alerts management about the future changes. Although these authors agreed on the existence of early warning signals, some others doubted the existence of the signals. For example, Webb (1987) claimed that there is no earlier foundation for the Ansoff's theory of weak signals and messages or information about the future could not be obtained. He also

claimed that the signals just provide some information and give weak knowledge of the final threat or opportunity. In addition, according to Ashley (1989), those discontinuities can only be seen after their occurrence and possible pre-signals of their arrival can only be identified with the benefit of hindsight. Makridakis and Heáu (1987) also stated that the theory of weak signals is remained an academic idea. But still many research are supporting the existence of weak signals (Haji-Kazemi et al., 2013). Weak signal has been used in future studies (Uskali, 2005). Mannermaa (2004) claimed that "weak signal is one of the most fascinating questions in future research". According to Michelle Codet "a weak signal is a factor for change hardly perceptible at present, but it will constitute a strong trend in the future". On the other hand, Pierre Mase claimed that a weak signal is "a sign which is slight in present dimensions, but huge in terms of its vital consequences" (E. Ahola, Ilmola, Kuusinen, & Pesonen, 2003). Therefore, different authors have had different opinions about ability to perceive weak signals at present time.

Ansoff (1980) claimed that those sudden changes in projects which have effect on the whole organization could have been identified by some weak signals which have grown in time. A postmortem examination of IT failed projects done by Kappelman et al. (2006) also resulted that long before the failure there had been some signals and symptoms alarming the troubles. Keil and Montealegre (2012) claimed that project managers need to look for any red flag at early stages of projects and consider them serious enough for terminating or redirecting projects. Institutionalization of such signals helps organizations to save large amount of money by identifying failed projects early enough.

3.1.2 Levels and groups of early warnings

Literature indicates that there are different levels of signals. According to Ansoff (1990) that level of information has two extreme stages, including strong signals and weak signals; the weak signals progressively get stronger in time and turn into strong signals, therefore we must be prepared for any vague information (Uskali, 2005). A business news case study done by Uskali (2005) indicated that weak signals are classified into 4 different categories based on the quality and exactness of the arguments, sources of data and focus on the future; including feeling signals, uncertain signals, almost certain signals and exact signals. "Feeling signal" is related to the reporters' feeling that something is happening. Different reporters may have different feeling about things that are happening. Enough facts for these signals are missing but they may help the person for better monitoring in future. Usually, these kinds of signal are

not reported. "Uncertain signals" are those which indicate a change in the environment and it is possible to find anonymous sources about the matter. "Almost certain" signals are also those which are more certain than uncertain signals but still there are difficulties in measuring and calculating their changes, their time of occurrence and their consequences. And finally, "exact signals" are those signals which have enough facts and exact dates and numbers of their occurrence.

In addition, there are different groups of early warnings. Kappelman et al. (2006) divided IT related early warnings into three groups of people, process and product related groups. For example, some of people related early warnings which were introduced by Kappelman et al. (2006) are "lack of top management support", "weak project manager", "lack of stakeholders involvement", "weak commitment of project team", "lack of requisite knowledge by team members", and so on. Some of the process related warnings also are mentioned as "lack of documented requirements", "no change control process", "ineffective schedule planning and management" and "communication breakdown among stakeholders", "no business case for project" and so on.

3.1.3 Approaches for Identification of signals

As Nikander (2002) claimed, very little literature deals with the theory of early warning signals. Literature discussed some approaches for identification of earl warning signals such as risk management, earned value management, project assessment, and cause and effect analysis and so on. Following, some of these approaches are going to be explained briefly.

According to Nikander (2002), since early warnings alarm about problems that may arise in the future, there is an obvious relationship between early warning phenomenon and risk management. According to Nikander (2002) any possible problem is called risk and as early warnings alarm about potential future problems they are related to risk management. Therefore risk management methods are suitable in identifying signals.

3-2. Risk analysis source for identification of early warning signals (Haji- Kazemi et al., 2013)

Haji-Kazemi et al. (2013) studied risk analysis as one of the approaches for detection of early warning signals. figure 3-2 Indicates how this approach is used in identification of the signals. Haji-Kazemi et al. (2013) claimed that risk analysis would lead to identification of possible future risks in each reject, therefore by assigning responsibilities for monitoring those specific situations, many risks can be prevented by looking for early warning signals.

Following figure presents the main concepts, their risk related parallel concepts and the way they influence each other.
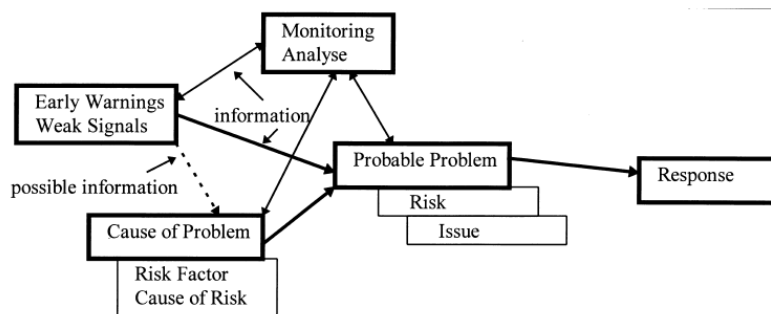
3-3. Parallel concepts(Nikander, 2002)

As figure 3-3 indicates, each probable problem is in parallel with the concept of risk and issue. These problems/risks/issues have their own cause of problem/risk factor/cause of risk and there had been some early warnings/weak signals previously which could alarm materialization of these risks and issues (Nikander, 2002). Also, Kappelman et al. (2006) linked these two concepts by claiming that early warning signs provide indications of future risks and thereby an assessment of a project's critique to future problems and turbulent situations. Niwa (1989) did an research on the link between risk and early warning and outlined an approach based on the use of computer-based expert systems. According to him, risk alarms are in parallel with early warning signs of emerging problems.

Other approach which provides information about possible future problems and early warning signals is Earned value management. Earned value technique is used for measuring and evaluating the health of a project. This technique is a good forecasting method and early warning tool which enables managers to plan and control projects proactively and brings the project back on track in case of problems (Vanhoucke, 2012). According to Lipke, Zwikael, Henderson, and Anbari (2009) this method (EVM) helps for predicting the outcome of a

project as soon as the project is started. Therefore, managers will have a lot of time for implementing corrective actions before facing with failure.

3-4. Earned value management and identification of early warning signals(Haji- Kazemi et al., 2013)

According to Haji-Kazemi et al. (2013) earned value management's focus is on keeping track of time and cost-related issues in a project. By continuous measurement of project progress over time and comparing parameters such as planned value (PV), actual cost (AC) and earned value (EV), early warning signs of serious future deviations can be identified.

Authors such as T. Williams, Klakegg, Andersen, Walker, and Magnussen (2010) also assessed the use of project assessment tools in identification of early warning signals. According to the authors, project assessment is a wide concept which comprises any kind of appraisals and examines project documents and practices for supporting decisions, learning from past and ensuring that expectations are met. Assessment can be done at all of the stages of a project and at different stage gates (T. Williams et al., 2010). Early stages of projects are the best time for assessing the project and identification of early warning signals. Implementation phase of projects usually consist of many activities that may distract the attention of practitioners from identification of early warning signals. And finally post-mortem analysis and assessment of projects is usually late for identification of early warning signals (T. Williams et al., 2010). A case study done by Haji-Kazemi et al. (2013) concluded that early warning signals may be identified by assessment methods but, regarding assessment is successful or not (in identification of early warning signals), actions for dealing with the signals might be ignored; therefore the assessment can be a waste of time and effort.

3-5. Project assessment and identification of early warning signals (Haji- Kazemi et al., 2013)

Cause and effect analysis is also indirectly relevant to the topic of early warning signals (Haji-Kazemi et al., 2013). According to Nikander and Eloranta (2001) in order to take the best use of early warnings it is beneficial to understand the interdependencies among different concepts and understand early warnings' causes and potential future problems. Following figure indicates the hypothetical dependencies between early warnings, problems, causes of problems and responses.
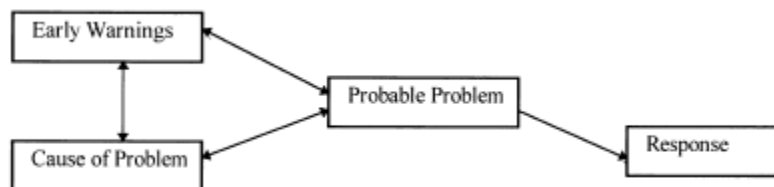
3-6. dependencies between early warnings, problems, causes of problems and responses

(Nikander & Eloranta, 2001)

As figure 3-6 indicates, each problem has a cause and early warning; the probable problem may materialize in the future or not. If it materializes there would be a need for reactive responses. After interpreting the signals of discontinuity, it is very important to not stay content this suspicion. Measures need to be carried out actively in order to lessen the threat, and preventive responses should be planned and implemented (Nikander, 2002).

3-7. Cause and effect analysis and early warning signals(Haji- Kazemi et al., 2013)

After identifying all of the early warnings, problems, causes of problems and responses, the dependencies among all of these phenomena need to be understood. These phenomena are chained together and sometimes the chain is too long (Nikander, 2002; Nikander & Eloranta, 2001). Early warnings, project problems, and their causes may create a very long and a multi-branched chain. In addition, a phenomenon may be interpreted as an early warning, or a problem or a cause depending on the time of observation and point of view. As figure 3-8 indicates, problem A at the time of T-n (yesterday) was interpreted as a problem which had a cause in the past, the problem could be considered as an early warning sign of problem B at

the time of T (today). Now, if we observe B at today time, problem A is considered as a cause for problem B. This chain can be endless and very long (Nikander, 2002).
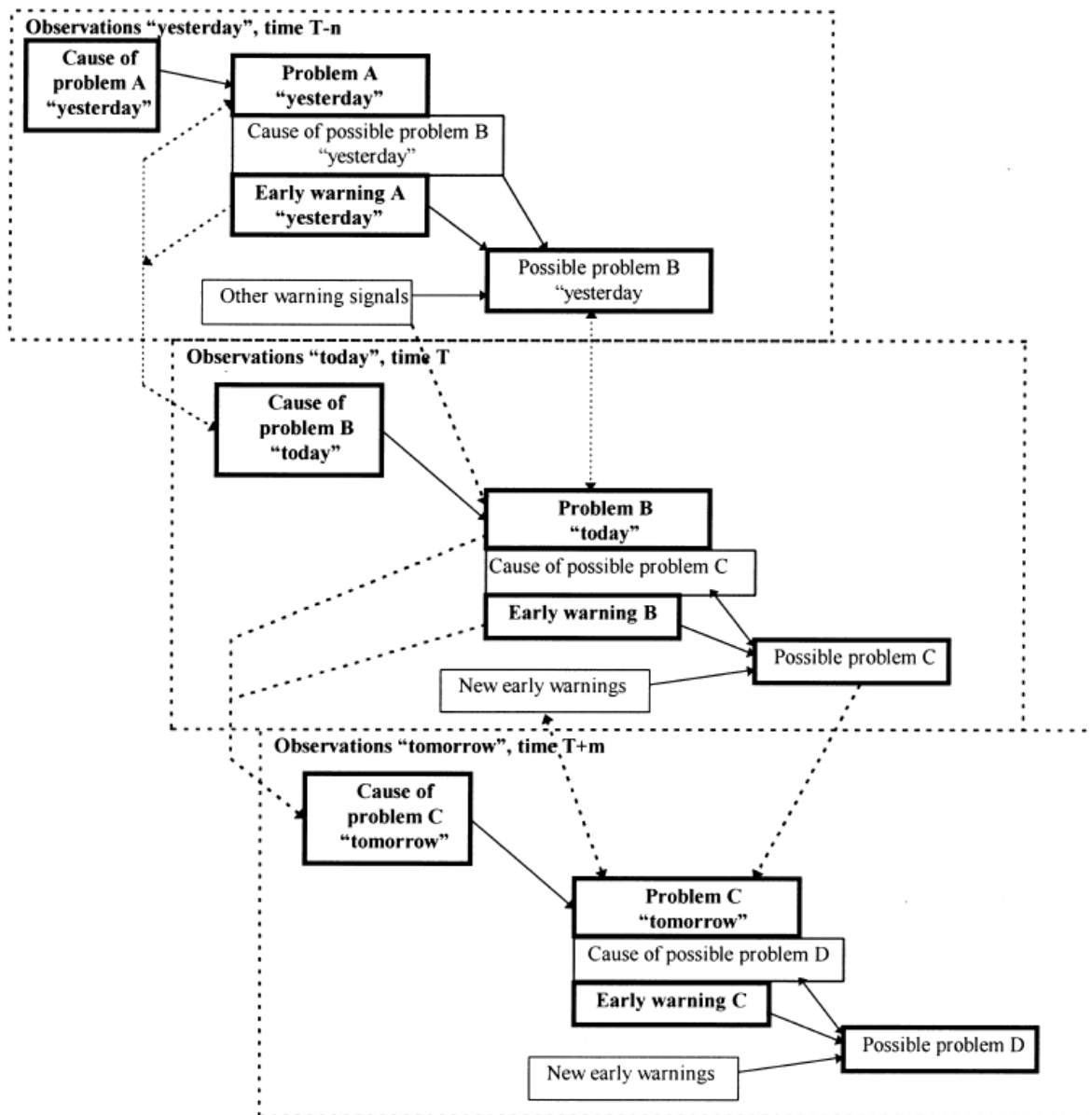
3-8. A chain of problems-early warnings-responses (Nikander, 2002)

A study done by HUT indicated the following methods (Figure 3-9) for obtaining more information about different situations in a project.

Project problems	Method
Scheduling problems	Advence schedule checkup
	More information obtain while monitoring
Cost-related problems	More information obtain while monitoring
Financial problems	Advance research
	Hard to get information
	Hard to get information
	More information in prequalification
Delivery problems	Visiting the supplier
	More information while monitoring
	Monitoring site mobilization

3-9. Methods for obtaining information (Nikander & Eloranta, 2001)

However, according to Nikander and Eloranta (2001) the experience and eagerness of observer for obtaining information is more important than other methods. In addition, analyzing the written documents would be one of the most important sources for gathering information. According to the authors the conventional methods such as reporting, monitoring and control, despite of being based on historical data, should not be forgotten as well.

Early warning signs have a very valuable utilization in project management. According to Ansoff (1980) early warnings can be used in strategic issue management system models for strategic planning and management. Nikander (2002) developed a model for identification of early warnings in projects as indicates figure 3-10.

The model and its process can be divided into two stages (Nikander, 2002):

1) Detecting and accepting early warning signs which provides information for further actions.

2) Analyzing the information and implementing responses.
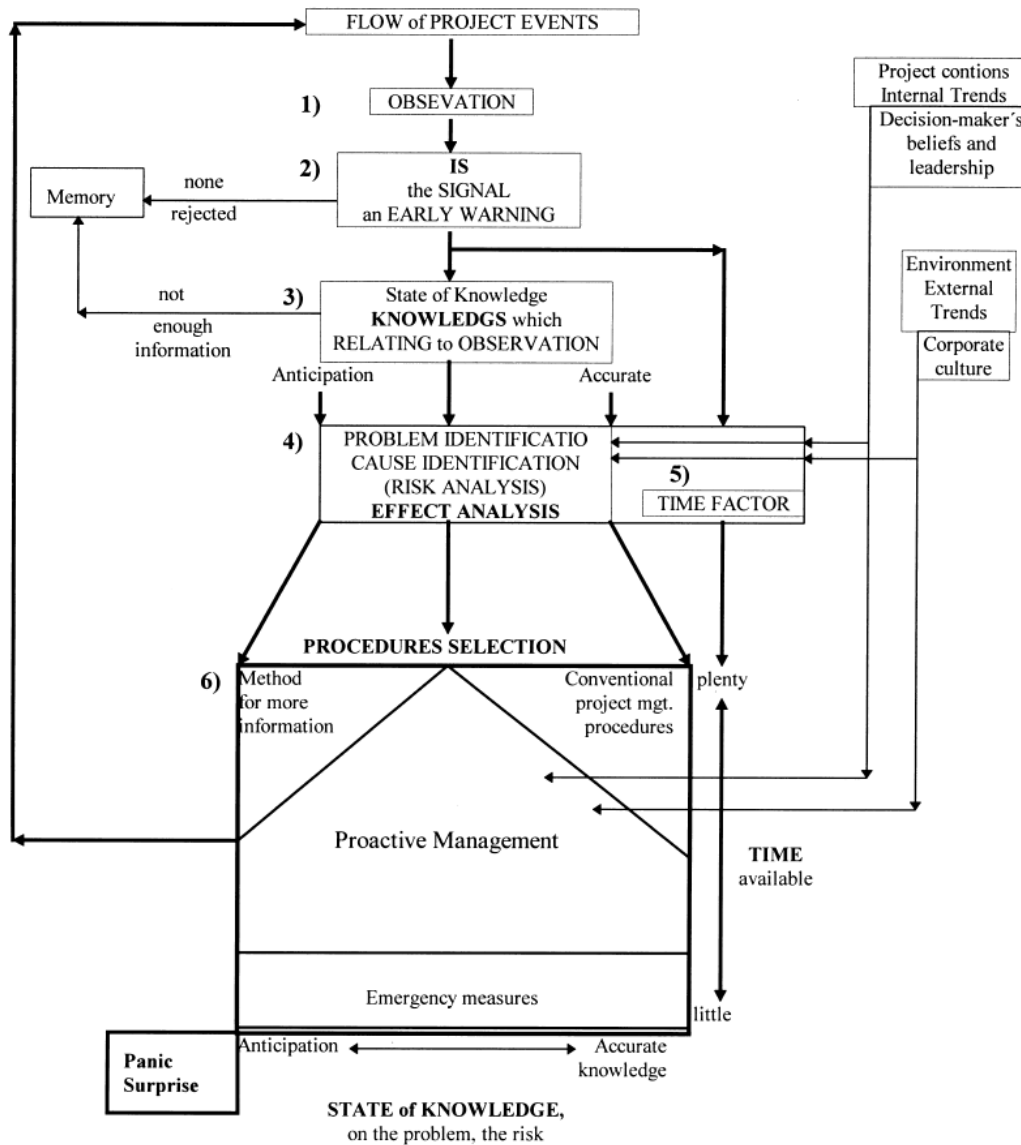
3-8. Decision support model of early warning signs(Nikander, 2002)

Here a summary of the above model introduced by Nikander (2002) is given:

First stage is observing and detecting early warning signs; he advised that people who are responsible for identification of the signs should be very sensitive to all of the environmental issues and effects. Sensors and Environmental scanning are used in this stage for identifying the signals (Nikander, 2002). According to Ansoff (1980) the senior manager who has authority and resources to initiate actions should be given responsibility for managing the system. Senior manager directly assign responsibilities to people in different hierarchies who are most related to deal with the issues. The assigned responsibilities are related to solving problems rather than planning.

In the **second stage** the observer either accepts the sign detected or ignore it as unimportant one. The important point here is that observer's tacit knowledge and his mental model has effect on accepting or rejecting the signs, because each person has his own mental model of reality. According to Kuusi and Hiltunen (2012), observer perceived the message based on his own mental model of reality.

In **third stage** the observer determines the state of knowledge of the early warning signs to see if there is enough information available for further investigation or not (Nikander, 2002).

In the **fourth stage** all of the possible risks and their causes will be identified and assessed, this identification can be effected by the persons' believes and leadership position, project conditions, environment, and corporate culture of the organization. Information about the dependencies of the project problems and causes and how they are chained can be helpful in this stage. It has been claimed that not all of the causes are possible to be altered, for example causes which are past events are history and impossible to be affected. Or causes which are outside of project management influence cannot be changed.(Nikander, 2002)

In **fifth stage** the available time for implementing responses will be evaluated. It will be assessed if the situation is urgent, postponable, or delayable based on Ansoff classification of situations. Delayable is the situation which needs more information and can be delayed, postponable situations will be planned for next cycle of planning and urgent situation should be responded rapidly. According to Ansoff (1984) time available concept is "the amount of time which is available before the problem that is indicated by early warning signs to become appear and have its full impact". The available time is the amount of time in which responses can be implemented. Implementing actions depends on the time of detecting early warning signs and also if the indicated problem needs immediate and quick action or not.

As the figure 3-11 represents, firstly an early warning would be identified by a person who is observing the flow of events. Then the observer would accept the signal and start reacting on it or would consider it as unrelated (useless) and simply reject it. In the next step, the observer would give sense and meaning to the information that is obtained. Then the potential future problems (risks) and their causes (risk factors) would be identified. In next step the available time for implementing actions would be assessed. This factor would have effect on the kind of actions and responses that would be planned, for example if there is lack of exact information and if there is plenty of time available, then it can be decided to obtain more information. According to Nikander and Eloranta (2001) many of risks and potential future problems are

outside the authority of those who are making decisions. Humans are those who observe the warnings and documents are drawn up by them. So, identification, observation, interpretation and making decisions are strongly linked to humans (Nikander & Eloranta, 2001). Those who are responsible for identifying issues need to listen with their ears close to the ground for identifying early warnings of threats and opportunities. In addition, detection of the signals requires observers who are sensitive and have experience. Following figure indicates the nature of early warnings. According to Nikander (2002), a project is a flow of events from which the observer obtains information.
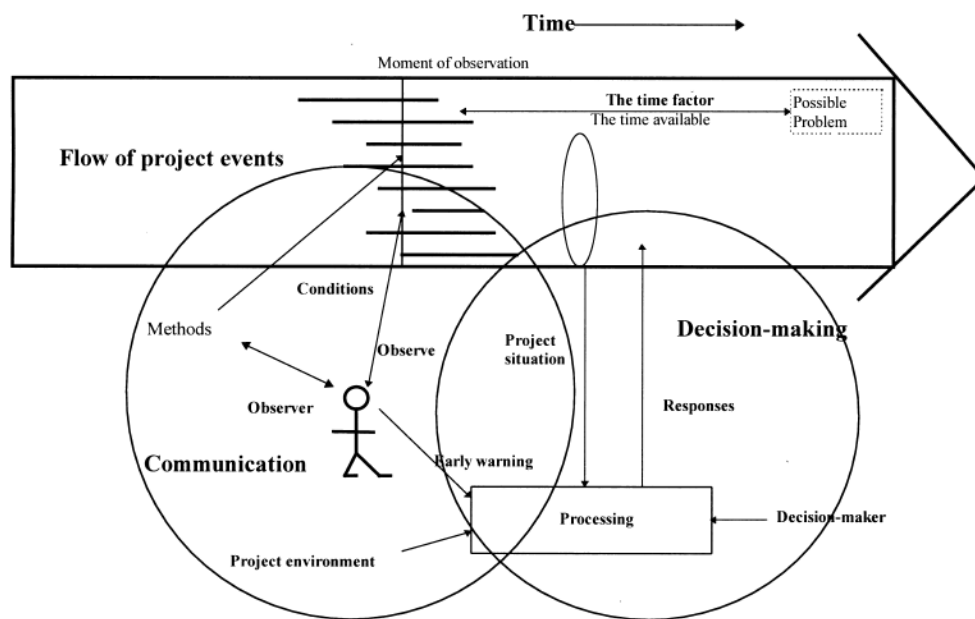
3-9. The process of identification of early warning signals(Nikander, 2002)

The human observer continuously looks at the events and communicates observations and messages. After accepting and communicating those signals, the information would be analyzed and decisions would be made on the basis of the information obtained, in this process a decision maker is also involved. According to Ansoff (1984) companies need to obtain information mostly from the environment, while Nikander and Eloranta (2001) claimed that most of the information are coming from within the project and only a small part comes from the environment. As the figure indicates and as Ansoff claimed for a problem it takes some time to be materialized and to have its full impact (Nikander, 2002). Therefore, environmental scanning can be helpful for anticipating problems early enough before their full impact.

According to Uskali (2005) one of the reasons for concentrating or building early warning systems by scholar has been predicting political changes and crises. But, researchers study has shown that the focus had been on strong signals. Lack of knowledge of mechanisms might be one of the reasons for not identifying many signals. In addition, automatic and human coding systems can be other reason for building wrong assumptions and categorizations. The study done by Uskali (2005) resulted that weak signals are existent, there is a need for being sensitive for unpredicted shifts in the environment, and there is a need for being expert in preventing any bubbles.

According to Haji-Kazemi et al. (2013) there are many approaches for identification of early warning signals and the choice of appropriate approach is dependent on the project, project organization and the project context. According to the authors, each approach has its own strengths and weaknesses. Despite of development and improvement in today's project management methods and tools, still large numbers of projects are registered with poor performance (Locatelli et al., 2013).

To sum up, in each project there are some weak signals of probable future problems/issues/risks. If these signals are identified early enough there would be plenty of time available for planning and implementing preventive responds, otherwise the problems would materialize and lead to large number of other problems and losses following them. There have been many tools for identifying warnings early enough but it seems that still many signals are missing. Following those concepts that seems have effect on identification of signals are introduced through literature. It would prepare the researcher by giving her ideas and hints for evaluating two case projects later in this thesis.

3.2 Environmental Scanning

As the purpose of this mater thesis is addressing the barriers of identifying early warning signals, and as there is a lack of literature which directly represents this issue, in this section, environmental scanning has been chosen for more research through literature. In addition, barriers of proper environmental scanning such as issues related to filters, optimism bias, and communication and so on are going to be addressed in this section. When reviewing literature related to these topics, the author wrote down some findings as possible barriers of identifying early warning signals.

According to Webb (1987), organizational environment and the degree of its change might have effects on identifying the signals. Ansoff (1984) claimed that detecting early warnings can be done both in individual level and by a detached environmental scanning which requires listening to environments. This represents the importance of environmental scanning and a need for further research through this topic. According to Åberg (1993) detector of the signals is anyone in the corporation with wide contact within the firm. Everyone in the corporation needs to be sensitive to the signals and the identification should not be limited to a few number of the participants; everyone in the organization should be involved in the process; including leaders, experts (social/political/economic), marketing people, customers, researchers, and anyone else (Ansoff, 1984). According to Juran (1995) a sensor is "a detective device, highly specialized to recognize certain signals". The sensors give information before the problem materializes, in another words they can recognize early warning signals. According to Ansoff (1984), procuring early warnings is expensive. That is why he suggested the use of 20/80 pareto rule for filtering the most important early warnings that worth to be identified. In addition, he claimed that the most important sensor for identification of the signals is human. Humans visit the signals based on their own standards and expectations and then communicate what they have seen. It should be kept in mind that humans are not accurate at all the time. It is possible that they give wrong information intentionally because of their own comfort or due to lack of accurate information and many other reasons. The issue of optimism bias can also lead to not considering many risks and missing many early warnings relevant to those risks and potential problems. According to Ansoff (1984) for a message to get to the firm, it needs to be passed through various filters from environment until it gets into the firm. These filters can make the identification of the signals either easier or even more difficult. In this section the barriers related to the filters and transferring messages from environment into the firm will be assessed.

Therefore, environmental scanning seems a very relevant topic on which there will be a focus in this section for assessing its impact on identification of the signals.

3.2.1 Definition and benefits of environmental scanning

Policymakers and practitioners usually make inappropriate decisions because of lack of sufficient evidences, while it has been seen that many of the issues that are happened suddenly could have been predicted (Sutherland & Woodroof, 2009). According to Sutherland and Woodroof (2009), routine horizon scanning would be a solution for this lack of preparation for facing with problems. Environmental scanning is about the internal communication of external information which can have effects on decision making processes (Albright, 2004). According to Choo (1999), organizations scan the environment in order to understand external forces of changes, therefore they can develop effective responses which improves their position in the future. Organization's survival is highly dependent to the nature of the environment in which they are operating. Therefore, it is very crucial for organizations to be aware of the changes in their current and future environment. That is why for those responsible for strategic planning attention to the environmental scanning and forecasting the future is very important for appropriate planning (Fahey, King, & Narayanan, 1981). According to Ansoff (1984) environmental scanning are included in the strategic management models. David (1991) claimed that environmental scanning is about, "Performing external audit to identify key opportunities and threats" and "performing internal audit to identify key strengths and weaknesses". Organizations by identifying the external forces can examine their own responses to the external challenges by considering their internal weaknesses and strengths (Albright, 2004). Åberg (1993)'s environmental scanning is also about examining the sources of information and issues, different systems of observing the signals and analyzing the environment. According to Nikander (2002) such examining of environment, besides internal events and procedures in the project, are very crucial in identification of warning signals. According to Albright (2004), as the environment is changing rapidly, new and emerging business practices are arising. If the organization is not keeping up different trends in areas such as technology and regulations, there would be a high likelihood of failure. In fact, environmental scanning reduces the chance of blind-sided decisions. In addition, it helps in identifying and addressing external competitive, social, economic and technical issues that are usually hard to be identified. After identifying those issues, responds can be planned in a timely effective manner. Therefore, by understanding the complex issues in the

environment, the focus of the organization will be given to strategic thinking and planning. Understanding the external influences and internal responses also would lead to organizational structures that are more effective in this changing environment. As the following figure indicates, all of the external categories shown in the figure can impact the organization negatively and result in poor performance (Albright, 2004).
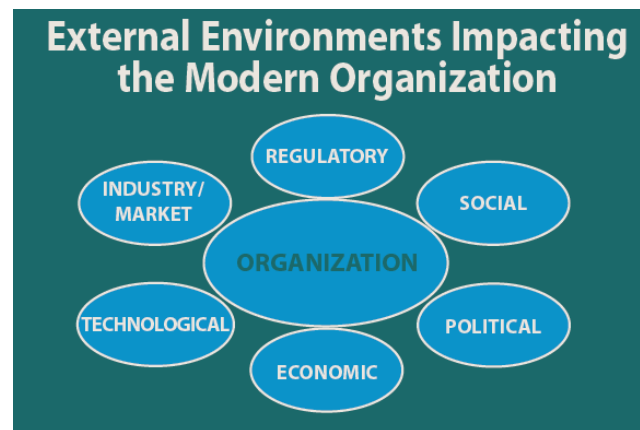
3-10. External environment impacting the modern organization(Albright, 2004)

Monitoring these external environments groups helps in adjusting the responses based on the changes in these specific factors. Environmental scanning helps in identifying those potential problems that are arising from the changes in the environment. Then plans can be considered for the unexpected changes that will affect the organization. As the figure indicates, environmental scanning will keep a watchful eye on the key competitors and their relations as a potential future problem (Industry). In addition, it can monitor changes in the technology and its effect on the business; technological changes may raise the need for new products and services (technological). Changes in the law and regulations also have important impact on the organization (regulatory). Economic information helps in being prepared for the potential changes (economic). Social changes would lead to changes in the market which itself can have effect on the organization products and services (social). Furthermore, the organization by knowing its political climate can be better prepared for sudden changes (political). So, all of these environmental groups mentioned by Albright (2004) need to be monitored and scanned by environmental scanning (Albright, 2004). So, scanning not only covers competitors, suppliers and customers, but also technology, economic conditions, political and regulatory environments, social and demographic trends (Choo, 1999). Åberg (1993) argued

environmental scanning has been used years ago by Shell for anticipating Iranian Islamic revolution before it happen.

F1: An effective environmental scanning requires scanning different sources of change in an organization, including changes in the industry, technology, economic, society, politic, and regulations. Ignoring each of these change groups may lead to missing many signals related to that kind of changes.

Both economical and non-economical factors' impact is growing in today environment and it requires instruments for recognizing the trouble factors and weaknesses earlier than other competitors in order to adjust the business activities (Reinhardt, 1984). So, introducing an effective early recognition system for identifying those business opportunities and risks is a major management task. For example, the following figure indicates different changes in a company's environment.

Growing impact of non-economic factors

New technologies

Increasing governmental influence on industry

New centres of power

Shifts in population structure

Changed motivation for work

Changed value concepts and lifestyles

⇩

Need for new management concepts

3-11. Substantial changes in the company's environment(Reinhardt, 1984)

By considering those social, political, and technological changes, managers can make decisions about how to react to those changes, whether to follow a trend, or act against it.

As Albright (2004) claimed, by environmental scanning potential threats and opportunities in an organization would be identified, the organization then can assess its own strengths and weaknesses in facing with such environment and weaknesses can be overcome. Being surprised by unforeseeable problems would be very costly, and the solution for it is the horizon scanning (Sutherland & Woodroof, 2009). According to Sutherland and Woodroof (2009) the reason for failure in responding well to the forthcoming issues is the weak decisions made by policymakers and practitioners. As addressed in the European

Environment Agency's report (2001), reducing the likelihood of facing with such unforeseeable problems would require "researching and monitoring for early warnings" and "researching out and addressing blind spots and gaps in scientific knowledge". Horizon scanning can be used for strategy making, policy making, risk management, threat identification and research prioritization (Sutherland & Woodroof, 2009).

Fahey et al. (1981), mentioned three kinds of environmental scanning; irregular, periodic and continuous. In the case of irregular scanning, the system would respond to the crises and it would not be systematic. The focus would be on short term specific problems. The organizations using this kind of system are not planned strategically. These systems fail in radically predicting future new problems and solutions. On the other hand, periodic systems are more complex and sophisticated. These systems' focus is also on problem solving but with a more proactive characteristics and keeping an eye on the near future. And finally, the continuous systems are the ideal kind of systems in planning. The focus of this system is on opportunity-finding rather than problem solving. The use of these systems would lead to strategic planning and future survival in a proactive way. These systems are usually appropriate for handling the uncertainty.

F2: An inappropriate environmental scanning would lead to not considering many future issues when making strategic decisions. Therefore practitioners would not be able to recognize warnings in future due to the inappropriate strategic decisions that had been made previously.

Today project managers need to actively observe their environment. According to Reinhardt (1984) the managers and directors spend many time for reading magazines and newspapers. Choo (1999) argued that managers who consider environment more uncertain tend to scan environment more. By environmental scanning managers can anticipate crises before they appear and therefore can make better decisions. In addition, environmental scanning leads to improvement in the learning system of an organization. In addition, it leads to development of strategic plans, policies and assessment of new information and adjustments. Therefore organizations can identify their own weaknesses and strengths in those new markets. According to Albright (2004), environmental scanning is an early warning identification system by alarming the organization about changes in the market. The ultimate goal of environmental scanning is to help organizations to learn about their external environment in order to become more flexible and responsive (Albright, 2004). According to Choo (1999), organizational scanning is a primary mode for organizational learning as by scanning the

environment constantly they can be adapted to the changes. A balanced organizational culture would encourage managers more for scanning environment and taking on a more adaptive outlook.

F3: An inappropriate organizational culture can be a reason for inappropriate environmental scanning and missing many warnings following it.

The study done by the Fahey et al. (1981) indicated that despite of recognizing importance of environmental scanning and forecasting, still corporations do not have widely developed sophisticated systems for strategic planning. According to Reinhardt (1984) a general business related observation system which observes the surrounding of a company would be able to realize the changes early enough, found their causes and their interdependencies, forecast their future state, show important deviations, forecast appropriate reactions, and so on. Therefore strategic early recognition of early warnings would be the first step in strategic planning of a company. Recognizing the early warnings early enough would results in introducing alternative strategies. Without a strategic early recognition system facing with future challenges would be more difficult. A manager who wants to beat competitors would act differently from other existing ways of thinking and behaviors. Strategic early recognition system works like radar and continuously and systematically records weak signals, therefore information would be used at earlier stages for anticipating appropriate reactions. According to Reinhardt (1984) social and political changes do not happen accidentally, they are made by peoples, are underlain by specific development mechanisms, are triggered by specific events, are pushed by precursors, and often cast their shadows ahead. Strategic early recognition of problems and systematic observation of relevant indicators would lead to saving billions of dollars because of unsystematic and useless information which cause misdirection from the real company's need.

F4: availability of a strategic early recognition system in an organization would help in identifying early warnings and lack of it would be a reason for missing many signals from the first place.

Research has indicated that environmental scanning is linked to improvement in organizational performance as organizational scanning would increase discussions about future oriented issues by people in an organization(Choo, 1999).

F5: lack of environmental scanning in organizations would be a reason for lack of discussions about future oriented issues and possible problems and therefore missing many signals related to each of those potential future problems.

3.2.2 Steps for environmental scanning and its state of art

As Åberg (1993) claimed, scanning the environment has 6 different levels, including recognizing the relevant signals internally or externally, considering a monitoring system, interpreting the signals, making recommendations and responses if are necessary, implementing the responses and supervising the solutions. According to Sutherland and Woodroof (2009), horizon scanning consist of steps such as scoping the issue, gathering required information, spotting signals, assessing trends, anticipating the future, agreement upon responses. The process of environmental scanning according to Albright (2004) is as following:

- The overall purpose of the scanning should be clarified and the participants should discuss the potential changes based on their own tacit knowledge and experience.
- Then a list of questions can help in gathering relevant information and knowing which areas should be focused on for scanning.
- After gathering that information, the information would be analyzed in order to find any trend. This step would be repeated if new questions arise.
- After analyzing the trends and addressing potential future problems that may arise, the information would be communicated in the organization. This information would have effect on decision making. Those reports which provide timely and required information for the managers in decision making can save a lot of their time.
- After presenting the environmental scanning activities, an appropriate leadership can start communicating the potential changes and responses into the organization.

Choo (1999), suggested four modes of environmental scanning; including unpredicted viewing, conditioned viewing, informal search and formal search modes. In "unpredicted viewing", the scanner has no specific information need in mind, so he/she just scan environment broadly in order to detect signals early enough. In the "conditional viewing", the scanner searches for specific information and topics, the purpose of this scanning mode would be evaluating specific information and its effect on the organization, if the impact of the issue is assessed as to be significant, the scanning mode would be changed to searching. In the

"informal search" the scanners look at the information for understanding a specific issue, the effort would be limited and unstructured; the purpose would be assessing the need for any action, if there is a need then the scanner spends more time to the search. During the "formal mode", the scanner uses a plan for obtaining information about a specific issue. The goal would be gathering information about a specific issue and then taking actions toward it. According to the author (1999) Environmental scanning in order to be effective need to consider and use all of the modes of scanning and searching. Unpredicted viewing gives a holistic view about different issues and let the scanner to think outside the box. Conditional viewing provides the organization with early warnings about the emerging issues by tracking the trends. Informal mode helped the organization to identify its main features and assess their potential impacts. And finally formal modes enable an organization to make intelligent decisions. According to the author the use of these different modes of scanning lead to a shift from novelty and variety of information, secondary sources, many to many communication, and the informal World Wide Web to more accurate information, primary sources, one to one communication, and structured databases.

F6: an environmental scanning with focus only on some specific issues may lead to missing many issues related to other dimensions of the organization.

According to Choo (1999) scanning should be managed as a strategic activity, according to him successful scanning needs times around 3-5 years to develop its knowledge. The scanning system need to be a formal system which is planned, sustained and coordinated. The continuous monitoring leads to detecting the deviations from the norm and plan and then identifying early warning signs. Three kinds of experts are usually needed for environmental scanning. "Domain experts" who have knowledge about the business and guide actions and decisions or collect and analyze the information, "Information experts" who organize information into useful sources and add value to the information, and finally the "IT experts" who simplify the share of information. It has been noted that scanning information management consists of different interrelated processes, including identifying the information need, obtaining the information, organizing and sorting them, developing information products or services and sharing those information and using them.

Since environmental scanning is a formal and planned activity it should be flexible enough and provide space and freedom for participants to challenge assumptions.

F7: lack of experts in the process of environmental scanning would be a barrier in identification of early warning signs.

3.2.3 Barriers of effective scanning

Managers prefer to be presented information in person rather than reading that information, because they just want to receive the necessary and relevant information. This may lead to missing many relevant warnings. In addition, high volume of information may be a reason for inefficient environmental scanning. The huge amount of information may cause important information to be overlooked or be lost easily. In addition, the scanner may not be aware of much important sources of information that may lead to many potential future problems. Also, the market is rapidly changing and the information which was gathered before may not be usable anymore. Another barrier can be the interpretation of the information that has been gathered. Issues such as relevancy of the information, familiarity with the topic and information sources, the language has been used, the limitation of time, and the degree of the information accuracy all have effect on the analysis process of the environmental scanning. It also has been noted that over emphasis on the environmental scanning can be negative as it may lead to a lot of focus on external factors and being distracted from improvement processes in an organization (Albright, 2004).

F8: Managers tendency for hearing information rather than reading them may lead to missing many details and some signals that are not mentioned orally.

F9: gathering huge amount of information when doing environmental scanning can be a reason for overlooking some signals and missing attention to other important ones.

F10: if the scanner is not aware of many sources of information, consequently many signals would be missed.

F11: looking for pre-defined signals and those signals which were identified at the beginnings and forgetting the need for updating the list of probable signals can be other reason for missing many new signals that were not defined previously.

F12: internally, overemphasize on environmental scanning for identification of external signals can be a barrier for identification of signals related to internal processes of an organization.

The company's own staffs are the best factors for building up early recognition systems of signals. If the risks and threats are recognized early enough actions can be implemented more efficiently. According to Reinhardt (1984) environmental monitoring today is largely individual and is directed by persons specific interests. According to the author and as

indicated in the following figure 80% of the suitable staffs, monitor only 30% of the most important indicators.
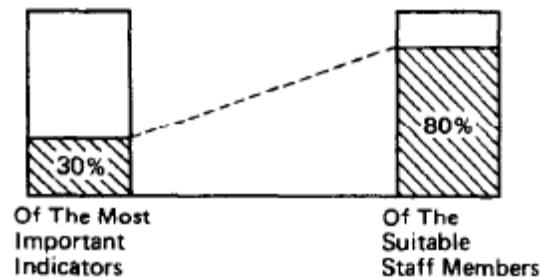
3-12. 80% of staff monitoring 30% of indicators (Reinhardt, 1984)

Analyzing sources of information in a company including the newspapers, magazines, reports and so on indicates that the focus on personnel is mostly on short-term and the areas of their own personal interest. In addition, the high amount of information forces the reader to just go through the most important headlines. And usually there is no classification of information in companies. It may lead to loosing many news through individual files and therefore for the company (Reinhardt, 1984).

F13: focus only of short term and those signals more familiar for the observers and employees can be a barrier of identification many other signals.

Other reason for losing the information is the hierarchies in which the information should be passed. Sometimes the information does not reach to the right person because of individual issues. So, managers are not informed or are informed too late. Therefore the important decisions are made without consideration of those strategic issues (Reinhardt, 1984).

F14: hierarchies in organizational structures and the need for passing information through many channels can be a barrier for access to the correct information at the right time.

The radar team observes and assesses different indicators; they just get information which is important for the company's strategy. If the weak signals become stronger they inform management about it. As the figure indicates some specific information such as marketing can be collected by a marketing radar system and then it would be transferred to the central radar unit. Sometimes firms just delegate the responsibility of gathering industry specific information to other companies in other market, although assessing the data would be the

responsibility of the company itself. It would save them a lot of their time for making other important decisions (Reinhardt, 1984).
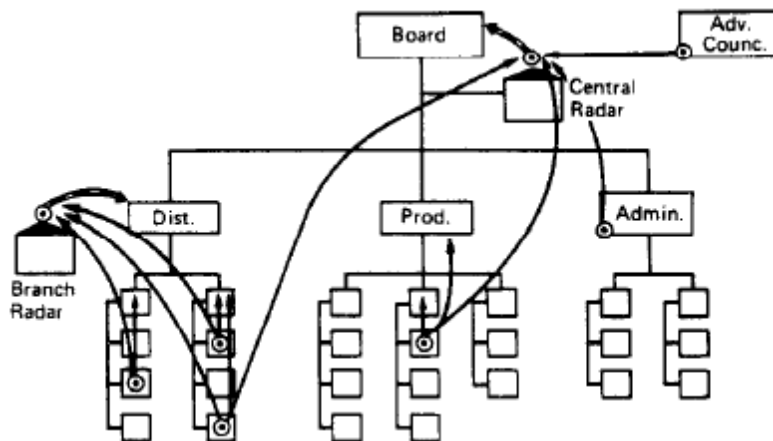
3-13. Different radar systems(Reinhardt, 1984)

Setting up additional branch radars would lead to making the central radar focused on general targets, rather than being swamped with lots of information. As the figure indicates different departments have different radar systems which are informing the central radar. It had been seen that do-it-yourself and unprofessional methods can block the recognition of early warning signs. It requires close cooperation with experienced consultants. An external consultant can avoid mistakes and reduce resistance; these external viewers can guarantee successful implementation of early recognition systems (Reinhardt, 1984).

F15: *lack of radar systems for different departments which are linked to the central radar system in an organization may lead to huge amount of unfiltered signals in the central radar system of the firm and being swamped and finally missing many important signals.*

3.2.4   Filters of environmental scanning

Igor Ansoff was one of the pioneers in considering the effect of projects' complexity and dynamic situation of the environments in projects' outcomes. As Ansoff claimed, strategic behavior is the way of interacting with environment (Ilmola & Kuusi, 2006). By facing with more complex environments, the available time for reacting to the changes are becoming shorter and the organization becomes more complex, therefore in order to be responsive to the changes the organizations require to scan environment frequently for possible changes

(Ansoff, 1980) . The scanning system consciously or unconsciously contains many filters. In order to accept the signals passing through the filters, organizations use their mental models in evaluating the signals (Ilmola & Kuusi, 2006).

To achieve and sustain competitive advantage, companies in the environments with turbulent situation has to scan the environment for capturing weak signals of early opportunities (Seely Brown, 2004). In order to be able making decisions pro-actively, companies should use the early information into their strategic plans and utilize the dynamics of their operating environment (Ilmola & Kuusi, 2006). According to Ilmola and Kuusi (2006) methods of environmental monitoring may cause some weak signals to be taken into account or be filtered out, depending on the vision statement of an organization.

According to Ansoff (1984) for a message to get to the firm, it needs to be passed through various filters from environment until it gets into the firm and the relevant person. These filters can make the identification of the signals either easier or even more difficult. Ansoff (1984) introduced three kinds of filters: surveillance filter, mentality filter and power filter. Following figure indicates different filters mentioned by him.
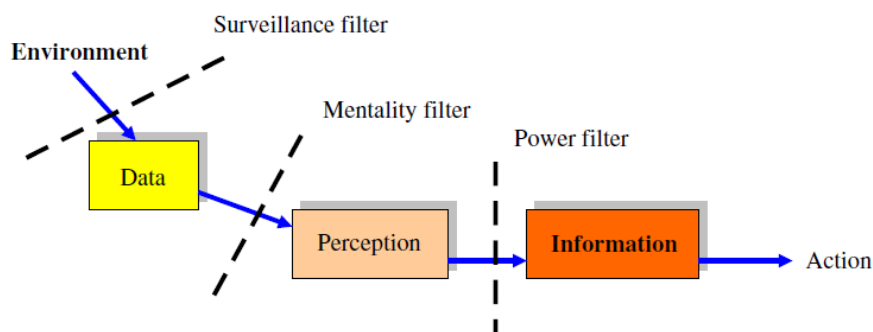
3-14. Different filters (Ansoff, 1984)

The first filter (surveillance) helps the organization to choose which kind of information they need, and which techniques they should use in order to collect that information. According to him there are some limitations in gathering information and also it requires experts for identifying the signals. The second filter, as is indicated in the figure, is Mentality filter which depends on sociological and psychological issues such as optimism bias and mentality model of reality. In this stage the receiver would evaluate all of the signals and decides upon the signals that should be passed across the filter and those which should be excluded because of their irrelevancy, being unrealistic or unnecessary. And finally the last filter is the Power filter

which determines which signals are allowed to have effect on decision making based on the political limitations of the firm.

In using filters, the mental models are used in order to assess the data which should be passed through the filters. According to Ilmola and Kuusi (2006) "Mental model are the cognitive knowledge structure that management is using in decision making when they are making sense of their environment". These mental models have a huge effect on processing information. There is a few researches done on the weak signals and filtering processes (Ilmola & Kuusi, 2006).

F16: mentality model of observers who are filtering signals has a huge impact on identification and consideration of many signals and letting the important signals to be passed through different filters and to be reached to decision makers.

According to Anderson (1999), a system which is on the edge of chaos is more flexible for being adjusted to the changes. Organizations as open and social systems are in direct relationship with the environment and the information from outside when are imported into the system may cause disorder, therefore filters of environmental scanning play a primary role in adjusting this situation (Ilmola & Kuusi, 2006). In order to control weak signals capturing in an organization, understanding the current mental models in an organization would be very helpful (Ericson, 2001). Then environment is very complex and it is the responsibility of managers to reduce the degree of complexity by just accepting those effective and relevant signals (Ilmola & Kuusi, 2006).

In order to accept signals through filters there are two kinds of factors related to filters: the depth of the filter and the width of it. According to the author, the width of the filter is about being open to different types of signals and ideas, while the depth of it makes a more detailed analysis of a limited types of signals and ideas (Ilmola & Kuusi, 2006). A wide filter may provide a large range of signals into account by the person or organization, it may also lead to considering irrelevant signals or noises, this may cause many problems related to information overflow. The width of filter means that the mentality filter provides large variety of signals for the actor. This mentality model may cause many important signals to not be considered and discussed in details. The depth of a filter also focuses the attention of the actor to those signals that making sense. The limitations in accepting signals requires that this filters consider those signals which contain the most important and relevant information for the organization. Considering the depth and width of filters in organizations are very important in

order to make explicit organizational strategy processes more efficient (Ilmola & Kuusi, 2006).

A study done by Ilmola and Kuusi (2006) indicated that a deep and narrow filter provides better focused and predictable outputs while a flat and wide filter provide diverse issues emerging from different sources. An open perception in filtering results in more number of diverse signals, while not all of them are relevant. According to Ansoff (1984), if an organization is operating in a complex environment in which flexibility is very crucial, an open scanning system would be more appropriate for capturing potential discontinuities. This open scanning method provides data for proactive decision making and creation of competitive advantage. On the other hand, when the organization is operating in a stable environment, the filter with deep focus creates a reactive and focused action and increases the organization's efficiency.
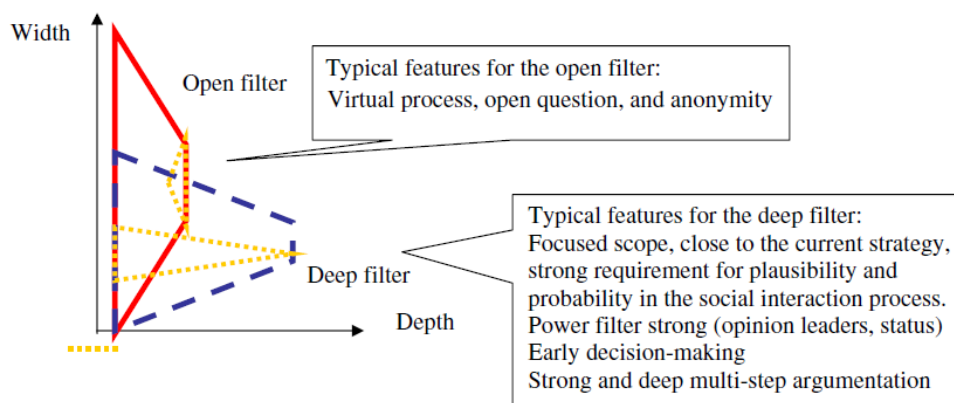
3-15. Wide and deep filters(Ilmola & Kuusi, 2006)

F17: Use of wrong type of filters which are not suitable and fit for a specific environment can be another barrier in identification of early warning signs. Changeable environments require wide filters which take into account larger number of signals. On the other hand, stable environments need deep filters focusing only on most important known issues.

3.2.5 Communication barriers

People need to exchange their information and knowledge with each other; this exchange of knowledge is called communication (Blankevoort, 1984). According to Blankevoort (1984), a project is a set of related activities with the aim of achieving a specific goal by many specialists, and its success depends on effective communication among those specialists. According to him, although communication of data and information in project management is very essential, it is usually neglected. The author gave the following definition of project:

"A project is a set of interrelated activities all necessary to accomplish predefined goals within certain situation at a given time and another defined situation at a time in the future. Therefore a project is a process of change."

Considering this definition, the need for the change arises if the future goal is communicated, it requires the presence of someone else and communication among those people who are supporting the change (Blankevoort, 1984).

According to Saunders and Stewart (1990) people's communication depends on their five senses, intelligence and commonsense. Optimizing communication depends on human responses. The more complex a project, the more partitions are involved because of more number of specialists, therefore communication become more difficult and complex and optimizing the communication would become more difficult.

F18: the issue of project complexity would lead to more difficulties in communication among participants. Complexity in communication can be a barrier in identification of early warning signs.

According to Wiio (1989) there are some barriers for effective communication which have effects on identification of early warning signs and methods used for this purpose such as environmental scanning. Wiio (1989) discussed about four groups of disturbances in communication; including barriers, loss, distortion and noise. The communication barriers can be issues such as "the message goes to the wrong address", "the message gets lost on the way", "the message doesn't get noticed", "the message is delayed", and "the participants are lacking communication skills". The communication loss is divided into two groups of "disappearance of the message" and "rejection". Disappearance can be the result of failing to perceive the message or sudden disappearance of the information from the internal system. Rejection also can be caused by individual rejection factors, for example perceiving the message as useless; these may lead to rejecting those messages that are not felt comfortable

by the receiver. Or even the overload of information may cause rejections, or even when our expectation is different from the information, it may also leads to rejection of the message. Sometimes the rejection is caused by the group; the group may not accept the message. In addition, technical problems can be other reason for missing or rejecting the message, the message may have been sent through the wrong channels. Distortion also may be caused by misunderstanding or misinterpretation of the message, because of different reasons. The receiver might not be capable of communicating, the message might be ambiguous in nature, the sender and the receiver may have different understandings of the message, also the message may be changed and altered when it is being transformed. Communication noise is also the result of getting buried the significant parts of information into the mass of irrelevant information, because channels contain noise, other messages, random disturbances and many other issues (Wiio, 1989).

F19: all of the barriers of effective communication such as noise in communication can be also barriers for effective identification of early warning signs.

Other authors also have discussed the barriers of effective communication as following:

According to Saunders and Stewart (1990) there might be two kind of barriers for effective communication, including technical and psychological. Technical barriers occur for different reasons such as load of information, lack of a logical structure, and so on. In addition, noise from different sources may cause problem in effective communication, it may lead to loss of information. So, the information does not arrive to the receiver or it does not mean the same for the sender and receiver, therefore the communication would not be effective. A communication would be effective when the message is received and understood correctly. According to the author there are also some psychological barriers for effective communication such as "disliking the sender", differences in education, Lack of credibility, lack of respecting sender, defensiveness, the feeling of being controlled by the sender and the receiver listens but she/he hears what she/he wants to hear. Therefore, factors such as differentiation on culture, education, training, language and so on, cause people to gain different impressions from the same thing. According to Saunders and Stewart (1990) unnecessary communication is a source of waste, therefore structuring and organizing communication helps in ensuring that all transactions are meaningful and communication is purposeful. It has been seen that communication only happen when there is a problem, while by then it is too late, communication should be done at all the time not only if there is a problem.

Blankevoort (1984) also talked about the problem of different perceptions of the same thing. He mentioned that one of the barriers of effective communication among two people can be the different perceptions of environment by them, as figure 3-16 shows:
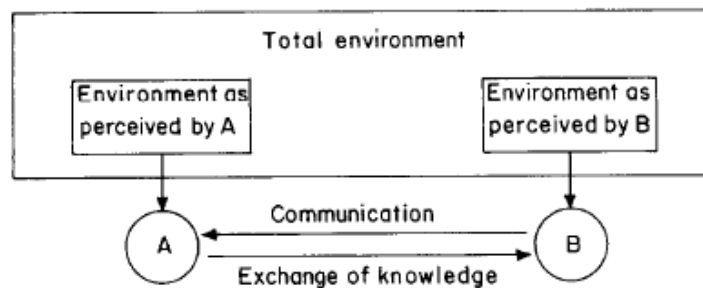
3-16. Different perceptions when communicating(Blankevoort, 1984)

For the same data, the perception of A is different from the perception of B when communicating.

F20: when communicating early warnings, different perceptions of senders and receivers about the issue might be a barrier for identification and consideration of early warning signals.

Discussing a problem requires an agreement upon the meaning of a problem. According to Kepner and Tregoe (1976), communication problem is the difference among what has been perceived by one person and what was expected or wanted to be happen by the same person. The difference between actual and expected situation is a problem (Blankevoort, 1984). According to Blankevoort (1984), the more complex a system the more attention is required to be given to communication. There are three kinds of errors which may endanger a communication, such as the error in sender, the error in the process and between sender and receiver and the error in the receiver (Blankevoort, 1984). According to the authors (1984), there are some perception problems such as different looks at starting situation of a project, specialists see things that its perception is not easy for ordinary people, or too much attention to a particular hobby by the specialist may cause them to not understand other facts perceived by others. Following figure (3-17) indicates how things can be perceived differently and cause error in messages.
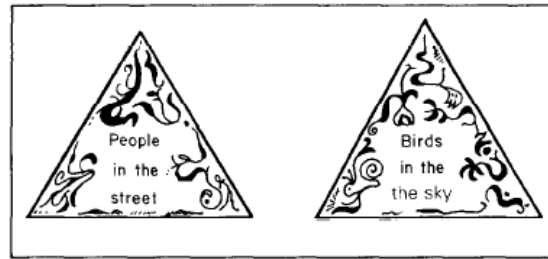
3-17. Different perceptions of a message(Blankevoort, 1984)

If there are two persons in the process control, one executing the job and one supervising it, in this case the likelihood of different perceptions would arise. According to Blankevoort (1984) communication among people is a very complex process and many things may go wrong.

F21: it is possible that those who are responsible for taking actions toward early warnings are different from those who are observing signals. Therefore, the signals would be easily ignored if those responsible for implementing actions do not perceive signals as important as observer's perception.

As the following figure (3-18) indicates when a sender transfers a message to receiver, the message might be changed or blocked in the transmission path.
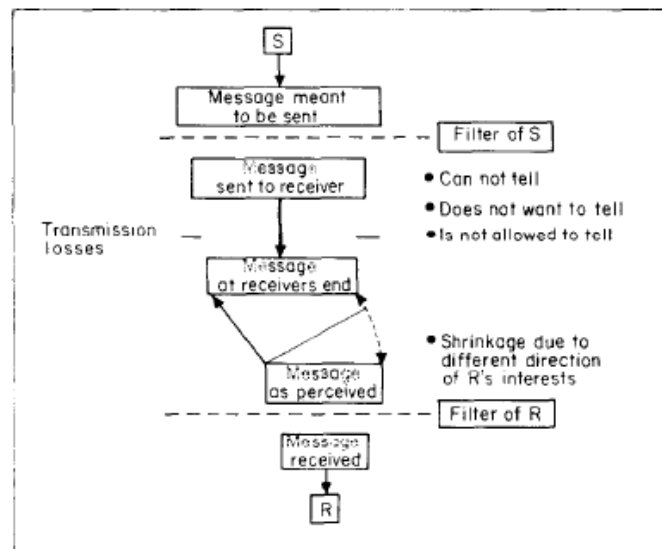
3-18. Change in message when passing through different filters(Blankevoort, 1984)

The sender (S) cannot or does not want to tell everything to the Receiver(R), therefore the message would be filtered. The message also would be perceived differently by the Receiver.

In addition, people usually communicate by making sounds or visually, and smells and touches are not used most often. Learning different meaning of different signals before communicating them is required otherwise different people would perceive the same signals completely different. In addition, it is possible to have different signals for the same meaning. It requires understanding other person's language (Blankevoort, 1984).

F22: lack of a standard language for communicating early warnings can be a reason for missing signals or not perceiving them correctly.

Sometimes management make a picture of future by some symbols which are not appropriate for their real meanings, these inappropriate symbols will misdirect subordinates in achieving the goal. So, the problem arises by symbols inappropriate to painting the future situation (Blankevoort, 1984)

Communication is possible if both the sender and the receiver know the meaning of the sent and received signals and it requires a common language. If people speak different languages they must exchange their language dictionary in order to prevent misunderstandings. Lack of standards for terms, symbols and glossaries may lead to inappropriate communication. Therefore, mutual agreements are needed for supporting communication among people projecting the future.

F23: defining and introducing symbols and signals which are not appropriate for those assigned problems and issues can misdirect project members from many signals.

One of the gaps which have important effect on project management is the language gap related to the meaning of systems information. If the user of a system is not informed about the system, effective actions would be unlikely. In addition, if the system provides too much information, being sunk in the information would also be a reason for not implementing sufficient action. Therefor when designing a system, it should be taken into account that there are varying qualities of humans and the information coming out of the systems need to be adapted to the users (Blankevoort, 1984).

There is a growing gap between the way of looking at the world between the system designer and the system user. The person who creates a system has different personality of those who are using the system. Therefore the system may not fulfill the need of users. There are three kinds of communication: between machines (A), between people and machines (B), and between people (C). The degree of complexity also increases from A to C.

People ⟷ Machine ⟷ People

3-19. People communicating through a machine(Blankevoort, 1984)

Difficulty increases as a machine comes between two people and influences their communications. If those people do not know each other, chaos in communication may arise, but if they are close friends a livable situation comes about. One of the properties of information system which worsen things is that the concept or idea behind it is not clear to anyone. People on both sides using the information system may think differently about the goal of the system. They may understand the real purpose of the designed system when it is too late and the system is completely abandoned and the system falls to pieces. Therefore the possible gap between the information system effective actions can be the lack of communication among people and lack of knowledge about what peoples really require. If adapting people to machine does not work, what is needed would be adapting people to people (Blankevoort, 1984).

F24: if those who designed the system for identification of early warnings have different perception from those who are using the system, then many signals might be missed.

Diallo and Thuillier (2005) also noted the importance of trust building among team members for effective communication and cooperation. Team members of a project when just attend the project team, they have many concerns. Trust, communication and cooperation among the team members are not taken for granted at the beginning of the team. Without trust and effective communication a team cannot achieve its goal effectively (Diallo & Thuillier, 2005).

Considerable damage would be the result of lack of an accepted level of trust among the managers and coordinators (Diallo & Thuillier, 2005).

F25: lack of trust among team members at the beginning of shaping the team can be a barrier for effective communication of early warning signs and therefore missing many of the signals.

In order to solve the problem of inappropriate communication authors have suggested many methods. An appropriate system of data would be very helpful. The system would put together all of the data and give the opportunity to the sender to assess the perception of the receiver through receiving feedbacks. Making a plan for what is going to be achieved in future is one of the most efficient ways. An effective action is a planned action, aiming at a future situation and is predetermined (Blankevoort, 1984). The task would be facilitated by having people who are observing the environment continuously. The use of information and

communication supporting systems are also helpful for effective communication. People need to be trained for the use of the system and implementing changes when requires. Systems might have some functionality that is not used by people because they do not know how to use them. They also need to learn how they have to communicate the data with each other. In order to prevent the problem of misunderstanding and different languages in communication, providing international standards of terms, symbols and glossaries for project management can be very effective (Blankevoort, 1984). According to Saunders and Stewart (1990) some detailed measures can help in improving communication in organizations such as documentation, distribution, meetings, reports, information exchange, and structures. As communication is very necessary for project success it requires as much thought and planning as the technology requires. What is required is that the necessary communication is transmitted and understood mutually and understanding the communication failure is important in problems identification.

F26: lack of plans for communicating early warnings and lack of training for using communication systems can be barriers for effective communication of early warnings.

Building trust among team members speeds up negotiation and cuts transaction costs. In addition, cooperation among team members would facilitate achieving goals, therefore both trust and cooperation are require for appropriate working relations. A minimum of trust is needed as communication would not be fair if information exchange is clouded with some doubts over motives (Diallo & Thuillier, 2005). According to Diallo and Thuillier (2005) communication, trust and autonomy are interchangeable, correlated and would strengthen each other. He also claimed that trust and autonomy among two persons develops by effective communication in time. Effective communication among the coordinator and the manager also depends on the trust among them. According to the author the quality of communication among team members and supervisors does not appear to be very significant, while the trust which is shaped among them is very crucial and the project profile depends on the trust among those actors. Finally, cohesion among the team members would be a soft factor that contributes in the success of a project.

To sum up this topic, according to literature, communication involves many barriers and those problems in effective communication may endanger project success. Therefore it can be inked to the barriers of identification of early warning signs. In the case of inappropriate communication, many warnings might be hindered for different reasons as mentioned. This topic would be discussed through the discussion section.

3.2.6 Optimism bias

Optimism is about the tendency of being unrealistically optimistic when are judging the degree of probable risks involved in different events and situations (DeJoy, 1989). For example, confidence in ones owns driving skills have been a subject for years (Mynttinen et al., 2009). According to Caponecchia (2010), "optimism bias is the tendency to think that negative events are less likely to happen to oneself than to one's peers". According to Weinstein (1980), optimism bias is defined as the tendency to think that there is a more likelihood of experiencing positive events than negative ones. Also, Lipkus, Martz, Panter, Drigotas, and Feaganes (1993) claimed that optimists are individuals who consider themselves less likely to experience negative events and are more likely to come into positive outcomes, these optimists are reporting greater likelihood of positive outcomes compared to others who are less optimists. Optimism bias is relevant to this thesis topic as it has effect on whether taking actions to protect themselves from harm or not. Due to optimism bias, people usually fail to consider probable events, follow safety procedures, and use appropriate methods and protective tools and so on. So, optimism bias is very important as it has effect on how people perceive risks at the organization. If people believe that the negative event will not happen to them, their contribution in improving safety would be undermined. According to Costa-Font, Mossialos, and Rudisill (2009), individuals care about the risks, but those risks are more likely to occur for others. Svenson (1981) Studied about the importance of people's self-image on their own risk taking behavior and their readiness for finding information about risk and safety applicable to themselves. According to him majority of drivers consider themselves as more skillful drivers than other drivers. Their study indicated that there is a strong tendency among drivers to see themselves as safer and more skillful than average drivers, in other words, majority of people consider themselves as safer. A study done by Dunning, Heath, and Suls (2004) indicated that when people comprise their own skills with others, they usually overestimate their own skills. There are many reasons for optimists to perceive themselves as those who are experiencing positive outcomes more than negative outcomes. According to Lipkus et al. (1993), optimists who are supposed to have favorable outcomes are expected to make decisions quicker than others, it may have effect on their decisions. For example, making predictions in one week will have different accuracy of those who predict future in one month (Lipkus et al., 1993). Lipkus et al. (1993)'s study showed that positive events happened for pessimists more than optimists. Also Lipkus et al. (1993)'s study resulted that the effect of optimism is differed as a function of both time and event

valence. In fact, people believe that in a shorter time negative events are less likely to happen to them in comparison with longer period of time. According to DeJoy (1989) people excessively and unrealistically are optimistic when are judging their own driving skills and their potential accident risks. DeJoy (1989) claimed that the degree a person perceives potential risks, has effect on protecting himself/herself against hazards. In other words, according to Rosenstock (1974), individual's subjective estimation of risk is more important among people than objective facts toward the hazards. Most of drivers consider themselves safer, more skilled, and less probable of facing with accidents in comparison with the average drivers (Svenson, 1981). Optimism is about the tendency of people of being unrealistically optimistic when they are judging the degree of probable risks involved in different events and situations (DeJoy, 1989). According to DeJoy (1989) those motorist who perceived themselves as more skillful, safer and less likely to have traffic accidents, were more optimism. He also claimed that excessive optimism would decrease the probability of appropriate anticipatory avoidance responses. People tend to think that they are invulnerable to the dangerous life events; they believe that misfortunes would only happen to others, not themselves. If all of the people claim that their chance of experiencing negative events are less than others, a systematic error is happening, and this would indicate the existence of optimism bias (Weinstein, 1980). Various researches have indicated that people are unrealistically optimistic about future.

F27: the issue of optimism bias also is one of the barriers of identifying many related signals. If those who are scanning environment are optimistic, they may not see many signals as important as those who are pessimistic.

The more undesirable the event, the stronger people believe that it will not happen to them, and the more desirable the event, the more they believe that there is high likelihood for them to face with that event. In addition, The greater the perceived probability of an event, the more people believes that it will not happen to them in comparison with average people (Weinstein, 1980). People usually think about those actions that facilitate goal achievement, not those that impede it, because usually those actions for achieving desired outcomes are easier for being achieved. In other words, the more undesirable the outcome, the less people believe that it may happen to them. In addition, when a stereotype exist of a particular kind of person, people less believe that it may happen to them as well. According to Svenson, Fischhoff, and MacGregor (1985), the use of seatbelts by drivers is highly related to their perceive of it as a mean of safety. According to the author advertising about the advantages of using seatbelts

may not be that much effective, as people usually consider it comfortless. According to Svenson et al. (1985), optimism can affect safety and strategic safety decisions, drivers who consider themselves invulnerable to dangers may feel that society is investing too much in safety. Svenson et al. (1985) argued that drivers are optimistic about their driving skills and their years of experience regardless of whether the experience involved any accident. In addition, drivers' optimism increases with the time in the road. So, the Svenson et al. (1985) expects that more optimistic drivers use less seatbelts as they are optimistic to the future problems and accidents.

F28: professional people responsible for identification of early warnings are usually more optimistic than others. It can be a reason for not seeing many signals.

As the perception of control is highly linked with favorable predictions, optimists believe that their outcomes is under personal control rather than external control, so they expect positive outputs (Scheier & Carver, 1985). Optimism arises because people overestimate their own control over events (DeJoy, 1989; Weinstein, 1980). DeJoy (1989)'s study also indicated that individuals are less optimistic when they are judging events on which they have less control. If the event is considered as controllable, people believe that they can control it and increase its likelihood of desirable outcomes (Lichtenstein, Slovic, Fischhoff, Layman, & Combs, 1978). The study done by DeJoy (1989) indicated that the college students were highly optimistic when evaluating their risk of being involved in variety of accidents, and they perceive accidents as being controllable.

F29: the thought that everything is under control may cause people to ignore external effect on events and therefore missing many signals related to those issues out of their control.

In addition, a study done by Preston and Harris (1965) represents that peoples have difficulties in learning from experiences. According to the study, majority of peoples with very serious accidents in their background still have frequency of traffic violations. In addition, according to DeJoy (1989) lack of experience with a specific threat might increase the probability of optimism, or people might be very optimism to highly improbable events. In addition, according to the author optimism may happen when people have a kind of stereotypic view about others who cannot tolerate a specific threat and particularly perceive themselves as not fitting this image. In other words, according to DeJoy (1989), lack of experience and the existence of vivid stereotypes would contribute in being optimistic. According to Tversky and Kahneman (1973), optimists may create a history of success and if they are asked about their chances of success, they may just trust to the positive history and

forget about the possible negative issues. Optimists usually make more positive wishful thinking; they use their successful history for solving problems and consider less negative occurrences (Lipkus et al., 1993).

F30: optimists by creating a history of success and forgetting negative experiences that they had previously are more exposed to not see negative signals that had been appeared previously.

A study done by Lipkus et al. (1993) indicated that woman who were highly pessimistic expected greater positive events to happen to them in comparison with others. The older and the more experience are the drivers the more optimism they are about their driving skills (DeJoy, 1989). It has been shown that new drivers considered themselves as poorer than average drivers, while after one year they started to perceive themselves as better than the average drivers. According to Matthews and Moran (1986), older drivers are less likely to perceive themselves as better in driving and above their peers in comparison with young drivers. Finn and Bragg (1986), argued that young drivers tend to consider less risks into account than older drivers. In addition, it had been proved that as young drivers acquire perceptual-motor skills, they feel more confident about their skills. According to Svenson et al. (1985), culture and age differences has effect on the degree of optimism among peoples.

So, it is very important everyone can perceive his/her own accurate driving competence, in order to adapting his/her own behavior to what is demanded for improving safety (Dunning et al., 2004). Mynttinen et al. (2009)'s study and assessments of novice drivers perception of their own driving skills, indicated that although in Finland drivers did a correct estimation of their own skills, in Sweden majority of the novice drivers were overestimated their skills and were unrealistically confident. The differences between their own self assessments of the drivers from those two countries had been because in training Finish drivers there are more self-assessment practices, that is why they gave better estimations of their own performance in comparison with Swedish drivers. In Finland the self-assessment has been a part of driving licensing process (Dunning et al., 2004). So, according to DeJoy (1989) it is very important to implement assessments in order to make drivers aware of the fact that they do not have full control over environmental factors that is threatening drivers. Young drivers need to become aware of their perceived and actual level of driving skills and it needs special attention for providing them with more realistic appraisals of their perceived vulnerability. To sum up, it has been seen that young drivers do not believe that these risks apply to them personally. The

complementary strategy for increasing the push to wear seatbelts is reducing sources of resistance. There is a need for increasing the convenience of belt use (Svenson et al., 1985).

F31: lack of self-assessment by those responsible for recognizing early warnings, can be a reason for not being aware of those factors which are out of their control and consequently missing many signals related to those uncontrollable issues.

A literature review through available materials about environmental scanning and other relevant keywords indicated that environmental scanning is very crucial in identification or missing early warning signals. According to the literature it was obvious that a good environmental scanning requires consideration of all of the sources of change in an organization. Scanners need to be aware of all of the possible sources; otherwise many signals would be missed and ignored. A complete environmental scanning would increase the probability of discussion about early warnings signals at the early stages of projects. Therefore, decision makers can consider possible future discontinuities into account when making decisions. According to the literature, both filtering too narrow or too wide can be a reason for missing many early warning signals. Too wide filters may lead to large amount of information which would hinder the most important ones. On the other hand, too narrow filter would lead to not considering some signals at all. In addition, those signals which are written down initially need to be updated continuously; otherwise the list which is not updated would misdirect people. Too much focus on environmental scanning can also be dangerous as it would misdirect people from paying attention to internal technical issues. Furthermore, as noted, issues related to filtering and communicating, and too many hierarchies can be a reason for change in the meaning of signals when passing through different filters. Optimism bias among scanners and decision makers also can mentally lead to not being cautious about possible future problems. This would lead to missing many signals related to those underestimated issues.

3.3 Project Governance

In this section the importance of project governance is going to be examined through literature. It has been seen that in complex projects most of the problems are the result of ill-defined projects' start-up and many problems ahead could had been prevented with well-defined governance. In other words, root of many problems has been lack of appropriate project governance. A proper and good project governance will results in a preventive risk allocation strategy and better project performance and finally project success. Therefore governance seems very crucial in identifying early warning signals. So, in this section a literature about this topic has been given in order to enable examining its relation to barriers of identifying early warning signals in next chapters. At first an overview of governance theory and its definition has been given which is followed by challenges involved in project governance, cause and effect relations, governance state of art, and defining critical success factors in governance through literature. Whenever a relevancy was felt to the barriers of identifying early warnings signs, the author wrote down findings.

"We know why projects fail, we know how to prevent their failure, but why do they still fail? (Too & Weaver, 2013). According to Too and Weaver (2013), system project failure is a result of organizational governance failure.

Projects' failure is not only because of inappropriate project management, but also because the governance of the project and its application is poorly developed, not integrated into the larger governance of the firm, and therefore is damaging (Lester, 2014). Not only a project manager is important for affecting successful delivery of a project, but also the organizational structure is critical, a structure which considers stakeholders, clarifies reporting structure and authorities, defines responsibilities of project team and so on (Patel & Robinson, 2010). A study done by Patel and Robinson (2010) indicated that poor delivery of early milestones in a complex project under their study was the result of ill-defined project start-up, inadequate resources at the front-end, lack of an accountable person for the scheme, irrelevant experience of team members, and lack of strong communication between stakeholders. In their project absence of critical decision makers at the early phases was an early warning sign which led to spending more time for making decisions. Some difficulties in the project could have been avoided with good governance which could alert team members about dangers ahead much earlier. This could lead to setting appropriate contingency actions in place. This study done by Patel and Robinson (2010) indicated that success in projects is highly dependent on adequate governance structure. A project with no single sponsor or governor is highly vulnerable to

risks. Proper project governance will be followed by clear leaderships, better decisions makings, and speed up processes in project delivery, and finally project success. Such a governance requires organizational structure, policies and frameworks such as risk management tools and an appropriate training for using those tools (Patel & Robinson, 2010). According to T. Ahola, Ruuska, Artto, and Kujala (2013), today's project-base firms are involved with several projects at the same time, and need to deal with many portfolio challenges related to resource allocation, prioritization, ensuring proper project managers following the goals, and so on. Sanderson (2012) claimed that main problems in performance are the result of misaligned governance mechanisms which leads to not being able to make quick decisions and be responsive when facing with turbulence environments.

3.3.1 Definition

Although there is a lack of universally accepted definition of project governance (T. Ahola et al., 2013), following some definitions of governance from different literature are given. According to Storey et al. (2008), governing means steering, ruling with authority, regulating, directing, and controlling. In organizational context, governance provides a framework for making decisions and taking managerial actions (Too & Weaver, 2013). An effective governance enhances the possibility of alignment of the organizational portfolio to the organizations objectives, the efficiently delivery of projects and their sustainability. Cooke-Davies (2002) defined project governance as a set of principles for conducting and managing individual projects, programs or project portfolios. Miller and Hobbs (2005), also argued that for large projects a project governance which adapts to the specific characteristics of the project is a requirement, and without such requirement the probability of facing with severe problems increases. In addition, Abednego and Ogunlana (2006) defined governance as a process for making and implementing decisions. Artto and Kujala (2008), claimed that projects are dynamic and complex in nature which need a specific mechanism which can adapt to an open system view, this mechanism is called governance. According to Muller (2012), the purpose of project governance is predictable delivery of projects and portfolios and finally achieving corporate strategic objectives. Turner (2009) also claimed that project governance provides a structure for addressing project objectives, means of achieving those objectives, and means of monitoring performance. Organizations with a structure for aligning the project deliverables with their organizational goals would be better placed to realize their

investment in projects and achieve the values aligned with the business strategy (Too & Weaver, 2013).

3.3.2 Governance Challenges

T. Ahola et al. (2013), conducted a comprehensive research about project governance and they found some challenges involved in governance definitions. Their research resulted in two kind of governance in literatures, an external view of project governance versus an internal view. In fact when governance is viewed externally to projects, it is called external governance with an intra-organizational focus, and when the focus is on a specific project shared among many organizations, the governance is inter-organizational. These two contexts require different type of safeguarding, coordinating and adapting (governance). According to Too and Weaver (2013) different types of governance are needed for different organization's sub-units such as IT governance, knowledge governance, network governance, and project governance. The following figure is their petal diagram of governance

3-20. Petal diagram of governance(Too & Weaver, 2013)

As figure 3-20 indicates, there are different functions of governing an organization under five main themes including relationships governance, change governance, organization's people governance, financial governance, viability and sustainability governance. Governing each part requires specialist knowledge and skills and the aspects are linked together, failure in one aspect can have effect on other aspects. So, there is a need for skills appropriate for each

governance aspect of the organization while at the same time remaining an integrated part of the overall governance structure (Too & Weaver, 2013).

F32: an ill-defined and incomplete definition of governance might misdirect practitioners and can be one of the barriers of identification of early warnings as it can lead to inappropriate risk management strategies.

According to Lester (2014), the governance of any specific project should be a subset of the governance of all the project management of an organization. Governance should cover all levels of organization from the board level to management of executions and down to the project level (Klakegg, Williams, Magnussen, & Glasspool, 2008). Too and Weaver (2013) emphasized the importance of separating governance and project management. According to Too and Weaver (2013) an organization consists of a hierarchy of subsystems, including the governance system, the management system, project delivery system and project management system.
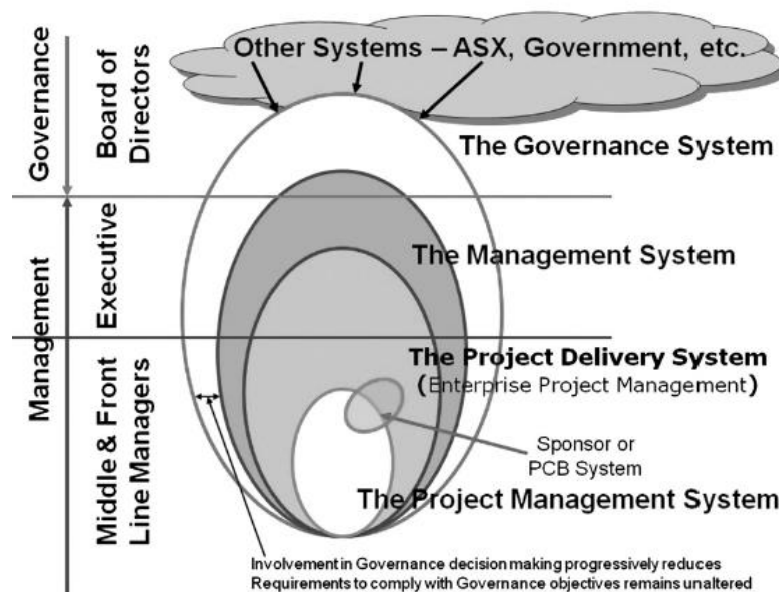
3-21. Different hierarchies of governance(Too & Weaver, 2013)

According to the authors (2013) the degree of decision making involvement would be reduced by reduce in the size of each system in the picture. Each of the lower level systems should follow the requirements and objectives of the higher levels systems. This figure describes a hypothesis which suggests that although a good project governance system provides directions, it requires support from management system (which is responsible for creating an organization capable of achieving governance objectives). In addition, the management

system provides support to the project delivery system but also needs deliverables from it (Too & Weaver, 2013). A manager cannot govern his/her own work, so governance and management need to be separated. A core aspect of governance is investing in development of appropriate management capabilities to ensure organization resources are going to be used efficiently and effectively.

In addition, T. Ahola et al. (2013) found that there are differences among governance of projects which have different number and type of owners. A project with a single owner requires a different kind of governance than those similar projects with many owners. Furthermore, according to the authors (2013), large infrastructure projects with involvement of many powerful governmental stakeholders would need different type of governance as these projects consist of more political uncertainties. In addition, other challenge had been the assumptions of bounded rationality and the risk of self-interest seeking behavior of those responsible of defining governance (T. Ahola et al., 2013). According to Hellström, Ruuska, Wikström, and Jåfs (2013) large and complex projects require proper governance schemes. One challenge in such projects is that besides the common goal of project, different actors have different objectives and sometimes conflicting goals. Many factors such as "the generic feature of the project business" and "the context of a specific industry" may have effect of the choice of project governance. For example nuclear power plants, because of their safety importance, may have a different type of project governance (Hellström et al., 2013). According to Ruuska, Ahola, Artto, Locatelli, and Mancini (2011), there is a need for an open view toward large projects embedded in institutional environment, because they are operating in complex contexts with many actors, they cannot be governed by closed activity system of one or only a few actors.

F33: different projects depending on their industry, their size, their number of stakeholders and other characteristics require different kinds of governance, failing in defining suitable governance can misdirect the team members when doing operations. Therefore, it would be one barrier for identifying early warning signs.

3.3.3 Governance and risk management

Guo, Chang-Richards, Wilkinson, and Li (2013), investigated the effects of different project's governance structures on risk management outcomes. According to their research, project

governance provides a mechanism for identification of risk in projects. It indicates the importance of establishing proper project governance for achieving the target risk management outcomes. Managing risks would be more difficult by increase in interfaces' complexities, novelties, and stakeholders' varieties. According to Guo et al. (2013), major infrastructure projects with many tasks and features, require more complicated organizational structures in order to be able to deal with more number of risk management elements. Guo et al. (2013) concluded that an analysis of risks and project organizational structure relations at the project feasibility stage will be beneficial in improving risk management for large infrastructure projects. In other words, project governance provides a structured mechanism for identifying risks as they occur. It showed the importance of considering the most appropriate project management modes at the governance definition phase of projects in order to attain better results for risk identification and mitigation.

F34: Inappropriate project governance which is lacking strategies for risk management would be a reason for not recognizing many early warning signs in the project.

Abednego and Ogunlana (2006) also studied about the effects of considering risk allocation strategies in establishing project governance and the final project performance under that governance.
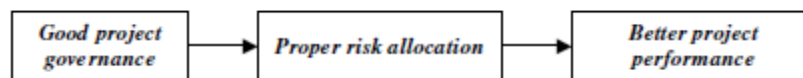
3-22. Effect of project governance on project performance(Abednego & Ogunlana, 2006)

As the figure indicates, according to Abednego and Ogunlana (2006) some consequences of risk occurrences could have been mitigated or prevented before their materialization if project owners have been more cautious about these possible risks and issues during feasibility study of projects. That could provide them much necessary information with details to prepare a more accurate project estimation and project plan. They assessed an Indonesian project performance and concluded that the undesired results is not only because of lack of management and proper decision making, but also absence of support from government had been a reason of failure in making the right decision in risk allocation strategies. Figure below indicated how inclusion of good project governance can enhance project performance.
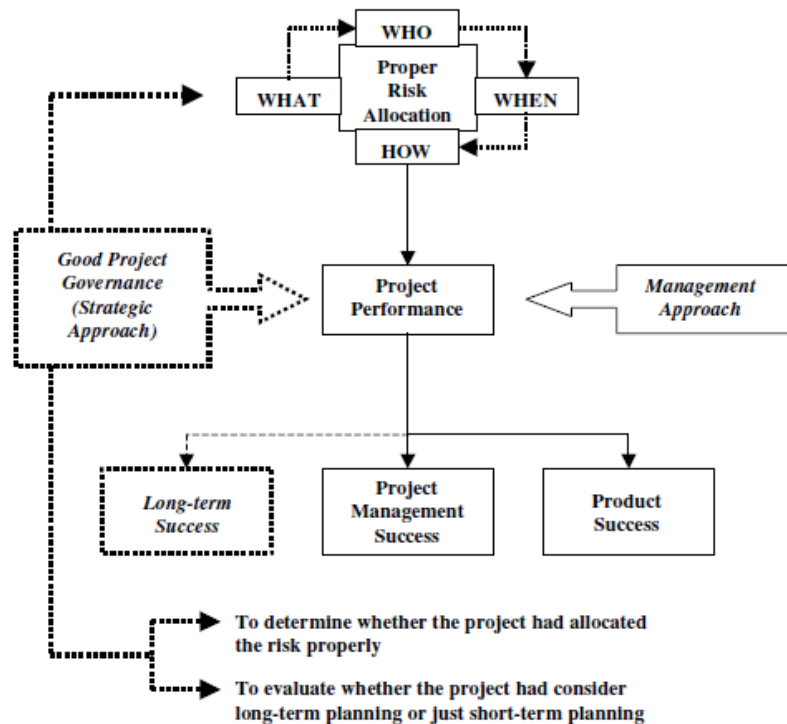
3-23. Effect of project governance on project performance (Abednego & Ogunlana, 2006)

As the figure indicates good project governance leads to a better risk allocation and finally improvements in project performance and achieving project success. According to the authors (2006) the good project governance will lead to an active participation and right decision at the right time. It will increase responsiveness within a reasonable time framework for any made decision. In addition, it leads to continuous project control and monitoring for achieving the common goal of different stakeholders. In that Indonesian project solutions were sought to cope with particular problems during the construction stage, although it would have been better if preventive actions had been taken. Risk management strategy in that project was more into problem solving rather than preventive actions and the incapability to control risk properly was the result of absence of good project governance. According to the authors (2006) the criteria for achieving a good project governance are "right decision at the right time or active participation", "contract fairness", "information transparency", "responsiveness", "continuous project control and monitoring", "equality", "effectiveness and efficiency", and "accountability". So, a proper and good project governance will result in a preventive risk allocation strategy and better project performance, all of these issues lead to project success as a whole.

F35: Appropriate project governance which takes risk allocation strategies into account would be more proactive and will lead to identifying early warnings early enough, instead of acting on problems and being reactive.

Hellström et al. (2013) also researched about the role of governance in establishing the premises for upcoming project management issues. Hellström et al. (2013) in their research focused on the issue of path dependency. According to P. A. David (2001), history matters. Path dependency is about how the historical decisions can lead to desirable or undesirable out comes, so history has impact on the results (Hellström et al., 2013). P. A. David (2001) defined path dependent processes as those processes that are unable to be free of their history. According to Hellström et al. (2013), projects are influenced by their historical data. In large projects many actions and decisions are made at early stages which create a possible direction for the project successively. Thus, according to the authors (2013) project governance has a very crucial role in overcoming mechanisms leading to detrimental lock-ins of projects in early stages. Identifying such governance requires a study over period of time before the project's start up and committing all relevant actors. In large projects, the formation of governance structure needs to be understood as an emergent process (Hellström et al., 2013).

F36: considering the path dependency issue, those decisions that are made at the early stages of project and the project governance can have effect on the issues following them. It indicates the importance of decisions that are made at the beginning and their effect on identification of early warnings.

According to Patel and Robinson (2010), project governance has effect on cost, speed of completion and quality of projects as it provides clear organizational culture, effective decision making structure and controlling processes. Williamson (1996) claimed that governance is critical in risk management and achievement of objectives as it ensures standards, procedures and controlling mechanisms are in place.

F37: governance ensures that standards, procedures and controlling mechanisms are in place, therefore lack of it can lead to not having any procedure and plan for identification of early warning signs.

3.3.4   Normalization of deviance and Governance

J. Pinto (2013) in his article discussed about the issue of "normalization of deviance". According to him the more people get used to the deviant behavior the more it occurs. In

other words, when people start to accept it, the unexpected will become expected. Some behaviors that do not seem normal for people outside the organization may be considered as normal inside the firm and would not be recognized (J. Pinto, 2013). The unaccepted behavior does not happen suddenly, it would be the result of many made decisions without any visible negative effect, so the potential of the catastrophic problem is not felt until it occurs. Normalization of deviance drifts organizations away from standards and lets the drift to become a norm (J. Pinto, 2013). Some issues such as infra-organizational conflicts may become a norm of deviance in time if it is accepted in the organizational culture. If the unexpected become expected, it will become accepted and will affect the project management processes. Some actions done for example in order to win a new contract may normalizes various forms of deviance within the firm (J. Pinto, 2013). Organizational learning is so fundamental for slowing organizations to identify normalization of deviance phenomenon and reflect upon it. A helpful method for strengthening organizational learning is the Flyvbjerg's "outside view" perspective and a quality control model in project management practices. As inside view is usually adapted by key organizational actors; an outside view would be a constructive alternative. Besides the need for organizational awareness of normalization of deviance phenomenon, there would be a need for appropriate organizational governance.

F38: normalization of deviance and getting used to some issues into the organization may be a reason for not seeing those issues as important signals because they have become as norms and standards in that organization. Therefore, when defining governance and making decisions, those issues would be ignored and lead to many other problems following them.

J. Pinto (2006) claimed that a top down method that primarily involve upper management oversight, a market mechanism which allow comparison among projects and a professional standard of best practice are helpful in addressing problems related to normalization of deviance. Top management has an effective role in identifying the pattern of behaviors; also a comparison with other competitors can help in identifying the available gaps and identifying the areas which need improvement. By the use of organizational governance many problems related to normalization of deviance can be solved by analyzing the standard operating processes, availability of a controlling mechanism which identifies the normalization of behavior would be of help.

F39: if the governance is lacking required analyses of standards and norms, the issues related to normalization of deviance would not be recognized and solved, therefore it can have negative effect on identification of early warning signs in the organization.

The use of external consultants with a "fresh eye" would lead to recognizing the issues related to normalization of deviance. Educating those who can identify the normalizations in their own behavior is another way for recognizing the issues. The accepted behavior which is considered as a standard behavior in governance model needs to be clarified. The normalized behavior is the result of not being aware of the inappropriate behavior, or usually the ethical model of behavior in the organization does not provide proper oversight. According to Muller (2012) it is critical to develop a culture of openness and transparency as a part of governance model, so the actors will know what the standard behaviors are and can perceive the ways these standards work and the way achieving organizational advantage as a whole.

F40: lack of the culture of openness and transparency in governance models would lead to not recognizing those issues that have become a norm in that organization. It would be a barrier for not identifying signals as they are accepted in that firm.

According to J. Pinto (2013) looking at the drivers of normalization of deviance in projects organizations help in addressing the behaviors and remediating them before they become worse.

3.3.5 System thinking and Governance

According to Locatelli et al. (2013) system engineering enables the successfully delivery of complex project by its broader view of success. The focus of system engineering is also on project governance which is an important factor in achieving project success (Muller, 2012). According to van Marrewijk (2005) poor performance of projects are the result of poor planning and project definition. According to Locatelli et al. (2013) underperforming projects are delivered in a project environment with rapid changes of technologies, their systems are interoperated and interdependence, they are lacking focus on quality, and their environments contains issues relate to integration, combined multiple disciplines, competitive pressures and so on.

F41: poor definition and planning of projects can be considered as one of the barriers in identification of early warnings, especially in uncertain environments with rapid changes.

According to Locatelli et al. (2013) a project which at least contains one of the following issues is considered as a complex project; issues such as several disciplines, strong implications for performing the project, strategic importance for the company, stakeholders with conflicting needs, high number of interfaces, and so on. According to the author in such

a complex environments a shift from "project governance" to "system governance" is a requirement and system engineering improves project performance by transforming the governance from "project governance" to "system governance". According to Floricel and Miller (2001) governability enables a project to react to unexpected events occurring during a project lifecycle. System engineering assures that interactions and interfaces among different subsystems are compatible. According to Locatelli et al. (2013) there are some tools and techniques in system engineering for supporting the governance of projects in complex environments. System thinking is a method of understanding how different correlated systems influence on each other as a whole (Jackson, 2007). According to Checkland (2012) system thinking in complex environment is required as its focus is on the whole system not on specific sub systems, the whole is more than sum of its parts. The governance based on system thinking would be able to address the increasing complexity, would look at different problems from different areas and their combination with each other, would link many specialist together for unifying influence on governance and solving complex problems, and would lead to changes in the way that both individuals and organizations work.

F42: lack of system governance in complex projects is also one of the barriers for identification of some signals which arise in connection of different parts and disciplines together. Such governance gives a holistic view for solving problems in complex projects.

Considering open system approaches when defining governance would be more appropriate in such a changing environment (Kowalski, Oblinger Jr, & Peresta, 1998). An open system approach leads to having an environment designed for unexpected changes; such a system will facilitate leveraging. An open system can be supported by many suppliers and their design is adapted to commonly used and widely supported standards. In order to achieve a better performance, the integration of open system approaches in project governance is highly recommended (Ruuska et al., 2011).

F43: lack of openness approaches when defining project governance can hinder many issues and signals related to unexpected changes in changeable and uncertain environments.

A multidisciplinary view in defining project governance will lead to solving problems related to complex environments. Such a system will ensure customer satisfaction through the whole system's life cycle (Bahill & Dean, 2009). Such an approach will lead to achieving not only project success but also system success as a whole. Each part of a complex system is dependent to the work of other parts and they cannot be considered and designed independent of each other. The application of system thinking mentioned by Bahill and Dean (2009) can

help in evaluating the whole system to make sure that all of the parts are compatible with each other. This helps the elements which are made by different departments to be checked for their compatibility (Kossiakoff, Sweet, Seymour, & Biemer, 2011). Locatelli et al. (2013) Indicated how open system and multidisciplinary approaches can help in governance improvement.
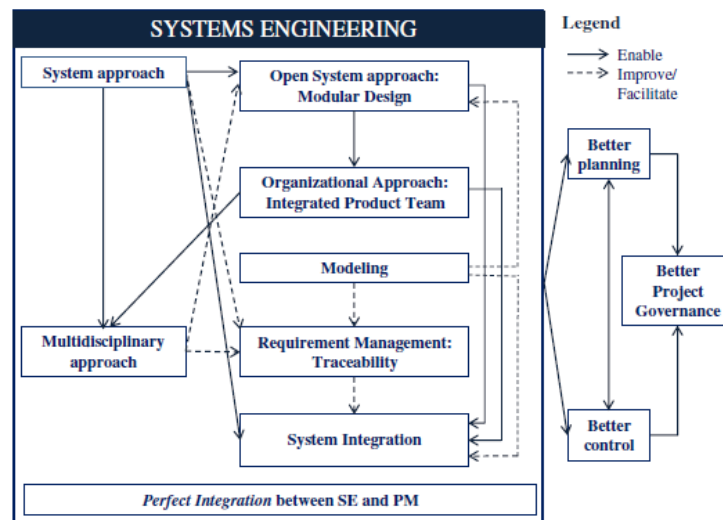
3-24. System engineering (system thinking) and project governance(Locatelli et al., 2013)

F44: early warnings might be missed due to inappropriate methods of planning and control resulting from lack of multidisciplinary approaches when defining project governance.

As figure 3-24 indicates, system engineering tools and practices enable managers who are responsible for project governance to deal with uncertainty and complexity by increasing the systems flexibility and reliability of project planning and control. A flexible plan can be adjusted during the execution phase of projects. System thinking enables dealing with complex issues and solving those problems on a multidisciplinary basis. The application of system thinking is more appropriate when different parts are designed and produced by different organizations. System engineering governance allows a better governance of different elements from the system definition until decommission. So, governance can be improved by the system approach, it leads to the right flow of information and the right kind of interfaces. System approach is more cost effective and helps in dealing with complex issues. It will lead to an open approach that facilitates the communication among the evolved organizations and therefore improvement in projects governance. The application of system

engineering integrated with project governance at early stages of projects increases the probability of project success (Locatelli et al., 2013).

F45: *a project governance lacking flexibility for dealing with uncertainty and complexity may face with the problems of missing early warnings.*

One of the advantages of system engineering is its holistic view even from outside, analyzing the interaction of the system with other systems and the changes in the environment. The reason for mentioning the system engineering approach by Kossiakoff et al. (2011) is that managers usually focus only on technical issues and they forget about the project environment and its effect on the outcomes of the project. In another worlds, system engineering considers the "soft constraints" of each complex project environment (Locatelli et al., 2013). Such consideration in governance definition will lead to more attention to the interactions among different system elements, stakeholders and all of the involved organizations.

F46: *just focus on technical issues and forgetting the importance of interaction with external environment can be consider as one of the barriers of identification of early warnings.*

Integrated governance of a project can benefit from a holistic view and integration approach by creating an effective interface between teams and ensuring the appropriate flow of information among different parts of the system. According to Browning (1999) creating work breakdown structure can facilitate leveraging the system integration process and leads to an improvements in information flow, better cooperation, situation viability, reduction in the amount of rework, and loss. Appropriate project governance by considering the system engineering approaches provides a structure for dealing with complexity, being responsive and flexible (Marshall & Leaney, 1999). Modeling and simulation also lead to a better analysis of system requirements early in the designs phase and improvement in communication; it will be very helpful in the front-end engineering phase of projects. This also improves the communication among different stakeholders. Simulation will facilitate the dynamic behavior of a system, and show how the components of the system will behave in cooperation with each other (Sinha, Paredis, Liang, & Khosla, 2001). A system engineering management plans the interfaces, makes participants aware of each other's responsibilities, and the procedures that should be followed in order to conduct the work. The system engineering management plan is usually considered in the early phases of projects and in defining project governance, then in later phases it will be updated (Locatelli et al., 2013). Application of requirement management tools in system engineering also is very effective in defining appropriate project governance. Requirement management is a system engineering

tool in capturing all of the requirements of a system, and analyzing and tracking them (Cant, McCarthy, & Stanley, 2006). Requirement management would link the requirements together in order to ensure that nothing is overlooked and also would track the status of each requirement during the project development.

As the figure indicates, system engineering and consideration of both open system approach and multidisciplinary approaches lead to improvement in the project governance.

Lester (2014) suggested a principle for ensuring reliable delivery of projects contributing to organizational success as following:

- The overall responsible for delivery of the project governance is the board of directors
- Project management governance roles and responsibilities should be defined clearly
- The disciplined governance arrangement should be supported by appropriate methods; controls also need to be applied through the whole project life cycle. Each project should have a clear sponsor.
- There should be a coherent and supporting relationship between portfolio and business strategy and policies.
- Each project has a review plan with authorization for reviewing costs, benefits, and risks. Decisions made at authorization level should be communicated.
- Those who are given authorization need to have appropriate competence, authority, and resources for enabling them to make appropriate decisions.
- There should be clearly defined plan for reporting project status.
- The organization need to have a culture of improvement and information disclosure.
- Stakeholder should be engaged in the organization in a manner that fosters trust
- Portfolio direction, project sponsorship, project management capability, disclosure and reporting are the main components of portfolio, program, and project management that need to be examined for ensuring compliance with a good governance principle.

Good project governance facilitates the way of achieving strategic goals of the organization for managers.

3.3.6 Critical success factors and Governance

According to Balachandra and Raelin (1980) defining critical success factors before the project start up, can be used as a model for detecting the early warning signals. Papke-Shields, Beise, and Quan (2010), claimed without high-level initial planning a project is more likely to

face with failure. Therefore here some of the critical success factors that can be considered when introducing project governance are introduced in this section.

According to Avots (1969), project management has become a very efficient method in today complex projects in comparison with traditional methods of project management with formal hierarchical divisions. Papke-Shields et al. (2010)' research indicated that there are differences in PM practices by variation in costs, durations and the number of people on the project. Besner and Hobbs (2008) also came into the same conclusion. In other words, according to Papke-Shields et al. (2010), the larger and more expensive projects require the more use of practices focusing on control (Time, Cost and Integration) which will lead to more need of quality and risk management practices. According to their study there is a direct relationship among formal PM use and project success. In fact, use of cost related practices will lead to meeting cost target, and use of quality related practices will lead to meeting quality requirements. Practices related to scope changes are necessary in meeting cost and time targets and satisfying clients. This kind of practices will make everyone aware of any changes. The use of status review meetings is also important in keeping the project on track of achieving objectives. Clearly defining the responsibility of each person will help in meeting time and cost schedule as well as technical specifications. The use of team-building events will help in improving project performance. This will result in a better environment for solving problems in a team. Communication with customers and stakeholder analysis will contribute in achieving satisfaction. Risk related practices such as qualitative risk analysis helps in understanding the potential risks that may arise in a project and their possibility and the impact they may have if they occur. This will help in providing a contingency plan for addressing risks that may arise and become prepared for implementing actions (Papke-Shields et al., 2010). By understanding what is involved in the project, the changes in scope, monitoring the progress of project, informing those interested in the project and having an effective team the chance of achieving project success will enhance. Other authors such Fortune and White (2006) mentioned some important CSFs in effective management such as "clear realistic objectives", "strong/detailed plan kept up to date" and "communication/feedback". According to Papke-Shields et al. (2010), having a good plan, right people who work only if are aware of the things which are happening in project and are ready for implementing adjustments if needed. According to Munns and Bjeirmi (1996), some factors may cause failure in project management such as:

- Inadequate basis for project

- Wrong person as project manager

- Top management unsupportive

- Inadequately defined tasks

- Lack of project management techniques

- Miss-used management techniques

- Not planned project closedown

- Lack of commitment to project.

So, a project manager need to make a plan with a commitment to complete the project, need to have required skills, should define the project adequately, plans the activities correctly, makes sure about the flow of information and communication, keeps an eye on changes and implements actions when discontinuities are identified (Munns & Bjeirmi, 1996). Avots (1969), claimed that project management failure can be avoided by paying more attentions to the factors which cause management failure. Papke-Shields et al. (2010), claimed without high-level initial planning a project is more likely to face with failure. In addition, a project may be considered as successful even with cost or schedule overrun as it is meeting long-term objectives (Munns & Bjeirmi, 1996). According to Duncan and Gorsha (1983) three problem areas in management failure are under-costing, overspending, and late delivery. They suggested the need for project planning in order to avoid these problems. Kumar (1989) stressed on the development of project strategies, philosophies and methodologies of implementing project and their importance in achieving success. According to Kappelman et al. (2006), ineffective schedule is another reason of failure. If team members do not agree on short term tasks they may not know how to accomplish the whole project outcome. Different tasks and skills are required in different point of time. Success of later tasks depends on success of earlier ones. To complete a project successfully all of the team members should make consensus upon the deliverables, due dates, and milestones. A project without knowing its status has no realistic chance of being completed on time and within budget (Kappelman et al., 2006).

F47: lack of clearly identification and definition of important success factors at the early stages of a project, such as providing a contingency plan for addressing risks, can be one of the reasons for missing early warnings.

According to Munns and Bjeirmi (1996), some managers just concentrate on techniques or hard issues of project management that are easily measurable. While these hard issues alone

do not guarantee project success. Soft issues such as personal and organizational skills are also necessary in achieving success (A. Jaafari, 1990; Randolph & Posner, 1988).

F48: only focus on hard issues and those phenomena that can be measured is other reason for missing many other early warnings which are soft in nature and are not measurable.

Decisions made by project managers may have effect on long-term situation of a project. Therefore project management is a subset of the whole project. Managerial techniques can for example identify unfeasible nature of a project and then decide upon its abandonment or its change (Munns & Bjeirmi, 1996). In addition, In order to implement a project successfully managers need to integrate inputs from all of the parties (including clients, project team, parent organization, producers and end users). Each of them has tasks, responsibilities and objectives which should be considered and integrated to achieve success as a whole (Kumar, 1989). Different stakeholders have different expectations from the project. Lack of a documented requirement or success criteria may lead to different assumptions about project and failure. So, it is very important for the stakeholders to sign a documented requirement to make sure everyone agreed upon it (Kappelman et al., 2006). According to Geraldi, Lee-Kelley, and Kutsch (2010), the ability of project managers in addressing unexpected events in the first place depends on their previous experience with such events and also the degree of embeddeness of risk identification in the organization as an organizational routine. They also claimed that identification of the events was not the end of the story, a lot of events were addressed but responses were not planned in order to act upon them. Project managers need to be able in making rapid responses in such situations. Ignoring early projects delay is an early warning sign of a schedule delay problem. Short-term review of the plan will prevent the project from facing with bigger changes. As change in projects is inevitable it requires stakeholders to communicate and work together on an ongoing basis. Otherwise, the project team will be pulled in multiple directions (Kappelman et al., 2006).

F49: lack of project managers who are able to recognize signals rapidly because of previous experience and lack of a culture of risk identification in organizations can be other reasons for missing those signals.

Clear leadership in guiding people toward the right direction also seems crucial in responding on time. The ability of managers in controlling their emotion in stressful situation was other important aspect noted. Over-reaction was associated with unsuccessful results. Situations in which people "do not panic" resulted in successful responds (Geraldi et al., 2010). According

to Müller and Turner (2007), there is a strong relationship between managers with high emotional intelligence and project success.

Traditional methods of project management breaks down the whole project into understandable chunks by work breakdown structures, fictional decomposition, specification hierarchies and the like. Although this reductionism helps managers in coping with complexity, they destroy the holistic perspective of a project. It will distract managers from a holistic perspective of future outcomes. Fundamental uncertainty and ignorance are inevitable parts of project management. There is a need for something more than the tools of probability theories to deal with risks. Uncertainty is defined as the variability of future out comes and a project because of being a unique undertaking consists of a large part of project management involved with uncertainties. When future cannot be imagined then there is a high probability of ignorance. Some times in projects the plan and considered risks remain constant and unchanged. This is very platitude in project management which is not reflecting reality. Projects at the outset are uncertain but as they move forward in other phases they get more certain. It is needed to reassess the project and consider new possibilities and implement changes. Because of the existence of ignorance in projects, managers usually need to consider a reserve in budget. A lot of occurrences in projects are open to elastic interpretation which will have fuzzy consequences, this fuzziness can be manages by effective and persistent communication. By increase in uncertainty the attractiveness of retaining an option (flexibility) increases. In projects with high uncertainty considering higher flexibility in plan is of more interest (Pender, 2001).

F50: lack of change management as the project is progressing can be a reason for ignoring and missing many signals which are related to the new environments that are being emerged.

Projects without defined success criteria cannot succeed (Pender, 2001). According to C. Jones (1996), requirements change at an average of 2% per month. It indicates the importance of change control system. The thought that requirements are frozen may lead to problems, requirements change in time. Competitors, business process, regulation, technology, and management changes. What had been perfect six months ago may not be perfect anymore. Change in projects is inevitable so every project must have a process of change management (Kappelman et al., 2006).

Managers should make decisions on alternatives every day. Experienced project managers know that projects need active hands on management. The options need to be assessed regularly (Pender, 2001).

F51: sticking to specific methods for identification of early warnings and forgetting consideration of alternative methods and other way of recognizing signals can be other reason for not recognizing some signals.

Project managers are also very crucial in a project success. They have to plan and coordinate many efforts rather than performing the effort. Communication skills and leadership skills are very important for a project manager to achieve success. Project managers without these skills cannot deliver the outcomes within schedule, budget and requested quality (Kappelman et al., 2006).

Generally managers learned to focus on what is critical based on their experience with the domain at hand and they usually refuse to consider any other events (Geraldi et al., 2010). According to the authors (2010) there are different reasons for lack of attention to these unexpected events. One of them is under the rationale "it will not happen to me". In another words, if the actual threat happen we get surprised because the actual threat was not considered pertinent when it had to.

F52: optimism bias and the rational "it will not happen to me" can be another reason for not considering some issues as dangerous; therefore, signals of those issues will not be seen as urgent and important.

Peoples have different perspectives from a specific event. What is important is the ability of project manager to recognize these differences and address all of them before they grow to a proportion capable of jeopardizing a project's success (Kirby, 1996). Kirby (1996), talked about a project called IRIS which failed because of lack of integration. IRIS failed not because of poor system analysis, programing error and so on which project managers expressed as failure reasons, it failed because project managers failed to recognize the subjective nature of project management for the meaning people gave to various events. People started to think that this integrated system project is going to have effect on their job, change their job, give more power to those who have control over their performance through the system, and finally it may reduce their flexibility. All of these assumptions led to various interpretations that people ascribed to various aspects of the project. Managers were just considering cost-benefit analysis while people were thinking about their self-preservation,

domination, and power acquisition. Managers' mistake was assuming that everyone is seeing the project from the same rational, economic perspective. They never thought that the same event can be interpreted so differently. It is easy for managers to miss the subtlety of alternative interpretations as they arise. People may resist the change and it is because of the fact that they do not see the light. If managers understand what others' goals are and try to align them with the goal of the project, resistance can be overcome. People had different perceptions because they viewed events from different perspectives. It will not be solved by educating people, in fact it requires spending time and understanding how people think and seeing events from their perspective. IRIS failed because managers did not consider different alternative meanings that were involved. This mistake led to several million dollars loss and abandon of original goal which was improving performance (Kirby, 1996).

F53: lack of integration system and standard meanings for the same words and issues sometimes can make problems; it can also be a barrier for identification of early warnings when communicating.

Without proper project management techniques the control of resources and individuals would be difficult. As project management is a subset of project as a whole, in order to achieve a project success first there is a need for improvement in the role of project management. Secondly, the client should be involved in the planning and execution phase of projects. It should be kept in mind that project management can contribute in project achievement but they do not necessarily stop a project from failure or success. A project can be considered successful without success in project management. Selecting the right project at the outset and excluding potential unsuccessful projects are more important in ensuring total project success (Munns & Bjeirmi, 1996).

Considering these critical success factors and many other factors at the projects' outset (when defining the governance) can lead to having a proper structure for identifying early warning signals.

To sum up the literature about project governance, as project governance defines procedures, plans and guidelines for the whole work, it will have a very important influence on project life cycle. Ill-defined project governance would misdirect practitioners. It can also lead to wrong risk allocation strategies, which is directly relevant to identification of early warning signals. According to the literature, a project governance need to be flexible and open in nature, it needs to be updated according to the changes in the project and environment. In addition, both detailed planning and holistic views are important when defining the governance of a project.

all of these issues related to governance seems to have effect on identification of early warning signals. In later chapter this issues are going to be discussed comprehensively.

3.4 Project Complexity

The nature of projects also can have effect on identification of early warning signals, such as "the issue of complexity". In complex projects identifying the outputs of specific inputs is not an easy task, because items in a complex system are interconnected and interdependent. A complex system is made of many parts and its behavior is uncertain. In such complex systems causality is less clear and by looking at the signals identifying the potential future problems is not an easy task. In addition, in complex projects identifying all relevant early warnings is not an easy task. Even heavy processes in identifying early warning signs may be a reason for not uncovering the signals. In this section, these issues are going to be examined through literature. Findings are written down through the literature.

The issue of complexity has been determined as one of the reasons of not identifying early warning signals. Project complexity can have effect on the identification and implementing actions to EWSs. With the increase in complexity, the uncertainty would also increase (Terry Williams et al., 2012). As Simon (1982) claimed and according to system theory, complex systems consists of many parts and the interaction among the parts is not easy. By increasing the complexity, uncertainty and interaction among parts, predicting the behavior and outcomes of a project will become more difficult. Complex projects usually do not behave the way it was expected, they are complex and may lead to outcomes which are not according to what had been expected. Assessment of complex projects shows that the documents are fairly developed based on the formal criteria and expectations; this indicates that generally we are not very good at picking up EWSs. Factors contributing in the complexity of projects are for example complexities which are caused by the decisions, issues related to leaderships, quality of the documents and information, degree of following the guidelines for early phase assessments, relevancy of the solutions to the problem, cultural aspects, needs for developing new technologies, identification of main risks, lack of knowledge of project team, and unclear role of sponsors (Terry Williams et al., 2012). In today competitive and complex environment performance measurement systems with focus on traditional progress indicators are not effective anymore, there is a need for new performance measurement approaches which focus on proactive project management methods rather than reactive (Haji-Kazemi & Andersen, 2013). A corporation (as a complex system which is working in other complex systems) needs to understand its total environment and their interaction with other systems. By gathering

constant information about the environment, the corporation will be able to anticipate future (Nanus, 1975).

According to Baccarini (1996), complexity is one of the certain characteristics of a project which determines the need for an specific kind of management. According to Bennett (1991) Practitioners usually differentiate complex projects from simple projects by emphasizing on complexity issues of that projects, it indicated the importance of complexity and its influence on management methods. Complex projects require specific planning and coordination and requirement of control mechanisms. The goals and objectives of these projects might be hindered because of complexity, and such complex projects require appropriate organizational forms. Complex projects also require specific and appropriate expertise and requirements, it also demands a suitable project procurement arrangement, and finally the broader project complexity the higher likelihood of facing with schedule or budget overrun (Baccarini, 1996). In addition, according to Morris and Hough (1987), "complex project demands an exceptional level of management, and the application of conventional systems developed for ordinary projects have been found to be inappropriate for complex projects".

3.4.1 Definition

Although managers use the term of complexity and complex projects, there is still no clear definition for it Williams (1999). Dictionary defines complexity in two dimensions: 1) a system consist of many different interrelated parts, 2) a system which is complicated, involved and intricate (Baccarini, 1996). Complex systems consist of many different elements that are interconnected and interrelated, a project can be considered as a complex system if its elements are highly interconnected (Klir, 1985). In many cases the meaning of complexity is close to the concept of uncertainty (Baccarini, 1996), although according to Mintzberg (1991) complexity theory is different from the theories of size and uncertainty. According to Baccarini (1996) project complexity is defined as "consisting of many varied interrelated parts" and can be operationalized in terms of differentiation and interdependency. According to Baccarini (1996), in term of organizational complexity differentiation means the number of hierarchies, units, division of tasks, and in term of interdependency it would be related to the degree of interdependencies among different elements of the organization. In term of technology, differentiation means the number of inputs, outputs, processes, and specialties, and interdependencies would be also about the interrelationships among the inputs, outputs, tasks and processes. R. E. Jones and Deckro (1993) also added "the instability of the

assumptions upon which the tasks are based" to Baccarini's definition of technological complexity. According to Kast and Rosenzweig (1985), technology is defined as the transformation processes of inputs to outputs which require the use of materials, techniques, expertise and knowledge. So, there are different types of project complexities, such as organization, technology, environment, information, decision making and system complexity (Baccarini, 1996). According to Li and Guo (2011) there are three kinds of complexities in mega project constructions; including technical, social and managerial aspects. According to the authors (2011), technical complexity would be the result of complex technologies and processes for designing and constructing, social complexity is determined by the complexity in the environment of the project and the degree of its uncertainty, and finally managerial complexity is the result of business and governance aspects of a project including complexity in financial management, scheduling, decision making and so on. Therefore, authors have defined different categories for complexity. Uncertainty in the methods of carrying out projects would add complexity to those projects. Based on this expression, those projects in which a body of knowledge exists are less complex than the state-of-the-art projects without any experience. In some other projects although the methods are known, the goals are not clear and the user's requirements are difficult to be specified. These would lead to product and project complexity, considering that the effect of project changes is more than the sum of changes in each part individually (T. Williams, Eden, Ackermann, & Tait, 1995).

F54: complexity and novelty of projects can be one of the barriers of identification of early warning signs, as project managers and team members are lacking similar experiences from past.

An organizational structure is usually developed for clarifying communicational and reporting terms, aligning responsibilities and authorities for decision making, and allocation of tasks. There are two dimensions for organizational complexity; vertical differentiation and horizontal differentiation (Hall, 1979). The more numbers of hierarchies and levels in an organization, the more complex would be the organization (horizontal complexity). In addition, the more numbers of organizational units, departments, groups and division of tasks which would lead to more division of labors and personal specializations, the more complex would be the organization (vertical complexity).

Williams (1999) in his article mentioned two terms of complexity; sequential complexity and feedback complexity. According to his sequential complexity, if a subsystem i affects subsystem j which itself affects subsystem k, it will have a sequential complexity with a

length of 3. And in the case of feedback complexity, if a change in subsystem i effects on subsystem j the system would be considered as complex. The more complex the type of interdependency, the greater the added complexity would be.

One of the ways of dealing with project complexity would be by integration, coordination, communication and control. As projects become more and more complex there would be more need for being worried about its effect on the project management processes (Baccarini, 1996).

F55: lack of coordination, integration, communication and control in a complex project can be considered as one of the barriers of identification of early warnings.

3.4.2 Complexity challenges

Despite of many advanced and substantial effort on tools and techniques, still projects continue to perform poorly. According to Lyneis, Cooper, and Els (2001), a major reason for these schedule and budget performance problems would be the complex dynamic nature of projects. Projects are becoming more time-constrained and the ability to deliver projects faster is in more demand, in order to win a contract (Clarke, 1994). By increase in the demand for tighter projects durations, the need for concurrent engineering is increasing, it will add even more complexity (Williams, 1999).

F56: project complexity and the need for concurrent engineering can be a reason for missing some early warnings when other signals are attracting the attention of scanners.

Project management concepts mostly have a static, narrow and partial view which is not appropriate for complex in nature projects (Lyneis et al., 2001). So, according to T. M. Williams (1999), traditional and mental models are not any more appropriate for dealing with today complex environments. According to Lyneis et al. (2001) strategic project management which is about making decisions up front when designing a project, would have long-term effect on the downstream performance of projects and is appropriate for dealing with complexity. Strategic project management involves defining the project, determining what indicators to measure and monitor, risk management, incorporating learning from previous projects, and making mid-course corrections. For example, some risks such as labor shortage and late designs may impact a project. If these risks had been listed and were thought in advance, managers would be more effective and quick in making appropriate decisions. In addition, they could be aware of the most crucial risks, their early warning signs and the best

practices for responding those phenomena if occurred (Lyneis et al., 2001). The non-linear feedback systems of complex projects are difficult to be managed successfully by the use of linear and traditional tools and methods. So, managing these systems would be facilitated by the application of system dynamic models (Lyneis et al., 2001).

F57: the application of traditional and linear methods of management for managing complex project may be a barrier for identification of signals in dynamic environment of complex projects.

According to Williams (1999) a top down holistic model can be suitable for modelling complex systems, these models allow a strategic and holistic overview and modelling of system effects that the bottom-up models are missing. In addition, as traditional methods are only good at picking up hard issues, soft operation methods are more useful in addressing less measurable in nature phenomena.

F58: only use of traditional method of management in complex projects may lead to not recognizing soft signals which exist in such complex projects.

According to Thomas and Mengel (2008), organizations are becoming increasingly complex, therefore understanding complexity has become very important in organizational theories. In complex projects there are interrelationships between internal and external environments which forces organizations to make decisions based on many unknown variables. These decisions which are made in uncertain environments, and the unpredictable and complex nature of consequences, indicates that there is a need for new methods of managing, planning, and executing strategies. In addition, managers have found that strategies and plans for execution can no longer be modeled as a linear mode without considering any space for changes. In addition, in order to initiate any change in an organization, it is necessary to destabilize the previous structure, in order to provide the proper environment for adapting and supporting the change in the structure. Managers need to be aware of the relationships at all levels of an organization, and be cautious about the fact that a small change in one part may lead to unexpected results as a whole. Peoples need to understand projects as adaptive complex system; they need to be motivated for adapting to any change, communicating the changes and supporting the change (Thomas & Mengel, 2008). Project managers need to pay more attention to the non-linear influences in their management and shift from linear quantitative analysis and project control methods (Singh & Singh, 2002). According to Ivory and Alderman (2005), project management tools are mostly linear which require more flexibility and adaptation than none linear methods. Thomas and Mengel (2008) claimed that

many of the tools and methods taught in management are not appropriate anymore, so they are ineffective in such a changing environment. It seems today project managers have not received appropriate trainings for dealing with complex projects. Thomas and Mengel (2008) also mentioned some competencies required for successful project management in complex projects and uncertain environments. Leadership skills, social competencies, emotional intelligence, communication skills, skills in organizational politics and so on have been those shared competencies based on the authors' research. Skilled project managers need to be both technically and socially skilled in order to develop teams and be able to work dynamically in changing and complex environments with many functional lines. According to Hällgren and Maaninen-Olsson (2005), project managers in order to be successful need to use both formal and informal communication and interaction for solving deviations. According to them, communication and knowledge sharing are very effective in order to manage deviations. Focus on leadership perspective in order to be able to deal with complex issues has been mentioned by many authors. According to Thamhain (2004), there is a great need for focusing on leadership perspective in project management. Project managers skilled with emotional and intelligent sense of management can be very effective in order to build relationships among team members and provide meaningful project environments (Zohar, 2012). Following figure represented by Thomas and Mengel (2008) indicates the importance of more managerial and leadership knowledge rather than just focus on technical expertise, by increase in both complexity and uncertainty.
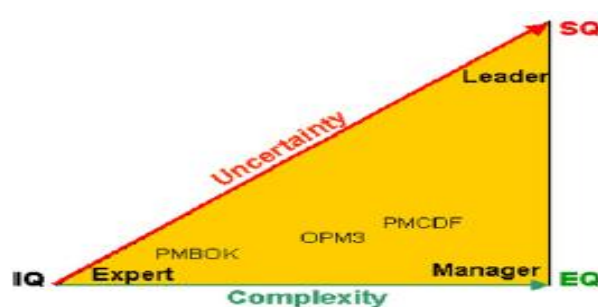
3-25. Management or Leadership skills depending on the degree of complexity and uncertainty(Thomas & Mengel, 2008)

F59: in complex and uncertain projects, focus on technical expertise rather than managerial and leadership knowledge would endanger communication. Consequently it may lead to missing early warnings signs.

Development of the best master project managers requires going beyond standards and best practices (Thomas & Mengel, 2008). Therefore, in order to be able to deal with different levels on environmental complexity and changes in today projects, managers require being able to adapt to the changes. The tools and techniques that we apply in project management do not necessarily result in project success (Thomas & Mengel, 2008). In addition, project managers' competencies related to standards are not always effective in complex environments. Instead of training managers to use tools and techniques, they need to be prepared for diagnosing situations, adapting suitable tools, adapting and learning continuously. Rushing to solve problems at hand immediately by application of available tools and lack of asking questions about assumptions and implications may hinder the real problems. What is needed is a holistic view in management. Furthermore, when problems appear people usually tend to use the simplest and most available methods and tools, it helps them to feel more secure. While this immediate reaction may distract them from the actual problem. So, it is necessary to move from "how to do it" to "when, where, why" questions (King, 1999). By integrating emotional and spiritual intelligence into other approaches, managers would move ahead. New project management education needs to help learners to identify and cope with various levels of complexity, change, and chaos. According to Thomas and Mengel (2008) there is a need for educational models of supporting change, self-organized networking, cross-cultural communication, coping with uncertainty, and increasing the ability to build high performance teams.

F60: agility in taking actions and not considering assumptions and implications may be a reason for hindering the real problems in complex projects. Consequently many early warnings related to other real future problems will not be seen.

According to Williams (1999) management styles also need to be adapted with the new environments, as in such environments there is more likelihood of conflicts due to the issue of complexity. Management need to be able to deal with such problems. In complex project there is a need to project managers with managerial styles such as ability of integration, systemic managing, simultaneous managing, team working, and so on.

F61: inappropriate management style which is not a fit for complex project can be other reason for missing early warning signs of complex projects.

3.4.3 Complexity and leadership

According to PMBOK (2008) leadership is defined "the ability to get things done through others". According to Varanini and Ginevri (2012), respect and trust rather than fear and submission are key elements of leadership. The authors talked about project managers' behavior in order to deal with complex environments. Leadership in complex projects is different from PMBOK's definition. Leadership in complex project is defined as "we are all, there is no leader", it gives the meaning of plurality or totality of leaders. According to this definition, the team members must act even if some members are absent. Those leaders should pay constant attention to the environment; they should look for the signals alarming both the dead calm and the storm situation. Besides the qualitative issues, leaders should be worried about the quantitative issues as well, such as the feasibility of the approach or potential cultural clashes. Leaders need to gather as much as possible information about different elements, these information will help them to become more cautious about the signals which will cause failure if are ignored (Varanini & Ginevri, 2012).

F62: leaders in complex projects require as much as possible information about different elements of the project. If the information is incomplete, signals related to some potential future problems will be hindered.

In complex projects despite of communication among team members of each subsystem, there are needs for communication among different teams from different subsystems, it will add complexity to communications and many groups may forget about considering the whole system. Management of relationships among different groups need more sophisticated methods of managing communications which is different from managing individuals. According to the author, managing the complex project with the linear methods of management would lead to a complete disaster. The right mix of management methods should be used in order to be able to deal with complex projects, it will increase the likelihood of project success in such projects (Varanini & Ginevri, 2012).

F63: complexity in communication can be a barrier for identification of early warnings signals.

Smart project managers must observe their situations for any critical situation to be able to spot ant initial spark for putting it out before it goes out of control. Proactive listening is the best way of being a good neighbor. According to the author the project manager should be very cautious even if everything is very calm, too calm; it can lead to a dead calm situation.

They should not afraid of the danger. The project manager with such characteristics would be an example of the whole team (Varanini & Ginevri, 2012).

F64: project managers who are not cautious especially in calm situations can be a barrier for identification of early warnings. A calm situation can also turn into a dead situation if signals are ignored.

A project is not only complex in nature, but also it is in connection with an uncertain environment. The project manager needs to have some skills which help him to give the project the right rhythm to dance according to the music. Although the signs are not that much clear but a good ear can hear them (Varanini & Ginevri, 2012).

F65: project managers should listen to environment carefully; otherwise many signals would be missed. Lack of this ability among project managers would be a barrier for identification of early warnings.

Leadership in a complex environment is a mix balance of skills, knowledge, attitude and tools, the project manager need to achieve the right mix of them (Varanini & Ginevri, 2012).

Therefore in complex situations issues are interconnected and interrelated and prediction of outcomes is not easily possible. Complex projects require specific kind of management and leadership; otherwise many early warning signals might be missed.

CHAPTER 4

CASE STUDY

4. Case Study

In this section, two case projects (Asker-Sandvika railway line and the opera house) have been chosen for more evaluation. Although these two projects are considered as success at the end, there had been many challenges and difficulties in their implementation, this indicates that some early warnings which could alarm those challenges earlier had been missed or ignored. Therefore, through this chapter, the researcher has tried to analyze both of those cases based on what she had learned through literature review and based on her own gut feelings. At first a description of each case has been given. The data about each project has been gathered through interviewing projects' experts and by studying published or unpublished papers and reports.

4.1 Case 1 (Asker-Sandvika Railway line)

4.1.1 Case company

Jernbaneverket (the Norwegian National Rail Administration) is the national railway authority. JBV (Jernbaneverket) is responsible for the management of national railway network, on behalf of the Ministry of Transport and Communication.

Through public funding and with a socio-economic perspective, its objective is to operate, maintain and develop the national railway network.

JBV is responsible for:

- Developing and operating a rail network that meets the requirements of society and the market

- Railway stations and terminals

- Timetabling

- Traffic management

- Regulation of the public rail network

- Studies and planning in the rail sector

JBV was formed in December 1996, when the former public enterprise NSB was split into NSB BA and JBV. Until July 1999, JBV and NSB BA shared the same chief executive and board. From this date, the board of JBV was abolished. [1]

Therefore, JBV is responsible for providing train companies with track capacity, and they are responsible for day to day traffic management.

4.1.2 Case description

Asker-Sandvika double track project

The following data about Asker-Sandvika project has been gathered through interviewing a project expert and by the use of some available reports and papers (published or unpublished).

Scope and purpose of the project

This project includes construction of 11.6 km new double track between Sandvika and Asker including works in tunnels and stations. The new tracks are partially laid along the same parcel as the existing rails and partly in tunnel. The project is divided into three main areas: stations, tunnels and railways. The Asker-Sandvika Project was a sub-project of the larger Asker-Skøyen project. The project was started in 2001 and finished in 2005, The cost of the project was also 4.065 billion NOK.

The purpose of this project is to increase the capacity of the Drammen Line. The capacity of the Drammen line was fully utilized due to significant growth in local and regional rail transport in the Oslo area. Therefore, railway capacity had to be developed in order to permit continued growth. In the early 1990s, it was assessed that the train services on the double track from Oslo and west had capacity problems. A significant expansion of homes and businesses in the Fornebu area was expected, where Oslo's former main airport had phased out in 1998. Therefore, building another double track between Asker and Skøyen in which the Asker-Sandvika double track project is included was planned, see Figure 4-1.

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[1] Source: Jernbaneverket website
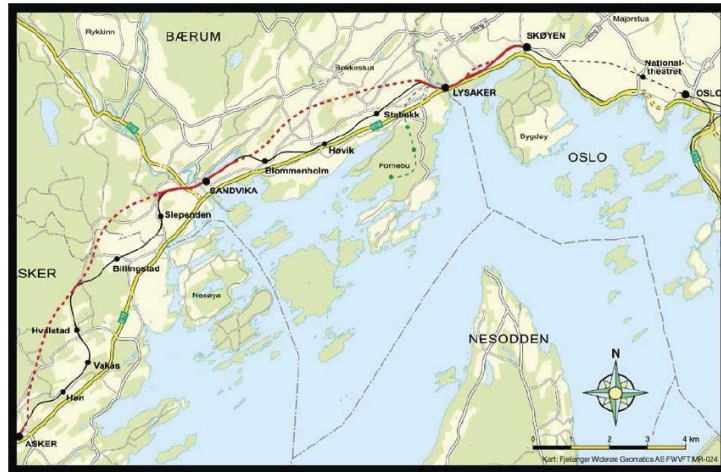
4-1. Asker-Skøyen Line (Nilsson, Nyström, & Pyddoke, 2012)

The entire investment Asker-Skøyen is divided into four sections as indicated in the following table but the main purpose of this study is to evaluate Asker- Sandvika line, the 11.6 km of new track, mostly in tunnel.

Sort	Start	Finish
Sandvika - Asker	2001	2005
Lysaker stasjon	2006	2009
Lysaker - Sandvika	2007	2011
Skøyen - Lysaker	Unclear	

4-1. Sub-projects of Asker-Skøyen line (Nilsson, Nyström, & Pyddoke, 2012)

According to Nilsson et al. (2012) the objectives of Asker-Sandvika double track project can be summarized as follows: (a) increasing capacity, (b) reducing travel time, (c) increasing public transport share and (d) improving local environment by the investment.

Previous assessments on the project

The project is described as a success by JBV. This means that performance targets are reached and that the process has been successful. JBV believes they have facilitated the achievement of the other goals set for the entire Skøyen-Asker line. According to Nilsson et al. (2012) by definition, the project has met the capacity enhancement target, The project budget was 4.065 billion NOK and it is obvious that there has been a cost overrun of about five percent, but for

such a large project this seems to be close to target when comparing with experiences of other similar projects. Also, the line was opened on time for traffic.

Finishing the project on time and within budget does not mean that the process has been flawless; it has faced several challenges along the way. The implementation of the Asker-Sandvika project has faced various challenges, and it was apparent that some parts would be done differently of what has been planned. The problems that arose along the way were resolved in a good way, probably because of acting on time on identified early warning signals.

4.1.3 Challenges involved in the project

One of the major challenges in this project has been the new organization of JBV[2]. The new organization needed more experience from larger contracts. At that time both JBV and contractors had much to do, many people who had little experience were given tasks they would not be given normally, this could cause negative effects on the project. For many yeas they were responsible for maintenance projects and they got surprised when the rail track project was assigned to them suddenly. JBV did not have the experience of that size project which had to be run in a short time. The project consists of 19 construction contracts, divided into subprojects such as stations, tunnels, railway engineering and upgrading CTC (Centralized Traffic Control). In addition to these, there are engineering contracts and contracts with vendors which JBV is responsible for. It was recommended to merge contracts, particularly contracts for tunnels. But as soon as calculations indicated a raise in cost by merging contracts, the strategy of merging was not implemented. So, the project was large and consisted of many small scale contracts. Interfacing all of these small scaled contracts was not easy. It seems that some suboptimal decisions were taken in the project and coordination was not good enough. This meant that the project leader got a bigger responsibility than what was originally planned. He took on a coordinating responsibility for project managers which originally was not his responsibility. Therefore, the project faced with changes in the organization during its lifecycle and it seems that individuals were given responsibility for which they were not fully qualified. According to the expert, the organization of the project was not appropriate from the beginning. The good results can to

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2 JBV was formed in December 1996, when the former public enterprise NSB was split into NSB BA and JBV.

some extent be attributed to individuals' willingness to take on responsibilities that were not normally required of them.

At the beginning of the project a guidance document for Sandvika-Asker was prepared. This was later extended to the entire Skøyen-Asker line. The project has delivered many different issues of governance document, indicating that it was a living document throughout the project and continues to be a living document for the remaining projects in the development area Skøyen-Asker. Such control document that includes the entire line contains less detailed information. This is perceived as potentially negative. It is likely that the generalization of document management makes it less relevant as a management tool for the individual projects.

In addition, the main objective at the early stages of the project was to increase capacity and reduce travelling time. But Sandvika-Asker project was a part of a bigger development project and conducting this project alone could not fulfill this objective. Social goals that apply to the Asker-Sandvika project is formulated for the entire Skøyen-Asker line and the project will not reach social goals before the rest of the stretch is complete. JBV believes they have taken the first step towards achieving the goals of improved service to local and airport trains/freight and district and regional trains.

When the ministry of transport (owner) got KS2 (kvalitetssikring) report they told JBV that they can decide upon how to use it in project management. Initially the project did not respect the advices given by KS2 report and no changes were made in the cost estimations resulted from different internal reports. When it later became clear that the project was going to go over the agreed cost framework, a new uncertainty analysis was planned under the auspices of the project organization itself. In connection with this analysis a cut list was reviewed and the cuts in relation to the project's original plan were completed. Based on the analysis, a new management framework, and cost framework was established and reported to Parliament through the Proposition. The cost cutting strategies included many changes in the functionality of the project, for example the size of tunnels and the speed of the train had been changed according to those strategies. These changes were decided a little too late in the project. So many change management strategies were required as the scope of work had been altered comprehensively. According to Kalager (2003) around 60% of the imitable elements which were sources of cost overrun could be removed from the project. Some of the most important cuts were:

- Reduction in designed speed from 200 km/h to 160 km/h, this gave a cost reduction of 6.2 million Euro. This reduction would limit the future maximum speed (Kalager, 2003).

- The planned train turning station was not built. It was planned to have a turning station by which trains could end at a municipal center without loss in capacity at the station serving this center. The cost reduction was around 4 million Euro (Kalager, 2003).

- All of the planned cables in the largest station in the project were removed in roofed platforms, stairs, and ramps. It required a redesign in the platform and a new safety analyses for the public areas. The cost reduction for this elimination was 1 million Euro excluding costs of redesign and safety analyses (Kalager, 2003).

According to Krane (2010) the total cost saving of this reduction list strategy was 21.1 million Euro. The cuts in cost reduced the functionality delivered, which was asserted by the project organization. In addition, the decision was immutable when it once made and there was no room for reconsiderations (Krane, 2010). Furthermore, when Krane (2010) did the interview he understood that still many of the internal disputes regarding the functional effects of the reductions had not been solved yet. So, the project uncertainty was increased by implementing the reduction list without a reassessment and without settling the resulting disputes. It was also claimed that a conflict sometimes happened between maintaining the functionality delivered by the project and keeping within the budget limitations (Krane, 2010). According to the expert, the project ended up with many changes that they did not know how to manage it; it required a lot of quality and change management.

The conditional frame of the project has been changed by the leaders in JBV. When the project was planned JBV had a frame of deal on the signal construction of Ebilock[3]. It was not clear that the signaling system is going to be used but it was terminated by JBV during the project. It caused that some works lose its value. Plus, the new signals system was more expensive and led to a cost more than the first estimation. Therefore, a new uncertainty analysis and establishment of a new cost frame was required in 2004. Uncertainties related to signaling systems at the largest station caused large amount of unexpected extra cost and the system which was planned firstly was replaced by a system from another vendor, and it caused added cost of 25 million Euro (Kalager, 2003).

Other challenge was related to the budget of the project, allocations that project received from the Parliament does not give an accurate idea of how much money the project has to use each

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[3] Framework for The signal system

year. JBV practiced portfolio management where the money was allocated to the projects according to how the agency found it most appropriate, although this involved a different division than the one that was decided in Parliament within the year. It was still necessary for the project to gain flexibility by coming into an agreement with any of the contractors on production before funding came from Parliament in connection with the new cost that had to be approved. Therefore, the risk of excess production by contractors was added, but the project had to pay for this through interest expenses. The intention was to do it at the contractor's risk and accept higher costs for the project in the form of accrued interest because of late payments.

The project Asker-Sandvika has been organized under the Development of Skøyen-Asker Unit. The project had a leader of the whole development unit who should define project administrators for this project as well. The project also had a project leader with decision authority to establish functions for project experts. Under project experts, the project has been organized and dedicated to people for constructing tunnels, building stations, railway engineering and land acquisition. The project managers worked more or less as independent sub-project managers without sufficient coordination and cooperation. This was a challenge for the project as the decisions were not integrated. The project leader holds responsibility for collecting project leaders around common goals. At the beginning of the project, all the capital up to the expected cost was spread out to the project managers for the various subprojects. There was no central pot to cover uncertainties regarding changes that could not be attributed to individual subprojects. Project leader believed that these funds should result in a central pot. He succeeded this and took a role as responsible for approving such changes and distribute to project managers as required. The project's top decision-makings were through the project meeting. This meeting was attended by all project managers and all leaders. The meeting was held normally every 14 day. The project's reporting was based on guidelines in contracts. Providers reported to the responsible construction manager pursuant to the provisions of individual contracts and the contractor's own quality assurance system. Construction Manager was responsible for approving the content of these reports and used them as the basis for a report to the project leader who in turn reports to the project manager.

In addition, one of the important backgrounds forming the context for this project was the experience from the Gardermoen project a few years earlier. Between 1994 and 1999, a high speed rail line from Oslo to the new main airport (Gardermoen) was built, 48 km in the north of Oslo. A 14.5 km long tunnel was included in the line. When constructing the tunnel large

amount of water was drained in and the sealing material became controversial (Krane, 2010). This problem became a large issue in media and also became a political issue. Finally the project was delayed with 215 M€ of cost overrun (Mydske, 1999). According to Smedstad (1997), analyses of the project's handling of news media resulted that the project "lost the battle about reality". This experience caused the project organization and JBV becoming determined that this should not happen again and emphasizing the importance of avoiding cost and schedule overruns and negative media assessments for later projects (Krane, 2010). The experience caused expensive strategies for keeping the tunnel drier. The tunnel was a large part of the work and implementing the strategy would require huge amount of uncertainty analysis on the project and training staffs. In order to secure the project from those overruns and bad reputations through media, JBV for the new project developed a communication strategy at very early stages. This strategy underlined the importance of the project's relation to the environment and the importance of proper information for reducing project's uncertainty. The strategy included issues related to taking care of neighbors, passengers, local authorities and ways for handling critical situations. Building a good reputation and reducing uncertainty required good communication and information sharing. In addition, one of the JBV's success criteria was building a good esteem. The project was proactive in nature by informing neighbors about upcoming activities. Some full-time employees were considered for handling information and contacting neighbors. A good trust had been created by the specific attention to neighbors, an example is a stone which went through the roof of a school through tunnel blasting and harmed a pupil, but the headmaster of the school said that "we are absolutely confident that JBV has this under control" (Krane, 2010).

Implementation of the strategies worked well. This is reflected in the good achievement of goals despite of the additional challenges related to the termination of the framework agreement with Ebilock. The excess of the original estimated cost was identified at a time when there was still room to carry simplifications and reductions for reducing costs. Therefore, basic steps were taken when necessary. The project management shall be praised for dealing with this challenge.

According to Krane (2010) the management of the internal stakeholders was less successful in the project. The use of simplification by the use of reduction list and not to install platform heating at the largest station reduced the functionality of the infrastructure delivered by the project while stakeholders in JBV believed that it would have a minimum effect on the

functionality. In addition, there had been a mismatch between statements about project's functionality indicated that there had been a lack of cooperation internally. The focus of uncertainty management had been on the issues related to cost and time overruns and the risk management regime seems to have focus on avoiding negative risks, and functionality was less in focus in this project. Different stakeholders have different interest (A. Jaafari, 2001), but it seems in this project the primary focus was on delivering the project within budget and schedule and the interest of owners regarding delivering functionality was not considered as important (Krane, 2010). The project of double track Asker-Sandvika has developed the role of project leader to something considerably more than what is traditionally the basis of project organization models. Project managers took over functions traditionally found in project manager role. This contributed to the increasing spans of control and expanded responsibilities. The role caused lack of internal coordination between the subprojects which probably was important for the result. Therefore, this case project effectively managed relations with external stakeholders by reducing risk of negative media attention, reducing disputes with neighbors and cost and time overruns following those disputes. While, less attention was given to internal JBV's stakeholders and project functionality. Uncertainty management's focus was on risk with little attention to opportunity management. The project was successful regarding external stakeholder management, while internally there was a potential for conflicts among stakeholders, this potential risk turned into a real problem in that project and led to many negative issues. Dealing with stakeholders in the project also worked well. The development occurred in an area with many powerful stakeholders (individuals, groups and companies). It was taken into account by blasting vibrations and implemented sound damping structure that reduced noise by passing trains. This was understood because there have been no complaints from neighbors in the implementation process or afterwards.

Following table (4-1) summarizes the challenges involved in this project.

Challenges involved in this project	
1	New organization of JBV and lack of previous experience with that size project
2	Assigning tasks to unqualified and unexperienced people
3	Initial sub-optimized decisions had been made. The project consisted of 19 different contracts which were not integrated.
4	A generally defined project governance for the whole Skøyen-Asker line and lack of guidelines in details for sub projects including Asker-Sandvika line
5	Lack of independent and clear goals for this project. Achieving goals were dependent to the success of other sub-projects
6	Not respecting initial advices given by KS2 report.
7	Facing with many changes in the initially planned frameworks in the middle of the project and lack of reassessments
8	Lack of agreements between JBV and parliament for allocating budget
9	Lack of cooperation and communication among managers of different parts of the project
10	Too many hierarchies in the reporting system
11	Too much focus on external relations and building a positive reputation
12	Focus on short-term objectives rather that functionalities of the project and long-term objectives
13	Lack of attention to internal relations
14	Lack of initial agreement about maintaining functionality or respecting cost cutting strategies

4-2. Challenges involved in Asker-Sandvika project

4.1.4 Analysis of case 1

As it can be understood from the case description, the organization of JBV was new at the time the project was introduced and they were lacking experience from projects with the same size of Asker-Sandvika double track. This lack of experience could lead to missing many early warning signs as people were not aware of challenges involved in projects in this size. In Finding 10 also it was noted that lack of knowledge about possible sources of information

can lead to missing many signals related to those ignored sources. As Åberg (1993) mentioned, environmental scanning is about examining sources of information and issues, different systems of observing the signals and analyzing the environment. Considering this definition of environmental scanning, as the people in JBV were lacking experience, it could be possible that many sources of information be ignored when scanning environment. Therefore there had been the probability of missing many early warnings related to those ignored sources of information. In addition, as mentioned in the literature, environmental scanning can help in making strategic decisions. In this project tasks were assigned to those who did not have enough experience, this could lead to not recognizing many issues and signals which would affect the future of the project. Therefor many strategic decisions made at the beginnings of the project could lack the use of correct considerations resulting from environmental scanning. As Albright (2004) claimed previously, understanding external influences and internal responses are required for being effective in uncertain environments, as was obvious from the case description, that the project faced with many challenges related to different changes. These changes could be managed and controlled more effective if strategic decisions had been made at the beginning. As the Finding 1 reveals, in a changing environments there are many sources alarming future problems, ignoring or missing each of the sources may lead to loosing early warnings related of potential future problems. In such a project with little experience this issues seems relevant in missing signals. The project has been faced with many changes during its implementation; and implementation of most of the changes was decided upon too late. It seems that the project was lacking appropriate strategic decisions from the beginning. By Finding 2 it was claimed that if projects are missing appropriate strategic decisions, there is a high probability of missing many early warnings and alarming signals later in the projects. Ilmola and Kuusi (2006) also referred the importance of mental models when doing environmental scanning and letting signals to be passed through different filters. As in this project people were lacking experience and knowledge, it is possible to say that some errors might happen when filtering the signals, this issue was noted in Finding 16 as well. Furthermore, the project consisted of 19 different contracts which were not integrated because of high cost of integration. It can be a reason for missing many early warning signs which could be identified by integrated contracts. Also, it was obvious that the project was lacking cooperation among different parts of the project; this could be another reason for missing many early warning signs which could be identified through better cooperation and integration. The leaders of different subprojects were not qualified and were lacking experiences from those tasks which were assigned to them. Therefore many signals

would be missed because of suboptimal decisions that had been made and lack of holistic strategic decisions in this project.

One of the challenges involved in the project was the fact that Asker-Sandvika project was a subset of the whole Skøyen-Asker project. In addition, as mentioned in the case description, the guidance of this subproject (Asker-Sandvika) was not in details and specific for Asker-Sandvika line. It was prepared in a more general way and was used for the whole Skøyen-Asker line. As noted through literature review, according to Patel and Robinson (2010) a project which is lacking a single governor is highly vulnerable to risks. An appropriate project governor would be followed by clear leadership, better decisions, and speed up in processes (Patel & Robinson, 2010). Therefore, in this project, as a specific governance and guidance for the Asker-Sandvika project was lacking, it seems that the general governance could not provide details related to plans for identification of early warnings specific for this subproject (Asker-Sandvika). In addition, as Sanderson (2012) claimed, misaligned governance mechanisms would lead to not being able to make quick decisions and being responsive in turbulent environments. In this project it seems that the general governance and guidance were not aligned with the characteristics of that project, it could lead to missing many signals and not being responsive on them. As Figure 3-20 indicated, each project require different types of governance including relationships governance, change governance, financial governance and so on. From the case description it was obvious that the project faced with many challenges related to the changes, financial problems and so on. It is possible to say that those types of different governances for Asker-Sandvika project were lacking. If there had been such complete governance, early warning signs of those challenges could be identified earlier and many later problems could be prevented. As mentioned in Finding 32, an ill-defined or incomplete definition of governance might misdirect people and could be one of the barriers of identification of early warning signs. According to T. Ahola et al. (2013) different projects have differ sizes and different number of stakeholder, therefore considering a general governance for the whole Skøyen-Asker line was not the best decision as each of the sub projects has its own size, complexity, number of stakeholders and many other characteristics. Finding 33 is supporting this claim. In addition, as the project was lacking appropriate governance based on Figure 3-22, it is possible to say that the project was also lacking proper risk allocation strategies. That is why; many changes and uncertainty analyses were required later in the project. As mentioned by Finding 35, project governances taking into account risk allocation strategies are more proactive in nature. Those changes in this

project indicate the project was reactive in nature rather than being proactive. It can be said that as there had been no specific plans for recognizing early warnings in that project, it faced with those mentioned challenges. According to Williamson (1996), governance is critical in risk management and achievement of objectives, it also ensures standards, procedures and controlling mechanisms are in place. In addition, as mentioned in the case description, the project consists of many contracts and different parts, it required a holistic governance which could govern all of the parts in connection with each other, otherwise many of the signals related to the connection of those parts would be missed (Finding 42). In such general governance important success factors of Asker-Sandvika project were missing. Considering Finding 47 and as Kappelman et al. (2006) mentioned, projects require success factors to be considered in their governance. For this project, because of general governance it seems that many success factors were not discussed in details at the beginning. This could lead to missing early warnings later in that project.

Asker-Sandvika project goal would not be achieved completely until all of the other sub-projects of the whole Skøyen-Asker line could achieve their goals successfully. Therefore measuring the project success and judging its performance was not easily possible as success of the project was dependent to the performance of other projects as well. White and Fortune (2002) did a study about the most important factors influencing project success and their result indicated that clear goal and objectives were one of the crucial factors in the success of projects. In addition, as Kappelman et al. (2006) claimed, unclear goals would have effect on the commitment of team members, this could lead to being late, going over budget, and not delivering the promised scope. Therefore, considering clear goals as one other success factors which could be highlighted in the project governance could help people in clarifying projects tasks and activities. With such a clear objective identification of early warnings could be facilitated. It is possible to say that one of the reasons of the changes in the scope and functionality of the project was lack of clear objectives from the beginning.

At the beginning of the project parliament provided JBV with KS2 report in which some advices related to cost estimations had been given. But, as mentioned in the case description, JBV did not use those advices initially and they just followed their own estimations based on their own internal reports. It can be a sign of optimism bias phenomenon in JBV. According to DeJoy (1989) optimism is about being unrealistically optimistic about probable future risks in different events and situations. In this project also it seems JBV was optimistic about possible risks of cost overrun in this project, that is why from the beginning they did not take

into account advices given by KS2. So, optimism bias could be considered as one of those barriers of identification of early warning signs. As mentioned in Finding 27, if those who are making strategic decisions and those who are scanning environment are optimistic, many of early warnings might be missed and not be considered for more assessment. In addition, as mentioned in the case description, the focus of this project had been on cost of the project, and they implemented some strategies by which they could cut some sources of cost overrun. For example the speed of train was reduced in order to bring cost down, while this could lead to limitations in future maximum speed of the train. According to Choo (1999) in order to be able recognize most of early warnings, all sources of information should be considered. But in this project by only focus on cost it seems that many signals related to other sources could be ignored. In Finding 6 also it was noted that an environmental scanning with focus only on some specific issues may lead to missing many issues related to other dimensions of the organization. Furthermore, in the case description it was written that after making decisions in the project, reassessments were not done and still there had been many conflicts internally about giving priority to functionality or cost reduction strategies. Therefore the lack of reassessment could be a reason for missing many signals related to the new systems. Finding 11 also indicated this issue, looking for predefined signals and those signals which were identified at the beginning and forgetting the need for updating the list of probable signals can be a barrier of identification of early warning signs of the project. Also, as mentioned by Reinhardt (1984) 80% of employees usually look for 30% of the most important indicators, therefore many other signals would be missed. In this project also it seems that the focus of the employees was given on cost cutting strategies and other issues such as functionality had been neglected. In addition, as described in the case, there had been some internal conflicts about maintaining functionality or sticking to the cost cutting strategies. Therefore, it is possible to say that overlooking external environments and overemphasize on cost reduction strategies had been a barrier for identification of internal problems and signals such as the conflict among internal stakeholders. Finding 12 also noted this point.

As in the case description was noted, there had been the probability of overproduction by the contactors, because JBV was coming into agreements with contractors after receiving budget from parliament. Therefore, it is possible to say that an integrated system which could link data from JBV to parliament and vice versa was lacking in this project. Such an integration system could lead to identification of many early warning signals and could improve communication among those parties; therefore many cost overrun problems could be

prevented in this project (Finding 53). Existence of an integration system and standard ways of communication not only could reduce the probability of overproduction and overruns, but also it could provide a plan and standard for effective communication with sponsors, it could also improve budget allocation among portfolio of JBV projects. As mentioned through finding 24, different assumption and perceptions by those who are communicating can be a reason for missing many early warning signals. It seems that in this project consensus among members upon budget allocation was lacking. According to Kappelman et al. (2006) if members do not agree on tasks, they may not know how to accomplish the whole project outcome. Considering this, it had been very important for JBV to come into consensus with contractors before receiving budget from parliament. As mentioned in Finding 47, lack of clearly defining success factors would be a reason for missing many signals, success factors such as a clear agreement on budget allocation could identify many signals of cost overrun. In this project it seems that lack of correct future anticipation also had been an issue. As mentioned in the literature, when future cannot be imagined there is a high probability of ignorance (Pender, 2001). This project also had been uncertain and faced with many changes during its life cycle.

As was mentioned in the case description, there were many challenges related to leadership and management of the project. It seems that the project was suffering lack of integration and many sub-optimized decisions had been made. The sub-optimized decisions could endanger the whole project especially when changes made in one subproject could lead to changes in the whole set of projects. So, as the project consists of many subprojects (tunnels, stations and so on), there had been a high probability of missing many early warnings signs due to lack of integration and communication among those sub-projects' leaders. The communication in that project was complex and many communication challenges were involved. Therefore, as claimed by Wiio (1989) the message and signals could be faced with many communication problems such as noise in communication when it was transferring from sender to the receiver (Finding 19). In addition, it was noted that there had been many hierarchies in reporting system of the project, in such hierarchies there had been the probability of changers in the content of those reports when passing though hierarchies. As mentioned by Blankevoort (1984) people usually have different perceptions about the same topic. Also, Finding 20 emphasized the important of the same perception of issues among senders and receivers, otherwise communication would be insufficient and it could lead to missing the actual early warning signals mentioned in those reports. Also as mentioned through Finding 21, there had

been the probability of ignoring early warning signals, if those who are acting upon signals do not consider them as important as those who are identifying those signals. In this project this could happen as there had been many hierarchies in decision making and reporting systems.

In the case description it was written that too much attention has been given to satisfy external stakeholders including neighbors and providing a good media reputation. Therefore it seems that many other issues were not as important as external relations. It could lead to missing many signals related to internal relation of that organization. As mentioned through Finding 6 an environmental scanning with only focus on some specific issues may lead to missing many issues related to other dimensions of the organization. Internal relations in such a challenging project could be as important as external relations. In the case it was emphasized that sometimes conflicts raised internally, this is a sign of lack of attention to internal stakeholders. In addition, internal relationship among stakeholders was weak; it could be another cause for missing many signals which could have been identified through proper communication. One of the reasons of focus on external relation in this project and forgetting about internal factors could be the governance of the project. The governance focus on making a good reputation leads to a culture in which people ignored the importance of other sources of information. Probably that governance included many external risk allocation strategies and was lacking a proper internal risk management. It is possible to say that because the governance was lacking required analysis of internal norms and standards, there had been a high probability of facing with normalization of deviance (Finding 39). According to J. Pinto (2013) some behaviors that do not seem as normal outside an organization, can become a norm inside the organization if people accept them, repeat them and get used to them. In this project also due to lack of internal assessment many behaviors which could be a sign of future problem had become a norm in that organization internally and were not recognized as important signals of potential future problems.

Following table (4-2) indicates some of the barriers of identification of early warning signals in this project:

Possible sources for missing EWS	Leads to…	Possible problems are…
New organization of JBV and lack of experience	- Not having experience of this size project. Therefore, not being aware of possible future problems - Not consideration of many signals into account when making strategic decisions - Defining a governance which is not suitable for that project	- Being surprised by unexpected problems - Spending a lot of time and money for re-planning and implementing changes - Spending a lot of time for training and not having enough time for environmental scanning - Being reactive rather than proactive
Inappropriate governance (Generally defined governance for the whole Skøyen-Asker line)	- No detailed planes for the whole work, therefore having no systematic method for identification of signals - An incomplete risk allocation strategy which is not taking into account all of the possible problems - Wrong filters and mental models when doing environmental scanning	- Spending a lot of time and money for wrong methods of work - Facing with many risks and overruns that were not planned at the beginning - Spending a lot of time and money for sudden changes in the initial frameworks - Being reactive rather than proactive
Focus on delivering project within time and cost budget	- not being able to spend time for other considerations - not being able to consider some strategies because of being expensive or time consuming - not being able to pay attention to functionality of the project and long-term perspectives	- Delivering results which are lacking promised technical capabilities and functionalities - Reduction in users' satisfaction - Bad reputation - Failure in long-term perspective
19 different contracts	- Not being able to integrate all of the parts and contracts - Not being able to communicate properly - Not being able to define a governance which can consider all of the details of different contracts into account - Lack of holistic view and missing many signals which arise in connection of different parts	- Spending a lot of time and money for integrating those incompatible parts - communication barriers and facing with conflicts - Being reactive rather than proactive - Making sub-optimized decisions which may lead to later overruns

Possible sources for missing EWS	Leads to…	Possible problems are…
Optimism bias among members	- Ignoring guidelines given by KS2 report	- Not being aware of cost related signals, missing them, and facing with cost overrun - need for re-plans and changes in the initial frameworks which are time and money consuming
Many hierarchies in reporting system	- Communication barriers and probability of change in the meaning of signals and missing first identified signals - change in the meaning of the first identified signals - Passing among many different mental models	- Acting on signals that are not similar to what had been identified from the first place which is time and money consuming - ignoring signals because those who are acting on signals does not consider them as important as those who identifies them
Too much focus of external relations	-Missing internal problems/signals - Missing many soft issues - Lack of trust among team members	- conflict may arise and many signals would be hindered in such situation - lack of trust among team members and not expressing signals that already have been seen by them - Facing with many overruns that were not thought about initially(issues related to missing soft signals)

4-3. Possible barriers of identifying early warning signals in Asker-Sandvika project

To summarize, it seems that the original planning of the project was too weak. According to Locatelli et al. (2013) poor performance of projects are the result of poor planning and project definition at early stages. As mentioned by the interviewee at the early stages of the project there had been no establishment of a system of external quality assurance or practice of establishing cost. But as soon as an increase in the cost framework was felt, many cost cutting strategies started to be implemented without a mature basis. It also seems that the planners did not consider the high uncertainty of the project into account when they were making the plan, so the plan was not flexible enough; when decisions were made there had been no space for reassessments. It also seems that the project did not consider enough uncertainty in their cost calculation, and thus recommended higher limits than the project operated with. The project retains its original plan until they realized that the project would have significant cost overruns. Then there was a new and large uncertainty analysis which resulted in a higher estimate of the expected cost and with more expressed realistic uncertainty. The new

uncertainty analysis was used actively in the remaining part of the project. It was followed by proactive monitoring of risks in the risk register with the specified consequences and probabilities. Identified uncertainty elements and recommended risk mitigation measures identified in KS2 were relevant. The project carried out a number of the risk mitigation measures identified in KS2, and also measures that were identified by the organization itself. This has contributed positively to the project. Therefore, in my opinion, the most important problem in this project was the issues of optimism bias among decision maker and its inappropriate governance framework which could lead to many challenges into the whole project. The project was lacking appropriate governance specific for Asker-Sandvika double track project. The general governance did not provide detailed guidelines for managing the project, that is why many changes were required later in the project and many early warning signals could be easily missed. Appropriate and complete governance which could make standards and plans for all of the important project related issues, such as communicating, reporting, and analyzing risk and so on could help in being more proactive and identifying many signals of future discontinuities.

4.2 Case 2 (The Opera House)

4.2.1 Case Company

Statbygg is a public sector administration company which is responsible to the ministry of government administration, reform and church affairs. Statbygg should provide appropriate, functional premises to public sector enterprises, as well as realizing prevailing sociopolitical objectives in relation to architecture, governmental planning interests, preservation of heritage sites and the environment.

Statbygg will provide guidance in the purchase and leasing of premises and act as building commissioner on behalf of the Norwegian government. As a building commissioner, Statbygg plans, quality assures budgets and follows up construction project. However, the actual design and construction of buildings is implemented by independent architects, engineering companies and construction companies. Statbygg organizes plans and implements around 160 projects (large and small) of which 20-30 major projects are completed every year.

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[4] Photo by Hans A. Rosbach (2007)

4.2.2   Case project and previous assessments on the project

The national Opera House located in Oslo in the harbor area of Bjørvika is a tremendous increase for culture in Norway. Opera house is the home of Norwegian national opera and ballet and also the national opera theatre in Norway. The client of this project was Statbygg and the project was owed by Oslo municipality. The project contained 52 different contracts with different contractors and the main architect company was called Snøhetta.

The project was started in 1999 and completed in 2007. It was also opened in April 2008. The construction of the project was started in 2003 and finished in 2007, for 4 years, and it was finished ahead of schedule. The project cost is approximately 4.4 billion NOK, it was also 0.3 billion under budget. The project has been a winner of culture award and stands out from other buildings in that area due to its specific size and its design. It appears as a national symbol and the innovative designed building with rectangles sides which provide a specific experience.

After years of debate, in 2000 the Norwegian parliament decided to finance the new opera house in Oslo. A part of the harbor area was undeveloped and the winning team came up with a low-rise important building to be replaced at the waterfront in that area.

The public debate was about the price tag. The first estimate was around 0.2 billion US dollar. After two years the estimation became more realistic and was estimated around 0.5 billion US dollar. But the price might have been increase to 3 billion US dollar if other necessary infrastructural development were included (Samset, 2003).

There had been many forces for and against about the project and it was highly controversial. The debate was mostly about the project budget and alternative ways of using the funds (Samset, 2003).

According to Samset (2003) there had been three suggested objectives for implementing the project as following:

- Increase tourism to Oslo, from inside and outside of the country for visiting the building or the opera performance.
- Increase in the cultural activities in Norway, the Opera could be a locomotive for cultural development and art.
- Development in the neglected part of the harbor in Oslo, as the existence of the Opera could attract investors to modernize and reconstruct area.

Increase tourism:

According to the amount of planning in this project and the competence of the contractors that were involved, the project is considered to be efficient in terms of cost, quality and progress. In term of effectiveness, as Oslo has less than 0.5 million population, it is not likely that there would be a major increase in the number of audiences even when new Opera is existed. Therefore, the economic impact of the project is limited. In term of relevancy, majority of people are against the project and believe that the fund could be used for alternative projects. In addition, the effect of Opera on tourism would be limited in comparison with the existence of other attractions. And in term of sustainability the project is considered as a disaster, the cost recovery might be less that 10% and soon in the coming years more than 50% deficit annually will be needed for the building to operate (Samset, 2003).

Increase cultural activity:

According to Samset (2003) its efficiency can be accepted. Its effectiveness is low and in terms of impact, it seems the project will have limited impact on cultural activities. In terms of relevance, the same fund could be used for other cultural activities in different parts of the country. And finally regarding its sustainability, the opera house is going to have an adverse effect on other cultural activities financially (Samset, 2003).

Urban development:

Efficiency is positive in this case as well. In addition, effectiveness of the project in case of urban development is uncertain and difficult to be assessed. The impact of the project of urban development also is uncertain and depends on many other issues. Relevancy of the project in this case depends on the financial viability of the urban development project (Samset, 2003).

To sum up, Opera project seems to fail supporting all of the three strategies and the project is not relevant in fulfilling the overall goals, there might be other alternative use of funds that could be more effective. According to Samset (2003) the project was not financially sustainable and financially, it is a disaster as a project.

Like other major projects such as pyramids or Eiffel tower, Opera house was not based on rational thoughts and politically expressed needs. Opera house might become a success in a perspective of decades and centuries (Samset, 2003).

4.2.3 Challenges involved in the project

One of the main challenges and problems in the project was the project horizon for approximately 10 years period. In such a long period technology and environment are changing rapidly. The old organization had to continuously update peoples' knowledge by providing required education for them, advanced level of programing was growing and new equipment were going to be introduced which needed users with high degree of education and profession in using them. According to the project experts, the owners did not understand the complexity of the project easily. As the market was changing, the strategy required many changes during project horizon. From the beginning many analyses were required, one or two uncertainty analyses were required each year due to rapid changes in the market. In other worlds, the organization needed to be prepared for 10 years ahead; it was a very big challenge for opera house project.

The project had to consider a horizon of 10 years from the beginning. In addition, they needed to consider a buffer for the next 10 years expenses and required changes considering the allocated budget and scope of work which had been confirmed and signed by government. According to Norwegian law, all of the state projects, road, railways, airports and construction projects which were budgeted more than 750 million NOK should go through a quality assurance process. For this opera house also the project went through quality assurance process and it required being controlled strictly by the financial department. Opera house was the first building in Norway which went through quality assurance process.

Other challenge was related to a balance between the design of the building (in order to differentiate it from other buildings in that area) and a design which is suitable for being an opera house. According to the project experts, the opera house in Sydney is not suitable for being an opera house internally. There was a need for controlling the architect and the use of the building as an opera house. Snøhetta as the main architect needed to decide upon giving priority to the functionality of the building or its design.

There had been some technical problems, specially related to stage equipment, there was a need for around 16 advanced elevators for the building and a few suppliers were able to fulfill this demand. Some contracts were too big and the small contractors did not have enough capacity for the whole work, so they could not have progress as plans. Statbygg did not see the limitation in the suppliers' capacity from the beginning. Even when they wanted to hire more employees, there were not many available resources in the market due to high demand for such tasks.

There had been some political administration problems, statbygg had to choose among Norwegian sources not from other countries.

Other important challenge of the project is related to its construction in the harbor area. Construction of the building required 50% of the building to be built on land and the other 50% on sea. The area around the building is clay and it may sink slowly, the level of the ground is sinking. Therefore making the foundation for the building was very challenging and could lead to many difficulties during construction of the project.

Following table (4-3) summarizes the challenges involved in this project.

Challenges involved in this project	
1	Conflict over concept of the project at early stages
2	Long horizon of the project (10 years)
3	Need for updating technologies and knowledge, and implementing changes, many analyses were required
4	Technical complexity and a few contractors were available
5	Small contractors were assigned large contracts, while they did not have enough capacity
6	Difficulties in hiring resources because of high demand in the market for such resources
7	Maintaining balance between both the design of the building and being suitable for an opera house
8	Predicting challenges involved in this project from 10 years ahead and defining an appropriate governance for such a long horizon
9	Construction of this project in the harbor area
10	The project consisted of many different contracts (52 different contracts)

4-4. Challenges involved in Opera house project

4.2.4 Analysis of case 2

According to Artto and Kujala (2008) projects are dynamic and complex in nature and they require open system mechanisms which can be adapted to the changes, the mechanism is called governance. Considering this definition of governance and as the horizon of the Opera house project had been around 10 years, it needed governance which could be adapted to the changes that the project could face during the long-term horizon. In addition, according to Muller (2012) the purpose of project governance is predicting delivery of project and contributing in successful delivery of projects' objectives. Based on this, it is possible to say that in such long term horizon it was not easy to anticipate and predict how the project will progress and achieve its objectives after 10 years. Planning and predicting for the next 10 years could increase the likelihood of ill-defined governance in which many situations could not be considered (As future is uncertain), therefore many early warning signals could be missed easily due to lack of awareness about future states. When future cannot be imagined there is a high probability of ignorance (Pender, 2001).According to the expert, during the project implementation many new equipment and technologies were arising which required many training and spending both time and money for learning how to use them.

Furthermore, as previously described, the project consisted of around 52 different contracts. If we consider each of those contracts as subprojects of the whole Opera hous, it is possible to say that all of the subprojects required governance which is open and flexible in nature and is a subset of the governance of the whole project and organization. According to Too and Weaver (2013) an organization consists of a hierarchy of subsystems each of them has its own governance and those governances need to support each other. Such governance was crucial for directing each of those subprojects and being updated to the situations and also it needed to support the whole goals of the project. It is possible to assume that lack of such complete and adaptable governance for this size project could be a barrier for identification of many early warning signals. according to Ruuska et al. (2011) there is a need for an open view toward large projects embedded in institutional environments as they are operating in complex contexts with many stakeholders and cannot be governed by closed systems of a few stakeholders. Also, previously through literature it was noted that a list of early warning signs would be changed by changes in the environment when project is progressing. Therefore in this project, with a horizon of 10 years, it seems that the list of early warnings needed to be updated continuously; otherwise many signals would be missed. Finding 33 also emphasized the importance of suitable governance, governance which can be matched with the

characteristics of the project. Otherwise, the governance would misdirect team members when they are doing operations, it can be a barrier for identification of early warning signals.

According to Guo et al. (2013) major infrastructure projects with many tasks and features require more organizational structures in order to be able to deal with more number of risks management elements. In addition, according to the authors, project governance provides a structure mechanism for identification of risks as they occur. Therefore, good project governance for Opera house has been required which could consider the probable risks of the whole horizon of 10 years. According to Finding 33, lack of appropriate project governance which is lacking strategies for risk management would be a reason for not considering many early warning signs in the project. According to Hellström et al. (2013) project governance has a very crucial role in overcoming mechanisms leading to detrimental locks-in of projects in early stages. In large projects, the formation of governance structure needs to be understood as an emergent process. Issues in a project are linked together and a path of different issues may appear. According to F36, decisions made at the starting point of project and through governance of project can lead to success or failure of a project. In the Opera house project the governance and decisions needed to be made in such a way that they can lead to successful operations during the whole horizon of the project. In appropriate decisions at early stages could lead to missing many early warning signs of what was required to be done.

According to Locatelli et al. (2013), rapid changes in the environment and technologies, systems which are interconnected and interdependent and so on would lead to lack of focus on quality and issues related to integration, competitive pressure and so on. In this Opera house also it seems that the 52 contracts required integration. At the same time architects need to compete with other competitors in order to provide an opera house which stands out from other buildings in that area due to its specific size and its design. Focus on these functions could lead to missing early warning signs related to other issues.

According to Locatelli et al. (2013) a project which has several disciplines, strategically is importance for the company, has stakeholders with conflicting needs, has high number of interfaces and so on is considered as a complex project. Therefore, Opera house is complex, as it had many different contracts and stakeholders which had conflicts over starting this project or using the funds in other alternative ways, also many interfaces had been included in this project; in addition, strategically the project was important for both owners and contractors, users and other stakeholders. According to Jackson (2007) in such complex systems there is a need for system thinking in order to see how these different sub-systems or

parts are related to each other. Therefore, Opera house as a complex project required thinking systematically when planning the whole project when defining governance. Otherwise, sub-optimized decisions would lead to missing many early warnings.

According to Ruuska et al. (2011) in order to achieve better results and performance, the integration of open system approaches in project governance is highly recommended. In this project also it seems that the horizon of 10 years required integration of open system approaches in project governance. The long-term horizon would face with many changes and the governance needed to be adapted to those changes in order to be able direct people correctly. Finding 43 also is addressing the importance of openness approaches in such changeable environments. As Figure 3-24 Indicates a system approach and multidisciplinary approach can lead to better planning and better control over project and consequently better project governance. It seems that this is considerably related to the Opera house project. This project could miss many early warning signs if these approaches were not used when project governance was going to be defined. Finding 44 also noted that inappropriate methods of planning and control, because of lack of system thinking and multidisciplinary approaches can become a barrier for identification of early warnings. According to Locatelli et al. (2013) application of system thinking is more appropriate when different parts of a project are designed and produced by different organizations. It seems completely related to Opera house as it consisted of cooperation of 52 different contractors which required a holistic view when managing the project.

As it can be understood from the case description there had been many conflicts toward using the fund of this project for other alternative solutions in a more appropriate way. Despite of those disagreements the Opera house was built and according to the case description the project terminated under budget and within the planned time schedule. Samset (2003) believes that the project was not strategically successful and he doubts if it is going to be a success in long-term perspective. He claimed that soon the project would require more expenses than its outcomes. So, according to him the project does not seem sustainable. As the project was terminated under budget and within time schedule it is possible to assume the focus of the project had been on success of project management (short-term success/efficiency) rather than success in long-term perspective (effectiveness). Therefore focus on short-term functionalities could be a reason for missing many early warning signs related to future effectiveness and sustainability of the project. Therefore, in my point of view Opera house has been too large for a country with this population rate. And it would be

financially sustainable and achieve its strategic objectives only if the population starts to increase super-ordinarily. But now, it is possible to assume that the project was lacking appropriate initial planning and defining strategic objectives. All of these issues could lead to decisions and plans which can have effects on identification of early warnings. According to Kappelman et al. (2006) different stakeholders have different expectations. And for this Opera house it seems that the short-term objectives of some stakeholders are outweighed the long-term objectives of others. In addition, according to the same authors, lack of documented requirements or success criteria which is signed and accepted by all of the stakeholders would lead to project failure. It seems that in the case of Opera house such requirement documentation was missing and it led to missing many relevant early warning signals.

Following table (4-4) summarizes challenges involved in this project and possible sources of missing the signals:

Possible sources of missing early warning signs	Leads to …	Possible problems are…
A lot of conflict in the project concept at the early stages	- Being distracted from other important considerations at the beginning - Inappropriate definition of governance - Inappropriate strategic decisions	- A lot of changes later in the project - Facing with cost and time overruns
Long-term horizon of the project	- Not being able to consider possible future risks and opportunities - Not being able to consider a need for flexibility - Not being able to provide enough training at the early stages of the project - Not being able to define a suitable project governance	- Tight plans and schedules without any space for committing changes and searching for signals - Spending a lot of time for training people and not having time for environmental scanning - A list of early warnings which is not up to dated and would misdirect practitioners - Not being able to deal with new technologies that are arising, missing many new signals, facing with cost and time overruns - Being reactive rather than proactive
52 different contracts	- Not being able to integrate all of the parts and contracts - Not being able to communicate properly - Not being able to define a governance which can consider all of the details of different contracts into account - Lack of holistic view and missing many signals which arise in connection of different parts	- Spending a lot of time and money for integrating those incompatible parts - communication barriers and facing with conflicts - Being reactive rather than proactive
Focus on delivering project within time and cost budget	- not being able to spend time for other considerations - not being able to consider some strategies because of being expensive or time consuming - not being able to pay attention to functionality of the project and long-term perspectives	- Delivering results which are lacking promised technical capabilities and functionalities - Reduction in users' satisfaction - Bad reputation - Failure in long-term perspective

4-5. Possible barriers of identifying early warning signals in National Opera house project

To sum up, the long horizon of this project (10 years) has been the most important challenge of this project. During these 10 years the project could face with many changes, it means that initial plans which were decided from the beginning were not suitable for managing the project in time. The plans needed to be updated and new risk register forms and list of early warnings would be required by changes in the environment. New emerging technologies were arising and people needed to update their knowledge, a lot of time and money was spent for updating people based on new technologies. It could also be a reason for being busy with other staffs rather than environmental scanning and looking for early warnings. To conclude, in the case of Opera house an open, flexible and appropriate governance needed to be planned, otherwise many issues could arise and many early warning signals could be missed easily.

CHAPTER 5

DISCUSSION

5. Discussion

Despite of much development in preventing projects' failure still large numbers of projects are facing failure and many signals which could have been identified by the available tools and methods are missing in projects. In this chapter the findings of literature review and case studies are going to be discussed in order to enable us answering the research questions.

According to Ansoff & McDonnell (1990), projects are important part of human life and any development in today life is dependent on a project. Today firms have many competitors and implementing projects as fast as possible is in demand in order to remain competitive and responsive. Therefore, firms need to speed up in implementing projects and any delay in this process can give the market share to competitors (Nanus, 1975). Therefore as Ansoff (1984) claimed proactive methods of project management are in demand. Managers need to anticipate future and prevent discontinuities by recognizing early warnings early enough. Different authors such as Nikander (2002) claimed that in each project there are some signals of potential future problems. If these signals are identified early enough there might be plenty of time available for planning and implementing actions in order to correct the situation and prevent the problems from materializing. Many methods had been identified and suggested by different authors for identification of early warnings such as risk analysis, performance measurement system, root-cause analysis as so on. Despite of development and application of these methods in industries, still large numbers of early warnings are missing. Therefore, it seems that there are some barriers in identification of early warning signals. The main purpose of this master thesis is identification of barriers of identifying early warning signs. A literature review through sources of information about early warning signals directed the author toward studying various topics such as environmental scanning, project governance, project complexity and many other sub-topics. Following the researcher discusses all of these potential barriers of identification of early warning signals.

5.1 Environmental Scanning

As noted in the literature, lack of sufficient evidences and warnings about future would lead to making inappropriate decision. Environmental scanning will be a solution. By looking at the environment, some hints would be given to decision makers about possible future

changes; therefore they can consider those potential issues into their decisions and be much prepared for future changes. In fact, as mentioned earlier by environmental scanning potential threats and opportunities and organization's strengths and weaknesses would be identified, therefore actions for overcoming weaknesses can be planned. In other words, by environmental scanning, many early warnings would be identified and actions for preventing potential problems and opportunities would be planned.

As mentioned by Fahey et al. (1981) despite of being aware of the importance of environmental scanning still there are some problems and barriers in the effective use of environmental scanning. As addressed in the literature, in order to be able to make strategic decisions a continuous environmental scanning is required, so other forms of scanning such as periodic or irregular forms may lead to missing opportunities because of their focus on problem identification rather than problem prevention. Presenting information orally rather than writing them with the purpose of just hearing what should be heard, as mentioned in the literature, can be another barrier for effective environmental scanning. On the other hand, scanning widely and collecting large amount of information would be a cause for missing many signals by focusing on irrelevant warnings. As addressed previously, environment is changing rapidly and those issues that were supposed to be scanned may not be relevant anymore, therefore scanning for those signals that are not relevant would distract the scanners' attention from more important and relevant signals. Literature indicated that environmental scanning can only be appropriate when the scanner is aware of and familiar with the situation, and knows what is relevant and what is not. Only focus on external factors and forgetting internal signals, may also lead to missing many internal early warnings in an organization. For example in the case of Asker-Sandvika rail track project, as analyses revealed, emphasize on satisfying neighbors and keeping cost as low as possible led to missing many signals related to internal stakeholders and internal relations, while internal communication could be very important for communicating the signals. As Reinhardt (1984) mentioned in the literature, 80% of individuals usually scan for only 30% of the signals. It can be one of reasons for missing many of the signals. People tend to scan for what they are familiar with, while many new problems may arise which could have been more serious to be scanned for. Furthermore, it was understood that some radars for scanning environment may not have specific information of the specific market; therefore the existence of different radars for different markets seems helpful in scanning the market. All of these radars need to be linked to a central radar and need to be integrated. In both case studies, it seems that the

projects were suffering appropriate integration of data. These could lead to making sub-optimized decisions, lack of holistic view and consequently missing many early warning signals.

In addition, hierarchies through which the information should be passed can have effect on missing many signals. After scanning environment, for a message to be reached to the right person in order to be acted upon, it has to be passed through many filters. Each of this filters would be a cause for missing some signals, if the chosen filters are not accurate enough many problems would arise. Inappropriate mental models in the use of filters would lead to selection of unrelated warnings. As mentioned in the literature, filters have a huge effect on adjusting the situation for organizations according to the changes in the environments. In the case of Asker-Sandvika project it was obvious that there had been many hierarchies in the reporting system of the project. It could be a reason for change in the nature of the signals and finally receiving signals which are completely different from what have been identified in the first place by the scanners. Ilmola and Kuusi (2006) talked about the depth and width of filters. This topic also seems interesting and can have effect on identification of early warnings. The width in filters would lead to being open when accepting signals, therefore large number of signals would be identified. This wide filter would be appropriate for organizations with huge changes in their environment. The use of deep filters also would narrow the view of scanner and lead to missing many signals in such a changing environment. In fact, for environments with a few changes (certain environments), the use of wide filters may lead to collecting many signals that are not relevant and overlooking some of them. Therefore, by providing the culture of continuous scanning and updating the list of early warning signal continuously, choosing the right people for the role of scanning (people with enough knowledge and experience and those who are sensitive for identification of signals), scanning with a holistic view as well as detailed scanning, and reducing the number of hierarchies in organizations (Hierarchies in reporting system) would contribute in improving the process of identification of early warnings by environmental scanning.

Even if early warnings are identified correctly, there might be some issues related to communication among people in an organization which may have effect on early warnings to be seen and discussed or not. According to Blankevoort (1984), a change in order to be successful need to be communicated correctly. Therefore, early warnings which are identified by methods such as environmental scanning need to be communicated among relevant people and teams in order to be applied in decision makings. The more complex a project, the more

communication channels are involved, therefore probability of missing early warnings would increase because of more communication channels. As noted by many authors in the literature, there are barriers for effective communication in an organization. These barriers would have effect on communicating early warnings. As mentioned before, there might be technical and psychological issues which would have effect on communicating a message. For example, large amount of information may lead to ineffective communication, or the personal problems among the sender and receiver may cause incomplete communication and therefore failure in communicating correctly. Authors also mentioned that the message can be meant differently by sender and receiver, and receiver may hear what he wants to hear. All of these issues are reasons for inappropriate communication. In the case of communicating early warnings these issues would lead to big problems and missing many early warnings which could have had influence in making strategic decisions. In the case of Asker-Sandvika project also there had been a high probability of missing early warnings because of the large number of contractors and hierarchies which would lead to complexity in communication and reporting systems. Therefore, identification of barriers in effective communication and solving those issues such as technical issues, would contribute in enhancing identification of early warning signals.

As mentioned by Saunders and Stewart (1990), usually communication happens only when there is a problem, but it would be too late. Communication need to be done at all the time, in order to communicate serious early warnings, this would lead to proactive management of projects and preventing surprising events in a project. Communicating only when problems are materialized is insufficient because many early warnings are already missed. In addition, as Blankevoort (1984) mentioned, if two persons who are communicating have different perception of the same thing, these different perceptions can be a reason for wrong communication of the message. Therefore, if persons who are communicating early warning signals have different perceptions of the signal's importance, there is the probability of ignorance of the signal by upper level decision makers who do not perceive the signals as importance as the scanner who found the signal initially. Therefore early warnings can be missed because of differences in perceptions. In addition, it has been noted that some times the sender may not want to reveal everything to the receiver, therefore the message or signal would not be communicated and will be missed. Language differences or different meanings for the same signal and so on were other influencing issues which require defining a standard language for communication. Furthermore, Blankevoort (1984) noted the importance of being

completely familiar with the system. If the user does not know how to use the system or is not aware of the full functionality of the system, many signals would be easily missed. It can also happen that the system provides much information which misdirects the user from the most important signals. What seems important is adapting a system to the need of the user and providing required training for the use of the system. Therefore, not being aware of how to use the system for identification of early warnings would be another reason of missing them despite of availability of systems and tools. By continuous communication among project team there would be more probability of identification of early warning signals. In addition, providing a standard for different words and terms would reduce the risk of defining and perceiving differently. And training scanners for using available tools for identification of early warning signals would remove the risk of not being aware of the systems' functionality which is followed by missing early warning signals.

Blankevoort (1984) also claimed that the communication among people becomes more difficult as they have to communicate through a machine. Especially if those people do not know each other, in this case the communication is lacking trust, and many signals which could have been communicated would be missed. Diallo and Thuillier (2005) mentioned the importance of trust building at early stages of a project, it seems relevant to identification of early warnings. As most of warnings need to be identified at early stages, lack of trust among members would hurt communication and lead to missing signals. For example as mentioned through the Asker-Sandvika case description, the organization of JBV was new when Asker-Sandvika was started, therefore probably complete trust among team members was lacking. This could lead to missing many early warning signals because of lack of communication and making strategic decisions initially without considering those influencing signals. Improving communication among team members in an organization and building trust among them can reduce the likelihood of missing the signals through different channels.

Through the literature review a section was also dedicated to optimism bias topic. It seems that the issue of being optimistic can have effect on identification of early warning signals. As indicated in the literature, people usually perceive themselves less vulnerable to negative events in comparison with their peers. In the case of early warning signs, if managers (or those who are responsible for identification of early warning signs) are highly optimistic to potential future events, they may refuse to consider some important and crucial early warning signs. Being optimistic may lead to not thinking about negative issues and the negative effects that may arise following them. This kind of thinking can be one of the reasons of not being

ready for protecting themselves if the surprising events arise. If managers perceive themselves vulnerable to some dangerous situation, they will probably think about some preventive actions in order to protect the project from those harmful events. As a finding of the literature review, managers who are less optimistic would be more sensitive and careful about potential future problems, and they would consider more risk reduction strategies into account when making decisions. Specially, according to the literature, this issue may arise when managers consider themselves more skillful than others, if they do, then they may underestimate many events and risk that may happen to them, because they just trust their skills and do not consider other factors that are more important than just having skills and experience. As Lipkus et al. (1993) mentioned in the literature section, optimists who are perceived to have positive outcomes are expected to make decisions quicker, therefore if mangers with good reputation and with optimistic views are asked to make decision in a short time, it may happen that many early warning signs may be ignored or missed by them. In addition as Lipkus et al. (1993) claimed in his article, I can say that those pessimistic managers usually are more sensitive for consideration of probable risks and negative events. Therefore, usually these managers are more successful in being prepared for future negative events, because they already have thought about possible issues and early warning signals. As DeJoy (1989) claimed, the degree people perceive themselves vulnerable to the risk, has effects on protecting themselves against hazards. Therefore, managers with these characteristics would be more proactive and they would protect the project more than others. According to Rosenstock (1974), among people subjective estimates of risk are more important than objective facts. So, optimistic managers may pay more attention to their own subjective thoughts of the risks than what is expected to happen subjectively. For example, in the case of Asker-Sandvika project we saw how managers initially ignored advices given by KS2 report and how by sticking to their own cost estimations and internal reports they faced with some deviations from cost framework in that project. As DeJoy (1989) argued, excessive optimism would decrease the probability of appropriate anticipatory avoidance responses, therefore if managers are optimistic excessively there is high probability that they would not take into account avoidance responses, therefor many early warning signs would be missed as they are not thought about. According to Weinstein (1980), the greater the perceived probability of an event, the more people believe that it will not happen to them. Therefore it is possible to say that, if there is a risk with higher probability, the fewer managers would consider it as a problem that may happen to them. In addition, according to the same author, people usually think about those actions that facilitate goal achieving not those that impede it. Considering

this hypothesis, managers' focus can be given to achieving the project management goals, including meeting time, cost and quality expectations, and not what may happen in the future. In both case studies (Asker-sandvika and Opera house), projects were finished within expected time and cost, but during implementation of both many challenges aroused, it is possible to say that managers attention had been given to achieving project management goals rather than preventing other future discontinuities. According to Weinstein (1980)'s stereotype hypothesis, it can be said that if managers consider some group or type of managers more vulnerable to some events than themselves, then it is possible that they do not consider that events happening for themselves. Furthermore, considering the issue of comfortless seatbelt mentioned by Svenson et al. (1985), if managers consider some actions comfortless, they may refuse doing it. If managers consider the issue of identification of early warnings as a comfortless issue, they may refuse doing it. In addition as the author said, driver's optimism increases with the time in the road. So managers' optimism through the project may increase with time, and it may lead to not considering many future probable problems. Also, Scheier and Carver (1985) argued that optimism arises because people overestimate their own control over events. They think because of having control over issues they can identify any discontinuities, while there are many issues out of their control. In fact, the thought that if they can control the situation it will lead to desirable results is not always true. According to DeJoy (1989) lack of experience of a specific threat may increase the probability of optimism. So, if the managers do not have any experience of a specific risk or negative event in the past, they may feel confident that it will not happen to them at all. This would contribute in not considering many early warnings into account when making strategic decisions. As mentioned through the case description of Asker-Sandvika project, the new organization of JBV did not have experience of projects with the same size of Asker-Sandvika project. It could lead to optimism bias among managers and not considering many probable future discontinuities. Also, as Tversky and Kahneman (1973) noted the issue of positive history, it is possible to say that those managers who have had a good background and history without any failure, may think that future is going to continue in this way. Therefore, they may underestimate those issues that may arise in future depending on the future changes. In fact, trusting the successful history can be a distraction from possible future problems. Svenson et al. (1985) examined the effect of age and culture on optimism, according to their finding it is possible to say that managers with different age and cultures may consider early warnings of potential future problems differently. To sum up the discussion about optimism bias, being too optimistic may lead to missing many early warning signals, while being too

pessimistic can lead to overlooking some early warnings not all of them are relevant. Therefore, managers, decision makers and environmental scanners need to understand being in between optimistic and pessimistic would be better for identification of early warning signals. Arranging some work-shops and self-assessment tests in which people can evaluate their degree of being optimistic or pessimistic can help them in fixing the issue of optimism bias.

5.2 Project governance

According to the literature review, project governance has a very effective role in identification of the early warning signals in project. In fact, the organizational structure which clarifies all of the roles in project, appropriate monitoring methods and tools, methods for dealing with different issues, considering stakeholders interactions and so on can provide a mechanism in which the failure in projects can be prevented. So, many difficulties in projects could be prevented by appropriate project governance which is able to alert project team about the risks and dangerous phenomena later in projects. As Patel and Robinson (2010) claimed project success is highly dependent on adequate governance structure. In fact, appropriate governance helps in being responsive when facing with turbulence situations. Project governance provides a framework which reduces the probability of facing with severe problems by creating a structure for addressing project success. If the structure which is designed for directing and guiding project team is not appropriate and flexible enough it would misguide people and leads to not identifying the relevant early warning signals. According to Too and Weaver (2013) there are many hierarchies in organizations' governance. Considering the chain of causes and phenomena which may be produced in a system, failure in defining appropriate governance in higher levels of the organization will spread in the whole system and lead to inappropriate methods of working, and finally not identifying early warning signals. As Figure 3-21 indicates, there are three sub systems in the governance system, if the governance system is not defined correctly by the board of directors; it leads to difficulties even for line managers in the project management system. In addition according to the literature review, each project and each organization require an appropriate kind of governance depended on their own specific nature, there is no general governance which would be a fit for all. Considering suitable governance for any specific system contributes in identifying the signals related to that specific system. In the case of Asker-Sandvika project it was mentioned that the governance was not defined in details and

specific for the project. The general governance was defined in a way that could be used for all of the other subprojects of Skøyen-Asker line. Such general governance could increase the likelihood of missing many early warning signals because of lack of detailed plans and guidelines. According to the study done by Guo et al. (2013), by considering the best management modes at the governance definition phase of projects at early stages, better results would be achieved by better identification and mitigation methods and tools. In addition, as the figure expressed by Abednego and Ogunlana (2006) indicates, if practitioners responsible for defining the project governance are experienced enough in addressing possible potential problems ex ante, a prober risk allocation strategies would be considered and finally a better project performance would be resulted by the use of pro-active project management methods. Considering the path dependency approach pointed by Hellström et al. (2013) in the literature review, historical decisions can have effect on the final results of a project, it indicate the importance of decisions made in the outset and when practitioners are defining the project governance, such decisions make a path for the rest of the project. Appropriate and complete project governance provides mechanisms for achieving objectives by ensuring the availability of standards, procedures, and controlling mechanisms. These standard controlling mechanisms help in identifying early warning signals by making right decisions at the right time. In the literature about governance some literatures about the normalization of deviance phenomenon was mentioned. Considering this issue, if something in an organization start to become a norm it would not be considered as an abnormal or unnatural issue. It can be considered as one of the barriers of identifying early warning signals. If managers or project team get used to the deviant, next times it would not be a visible problem to them, and the issue would be ignored easily. In the case of early warnings it would be a very common problem, especially if the normalization of behavior is emerged into governance. Appropriate governance with specific focus on the issue of normalization of deviance and informing peoples about its danger, can lead to appropriate methods of identifying those issues and preventing them from happening. So, according to these expressions, signals of potential future problems should be focused in order to not become accepted, if it become accepted it will not alarm anymore. Those in the board responsible in defining the governance can have a very effective role in this case; in addition a person from outside who does not get used to the working situation of the organization can be very effective by easily recognizing any deviance. Therefore, lack of an appropriate person in the board and lack of an outside viewer would be other berries of identifying early warning signals.

According to Locatelli et al. (2013) poor planning and definition at the outset of projects lead to poor performance at the end. As mentioned through analysis part of Asker-Sandvika case, one of the most important berries of identification of early warning signals in this project seems to be the weak planning and guidance of this project at the beginning. The project faced with many changes that were not planned from the beginning. One of the methods which had been suggested through the literature was the transformation of "project governance" to "system governance" (Locatelli et al., 2013). System thinking and system engineering mentioned through the literature would be of help in having a holistic view when defining project governance. As the whole is more than the sum of its parts, considering different parts of a system in isolation and evaluating issues related to those separated subsystems may lead to ignoring many issues which can arise in the interaction of those subsystems. As mentioned at the introduction chapter, hard issues and soft issues can combine together and make early warnings of other worse problems, but organizations usually consists of silo thinkers, who do not share and communicate issues. So the issues will be combined with other unsolved problems and lead to catastrophic situations. This factors which are called knock-on effects are usually hard to be identified (Terry Williams et al., 2012). So, lack of communication and information sharing is another obstacle for addressing the signals, a holistic view and considering the whole system specially in defining governance can be very effective. Then by involving all of the specialists which can consider different areas and their combination with each other many issues relevant to complex problems can be solved through defining appropriate governance. In both case studies, the whole project was divided into many different contracts and was planned to be done separately. Such division of work requires good communication and information sharing; otherwise many signals could be missed easily. In addition, according to the literature open governance which is flexible for any changes in the environment would be more appropriate in today changeable world. As mentioned in the introduction chapter, "Projects are dynamic" and early warning signs which were mentioned in the previous stages of a project may not be useful in later stages, as the nature of early warnings change with the changes in situations (Terry Williams et al., 2012). This indicates the need for an appropriate "change management mechanism" in projects. So, a closed in nature governance which cannot be adapted to the changes around it is one of the barriers in identification of the signal. The signals which were pointed and listed at the outset of the project (when defining the project governance) need to be updated and revised by changes in the environment and as the projects are progressing. If the signals remain fixed and unchanged, they would lead to focus on the signals that are not relevant anymore and missing

some more important early warnings. Therefore, project governance which considers system thinking, change management, and flexibility at the early phases of projects would lead to a proactive method of management and project success. In the case of Opera house project, the 10-year horizon of the project required such governance which was able to be adapted to the changes during that long period otherwise many signals would be missed. Furthermore, according to Terry Williams et al. (2012) when practitioners are defining early warning at the early stages of projects, they may overlook the signals, because of lack of information in this stage and high degree of uncertainty. So, as mentioned in previous sections, the use of requirement management as a system engineering tool ensures that nothing is overlooked; it would also track the status of requirements when the project is developing. Lack of such consideration would be a barrier for identifying the signals.

In addition, as pointed in the literature, when defining the project governance consideration of critical success factors can be very crucial and effective in keeping an eye on the potential future problems. For example as pointed previously, the use of team building practices early enough would lead to creating an environment in which team members can recognize and solve problems in a team early enough. This seems very effective in identification of early warnings in projects. Lack of such critical success factor would be a barrier or potential pitfall factor for missing or ignoring the early warning signs. Lack of some other critical success factors such as communication among different parties, appropriate methods of risk related practices and so on would contribute in missing those signals which could had been identified and acted upon. In the case of Asker-Sandvika project it seems that the new organization of JBV at the early stages of the project could endanger communication among stakeholders and employees and therefore lead to missing many early warning signals which could be identified through communication. As Papke-Shields et al. (2010) mentioned in the literature, without high-level initial planning a project is more likely to face with failure. So, initial planning at early stages of projects can be considered as a critical success factor which would help in identifying many signals or deviances, without such factors, the signal would not be identified. In the case of Asker-Sandvika it was concluded that lack of appropriate planning at the early stages of the project was an issue which could lead to many other following challenges. In addition, only focus on hard issues and ignoring soft issues can be consider as another barrier of identification of early warning signals. According to Terry Williams et al. (2012), many of signals in projects cannot be identified by available tools such as project assessment. "Many signals are soft in nature" and need project managers' experiences from

similar projects. So, managers' ability to understand the early warning signs by "gut feeling approaches" in projects is very crucial in anticipating what may happen in future. Lack of such capability and only focus on hard issues, may lead to missing many soft issues. In the case of Asker-Sandvika project it seems that responsibilities were given to those who did not have enough experience of the same size projects, therefore experience and gut feeling of people was not enough for identification of many early warning signals. As expressed in the literature, the existence of a documented expectations and responsibilities of different parties at the early stages of projects would be a critical success factor in integration of expectations and knowing other team members' tasks and responsibilities. It would contribute in a better identification of the signals that may arise in projects when the members are working together. Furthermore, mangers ability in addressing the early warnings and possible risks at the outset of the project (when defining the project governance) would contribute in a better recognition of those issues. If it is planned and expected to happen, it can be identified easier. Lack of such experiences from the past would be a barrier of ignoring and missing many early warnings. In JBV, as mentioned before, experience of large in size projects was lacking, it could be a reason for not considering many signals of possible future risks and problems. As addressed in the literature, short review in projects would lead to identification of the early warnings, so lack of such a review would be a barrier of identification of the early warning signals. Furthermore, the personality of the project managers and their ability to do not panic in stressful situation had been shown as other critical success factor which would help in identifying the signals. If managers get stresses they would not be able to make the right decisions at the right time, it will contribute in missing many early warnings. Also, the thought of "it will not happen to me" would be another barrier in addressing early warnings that may arise in projects. Other point mentioned in the literature is the importance of change management as a critical success factor in identifying the signals. As pointed before, the nature of early warnings would change through the project life cycle, and the signals need to be updated continuously. As Pender (2001) mentioned, considering alternative is one of the critical success factors and managers need to use active hands on management and regularly assess the possible alternatives, this success factor would be suitable for not only focusing on the available methods of identifying early warning signs, but also thinking about the other possible methods and ways of recognizing the signals. The IRIS example given Kirby (1996) also showed the importance of integration of different perspectives of different people as a critical success factor. It indicates that if different team members have different perceptions about the early warning signals, identification of those signals would be more difficult. In the

case of Asker-Sandvika there had been hierarchies in the reporting system, in such system different perceptions of early warnings which were reported among different hierarchies could lead to receiving a signal which was completely different from what had been identified previously.

To sum up this discussion, well-defined governance would provide accurate and appropriate plans for the whole work; it would guide practitioners and provide a framework suitable for identification of early warning signals. If the framework is not appropriate it would lead to wrong methods of working and missing many important early warning signals.

5.3 Project complexity

Another issue which seems can have effect on identification of early warnings is the issue of complexity. As mentioned in the literature review, in complex systems items are interconnected and interrelated and predicting the future outcomes is not an easy task. According to Terry Williams et al. (2012) factors such as complexities caused by decisions, issues related to leadership, needs for developing new technologies and so on lead to increase in project complexity. In both case projects (Asker-Sandvika and Opera house) there had been many disciplines involved, therefore complexity in communication and sharing information would increase. In addition, in the case of Opera house there had been a long horizon of 10 years during which there was a need for updating technologies. The case projects were complex and there was a high probability of missing many early warning signals as predicting the future of the complex systems is not an easy task. As mentioned by Haji-Kazemi and Andersen (2013) the use of performance measurement systems and reactive tools are not suitable any more for managing today complex projects. They require more proactive tools which enable us to identify signals of future problems. From the literature it can be understood that conventional methods of project management would hinder identification of early warning signals. As Morris and Hough (1987) claimed, application of conventional systems developed for ordinary projects have been found to be inappropriate for complex projects. Therefore, measuring project performance by different project assessment tools such as trends and s-curves in project controlling are not any more suitable as they just alarm issues after the fact. According to Baccarini (1996) the meaning of complexity is near to uncertainty. Therefore, complex projects are uncertain and identifying early warning signals of the uncertain behavior of projects is not easy. According to T. Williams et al. (1995) those projects in which a body of knowledge exist are less complex than the state of art projects

without any previous experience. Therefore, uncertainty and complexity of projects would increase by increase in the novelty of projects. In the case of Asker-Sandvika project, for the new organization of JBV it was the first time they were assigned a project in that size, therefore there had been many uncertainties involved, and it could lead to missing many early warnings because of lack of experience from projects in that size. Therefore, complexity and novelty of projects can be one of the barriers of identification of early warnings signs, as project managers and team members are lacking similar experiences from past. In addition according to Hall (1979) the more division of tasks and responsibilities would lead to vertical complexity, and the more number of hierarchies would increase horizontal complexity. In both case projects there had been many disciplines and contracts involved and for Asker-Sandvika project the reporting and leadership system contained many hierarchies. Therefor the project was complex both horizontally and vertically. It could lead to missing many early warning signals. As Williams (1999) claimed in today world projects need to be finalized quickly in order to remain competitive, therefore a need for concurrent engineering is increasing in projects. By doing tasks in parallel less time would be dedicated for identification of early warning signals through environmental scanning. Therefore speeding up in projects' finalization is another reason for missing early warning signals. Furthermore, as Lyneis et al. (2001) mentioned, some risks are impacting a project outcomes, if those risks and their early warnings had been identified and listed previously better responses could be planned and implemented for rescuing the project. Therefore, the application of traditional and linear methods of management for managing complex projects may be a barrier for identification of signals. In addition, according to Williams (1999) the use of tools which can just identify hard issues can be another reason for missing many soft early warnings signals. Many signals are soft in nature and they require methods which are able to identify them. Complex projects consist of both hard and soft issues and they require appropriate methods of identification of all of the signals. As Thomas and Mengel (2008) claimed many methods and tools taught in management are not appropriate for complex projects in changeable and uncertain environments. These tools can lead to not being able to identify early warning signals. Furthermore, it seems that the skill of leaders and managers who have a sense of intelligent and experience could be very effective for identification of signals in complex project (Zohar, 2012). In the case of Asker-Sandvika project it was obvious that many leaders were inexperienced, in such a large and complex project many signals could be missed because of this issue. Also, according to Thomas and Mengel (2008) in complex projects focus on technical expertise rather than managerial and leadership knowledge would lead to

inappropriate communications. Therefore, many early warnings would be missed easily because of not being communicated appropriately. In the case of both projects it seems that the focus on finishing project on time and within budget could endanger communication among different disciplines and finally missing man soft early warning signals. In addition, authors such as Thomas and Mengel (2008) emphasized the importance of adaptation to changes by managers in today environments. Today complex projects require methods that can be adapted to changes. In the case of Opera house as described there had been many changes involved in that project. Therefore, managers needed to be aware of methods of being adapted to those situations, lack of such skills would lead to use of tools that cannot recognize available signals. The issue of leadership seems very crucial and effective in complex projects for identification of early warning signals. According to Varanini and Ginevri (2012) leaders of complex projects need to work and communicate with each other continuously. For example, in the case of Asker-Sandvika project, it seems that there had been many disciplines and leaders assigned to each, and those leaders were not sharing information. That is why many sub-optimized decisions had been made in that project. Therefore, leaders in complex projects require as much as possible information about different elements of the project. They need to share knowledge and information. If they are lacking information, many signals of potential future problems would be missed and they would not be influenced in strategic decisions. Therefore, complex projects need a different kind of management and leadership methods; otherwise the likelihood of missing early warning signals would increase considerably.

Following figure 5-1 summarizes the findings of this discussion part.
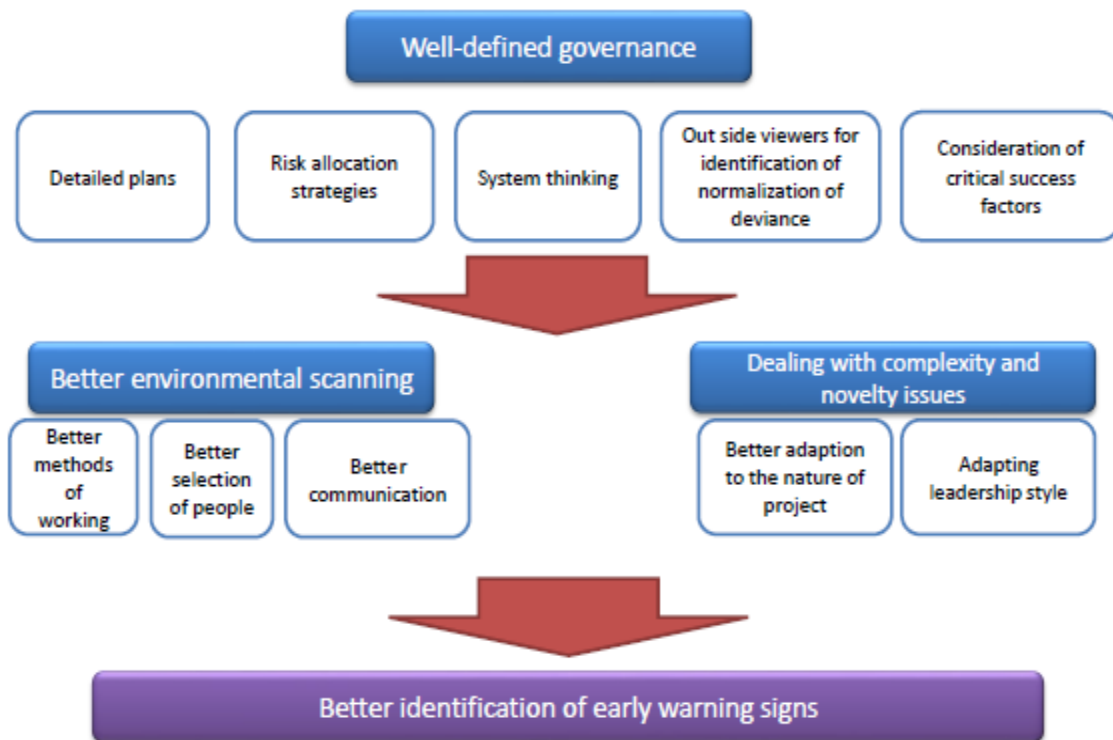
5-1. Findings of the research

CHAPTER 6

CONCLUSION

6. Conclusion

The main purpose of this master thesis has been finding the barriers of identification of early warning signals in projects. A literature review through some possible relevant topics and study of two case projects led to the following conclusions by the researcher.

6.1 Main findings

Environmental scanning has a very important effect on identification of early warning signals in projects. By environmental scanning many signals which will lead to future problems can be identified and be considered in strategic decisions. As discussed previously there are many barriers for effective environmental scanning. Irregular environmental scanning, scanners who are lacking experience and knowledge, wrong choice of scanners, too narrow/wide view when scanning, many hierarchies in communicating and reporting systems, lack of standards for terms and different perceptions, lack of awareness about the functionality of available tools, lack of trust among team members, and finally the issue of optimism bias were identified as those barriers of environmental scanning and reporting which will have effect on missing or overlooking early warning signals.

Project governance which provides guidelines for the whole work, including guidelines for procedures, controls, mechanisms, standards and so on can help in identification of early warning signals. Lack of such guideline would enhance the probability of missing early warning signals. Projects depending on their size and the number of stakeholders and many other characteristics require different type of governances. Inappropriate governance definition at early stages of a project can misdirect project team and lead to overlooking some irrelevant signals and missing more important ones. General definition of project governance which does not provide details related to specific characteristic of a project can lead to difficulties in identification of early warning signals. The issue of normalization of deviance in governance of an organization can lead to not being able to recognize those deviances that have become a norm. Lack of a person in the board and lack of an outside viewer who can identify the issues of normalization of deviance would be other berries of identifying early warning signals. Project governance which considers system thinking, change management, and flexibility at the early phases of projects would lead to a proactive method of management and project success; otherwise early warning signals would not be identified properly. In addition, lack of consideration of project success factors (such as clear goals,

clear plans, clear responsibilities and so on) at the project outset and when defining governance, can lead to missing or overlooking early warning signals.

The issue of complexity in projects also would have considerable effect of identification of early warning signals. Complex projects consist of many parts and disciplines and by looking at inputs identification of outputs is not easily possible, these projects are uncertain. Such uncertain projects require appropriate kinds of management and leadership methods. Tools need to be updated according to the changes in the environment and leaders need to apply proactive methods of management. Application of traditional and inflexible methods of management in such projects would lead to missing many early warning signals that are not able to be identified by these methods. Many signals are soft in nature and their identification require many experience, appropriate communication among team members, leadership skills and many other new methods of project management. Therefore, complexity and novelty in projects is another reason for missing or overlooking early warning signals.

6.2 Results vs. research questions

Through this master thesis the following questions were tried to be answered:

- *Despite of available tools for identification of early warning signs, still large numbers of the signals are not detected, what are the possible reasons?*
  The research concluded that issues related to environmental scanning, inappropriate governance and initial planning and the issue of project complexity and novelty can lead to missing early warning signals.

- *What is the root of causes for missing early warning signs?*
  Lack of requirement management, lack of consideration of critical success factors, inappropriate risk management methods and so on before defining project governance can contribute in having governance which is misdirecting practitioners and scanners by those signals that are not relevant to the current situation of the project. The wrong governance may contribute to wrong methods of scanning (too narrow or too wide focus). Therefore, as could be understood from this research, first plans and guidelines (governance) will have the most important effect on the whole project performance and being able to identify early warning signals in an appropriate time. The appropriate governance would be able to deal with project complexity and can be

adapted to the changeable and uncertain situation of projects; therefore new signals related to the new environment can be recognized by the updated plans and guidelines.

- *How the problem of missing early warnings can be solved?*

Improvement in the process of environmental scanning by providing the culture of continuous scanning, updating the list of early warning signal, choosing the right people for the role of scanning, training them, reducing the number of hierarchies in organizations, improving communication/trust among team members and so on can contribute in solving the problems related to missing or overlooking early warning signals. In addition, initial planning and choosing appropriate governance for the project (which considers flexibility and adaptability into account) can help in directing team members in the way of recognizing early warning signals. Reducing the project complexity or dealing with complexity issue by appropriate methods of project management and leadership skills can contribute in recognizing early warning signals and reducing the probability of missing or overlooking the signals.

6.3 Suggestion for future research

I would like to suggest some proposals for more future research:

1. The reasons of skepticism towards acceptation of early warning signs.
2. How responses to early warning signs can be enhanced in order to prevent failure.

CHAPTER 7

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CHAPTER 8

APPENDIX

8. Appendix

8.1 Preliminary report

NTNU

Norwegian University of
Science and Technology

Preliminary Report

TPK4905- Master Thesis

Department of Production and Quality Engineering

"Barriers of Identifying Early Warning Signs in projects"

Submitted by:

Ghanizadeh Poshtekooh, Nasim

MSc. in Project Management

Supervisor: Bjørn Andersen

February 2014

Introduction

According to Ansoff (1975), considerable surprises will not appear suddenly, there are some "weak signals" and symptoms of issues which appear much earlier than those issues themselves. In 1975 Igor Ansoff mentioned the theory of weak signals for the first time (Nikander, 2002). He claims that weak and small signals in each project will become bigger and stronger if preventing actions are not conducted. This indicates the importance of forecasting future and anticipating weak signals early enough. Decision making and implementing preventive actions take time, it shows the importance of recognizing signals as soon as possible in order to have enough time for implementing preventive or corrective actions. According to Bernstein and Bernstein Peter (1996), by available tools such as risk identification and measuring their consequences, human no longer consider future as an act of god, as they can predict what may happen in future. Because projects' nature is uncertain they are prone to unexpected events (De Meyer, Loch, & Pich, 2002; Huchzermeier & Loch, 2001; Sun & Meng, 2009). Events that are not expected to happen but could have been predicted, if these events happen they may have considerable effect on project outcomes.

In Nikander (2002) literature of project management it is mentioned that some approaches which are recognized as the sources of early warnings are risk analysis, stakeholder analysis, and performance measurement and so on. These approaches are an aid for project management to identify weak signals and decide upon timely actions before the problems materialize, hence they enhance the likelihood of project success. Despite of those available approaches, it seems that still many early warnings are not identified in projects and still many projects are facing with failure.

The objective of this master thesis is identifying the reasons of not recognizing early warnings in projects even if there are some tools for identifying weak signals. As Ansoff (1975) claimed there should have been some weak signals which could be predicted, but it seems there had been some obstacles in the way of identifying them.

Despite of a few literatures available with direct focus on this topic, Williams et al. (2012), mentioned some reasons of not identifying early warning signs in project. In this thesis I will take some hints from the work of these authors and add some more ideas by brain storming in conducting the research. Following some reasons of not identifying warnings are mentioned briefly.

Front end stages of projects are the best time to look for early warnings but usually in this stage, because of the issue of uncertainty and lack of information, the warning signs are over looked or are easily missed. Implementation stage of projects consist of periodic reviews which help in identifying early warnings, but usually at this stage people are busy with many other tasks, or there would be some distracting activities in the way of identifying warning signs. In addition, the issue of tight schedule and pressure in conducting the task may be other reason for not spending enough time for identifying signals. Furthermore, just focus on hard methods such as project assessment may lead to not identifying early warning signs of soft issues such as lack of communication among team members. Soft issues are usually identified by gut feeling approaches.

The issue of complexity is other obstacle in identifying the signals. Causality is less clear in complex projects and by looking at some inputs (signs) identifying the out puts (problems) are not easy. Most of complex project are undertaken for the first time and there is lack of similar experience in the past. In such complex projects identifying early warning signs is complicated and many issues are interconnected.

In addition, projects are dynamic in nature, even the goal of a project may change during its life cycle. So, pre-defined early warnings may not be suitable anymore as time passes and those signals may distract project team members from the new signals on which they need to focus more.

Lack of a strong learning system in organizations is another obstacle in identifying early warning signs. In the similar past projects there might have been some early warning signs which could be kept in mind in the current project. But because they were not recorded or because of just being mentioned orally they were forgotten. Or the thought that the project at hand is a unique project and the issues viewed in the past may not happen in this new project is a reason for not recording and using early warning signs.

Considering the contingency approach, similar projects in two different times of implementation may have different early warning signs. So, just focus on those issues that have happened in the past projects and forgetting the probability of the new problems that may appear can be another reason for not identifying early warning signs.

Too senior people in governance discussions who do not have operational experience are other obstacles in identifying early warning signs. In addition group thinking, and because of being loyal to the team, the opportunity of thinking outside the box will not be given to team members.

Project work is completely affected by peoples' actions; even project environment which is usually affected by natural phenomena is selected by humans, so again the human action has effect on the causes of problems. It shows the importance of searching for causes of problems around the peoples who are in charge of the task. People always compare the results with their own expectations and find the deviations, it should not be ignored that humans are not accurate at all the time and they may make mistakes. There are three kind of early warning factors, people related, process related and product related. It has been shown that people related and process related factors are bolder than the other one. It has been claimed that behavioral related factors have an effect on the whole project and will have impact on the project success or failure. Some factors such as workplace culture may cause the people to not identify early warning signs or not express their fears and what they have seen as early warning signs. These missing early warnings or fears and anxieties of expressing can be measured by for example surveys or engaging stakeholders. As mentioned, in delivery stage usually the Early Warning Signs are missed because of focus on other issues rather that what should be focused. Or, when the Early Warning Signs are acknowledged sometimes it is too late to implement any action, so they will be ignored or be hidden intentionally. Analyzing some projects which ended up with failure has shown that there had been some Early Warning Signs which could be interpreted as a sign of failure (Terry Williams, Ole Jonny Klakegg, Derek H. T. Walker, Bjørn Andersen, & Magnussen, 2012).

Problem statement

What is lacking within project management literature about early warning is that only few number of studies paid detailed attention toward why the early warnings are not identified despite of existing methods and tools. So, the purpose of this thesis work would be fulfilling this gap in literatures and researching about the major reasons of missing early warning signs whether the tools for identifying are available or not.

In this study, it would be tried to answer the following questions (Research questions):

(1) Despite of available tools for identifying early warning signs, still large number of the signals are missing, what are the possible reasons?

(2) What is the root of causes for missing early warning signs?

(3) What are the suggestions for solving the problem of missing early warnings?

Objectives and Scope of work:

This master thesis will be conducted through a literature review on related topics (Early warning signs, people related factors, complex nature of projects, etc.). The main sources of theoretical information are scientific papers, books, published case studies and the Project Management Body Of Knowledge (PMBOK©). An empirical study of a real project case is going to support the findings from the literature study. Therefore, the source of data required for this project will be collected from different papers and books besides the empirical study of the case.

The main objectives of this research work is going to cover the issues of not identifying early warning signs in projects.

Methodology

Research type and approach:

The purpose of this project is to conduct a research about fulfilling a gap among project management literatures and identifying why, despite of many available tools, early warning signs are not seen in projects. Fulfillment of this purpose requires evaluation of facts and information already available regarding relevant topics, in order to be able to find a link among those topics by analyzing the already done literatures. Once the relation has been established its causality comes into question. Causality can be found on the basis of theory (deductively) or empirical assessment (inductively). Note that for an inductive assessment either a qualitative research method could be used, or a quantitative study (Mol, 2003). Through this research both deductive and inductive approaches are going to be used in order to assess literatures qualitatively and find why early warning signs are not detected in projects. This research is perceived as qualitative as the gathered information on relevant topics will be analyzed qualitatively throughout this research.

Research method

At first, scientific databases will be searched in order to find relevant articles, books, journal papers and published case studies. Next, a comprehensive literature review about the relevant topics will be done. In the next step a qualitative empirical study will be conducted on a case of a project to identify why early warnings were not recognized in that case and how the issue led to other problems. Afterwards, an analysis of the findings of both literature and case study will be done and the research questions that are expected to be answered will be discussed. Finally, the research questions will be answered by a discussion among the findings of literature review and the case study. The whole paper will cover the research goals. This study does not focus on any specific industry.

Research Method

Finding relevant literatures → Literature Review → Case study → Data Analysis → Achievement of research objectives

Report Structure

This master thesis may consist of 9 chapters. A brief description of the content of each chapter has been given below.

Chapter 1 gives a short introduction of the project background, problem formulation, and the project objectives

Chapter 2 explains the research methodology including type of research, research approach, research design, method of research, limitations of research, references, research objectives and report structure.

Chapter 3 is dedicated to the literature review. The literature review includes the concept of early warning signs and relevant topics that may lead to not identifying early warning signs.

Chapter 4 introduces a project case, and the reasons of not identifying early warning signs before facing with the successor problems. Then the researcher would analyze the case project.

Chapter 5 discusses the findings of literature review, the case study and the analysis chapters and answers the research questions.

Chapter 6 concludes and sums up the findings and the results.

**Chapter 7** includes the sources used to prepare the project

Chapter 8 contains a list of appendix

Work Breakdown Structure:

A work breakdown structure has been developed in order to fulfill the objective of this research. Besides, the activities that should be done with approximate estimated duration are shown in the attached plan. In addition, Project main milestones and deliverables have been identified in this plan.

The project will contain some progress reports including the status of actual work in comparison with what has been planned and deviation reports.

Work Breakdown Structure (WBS):
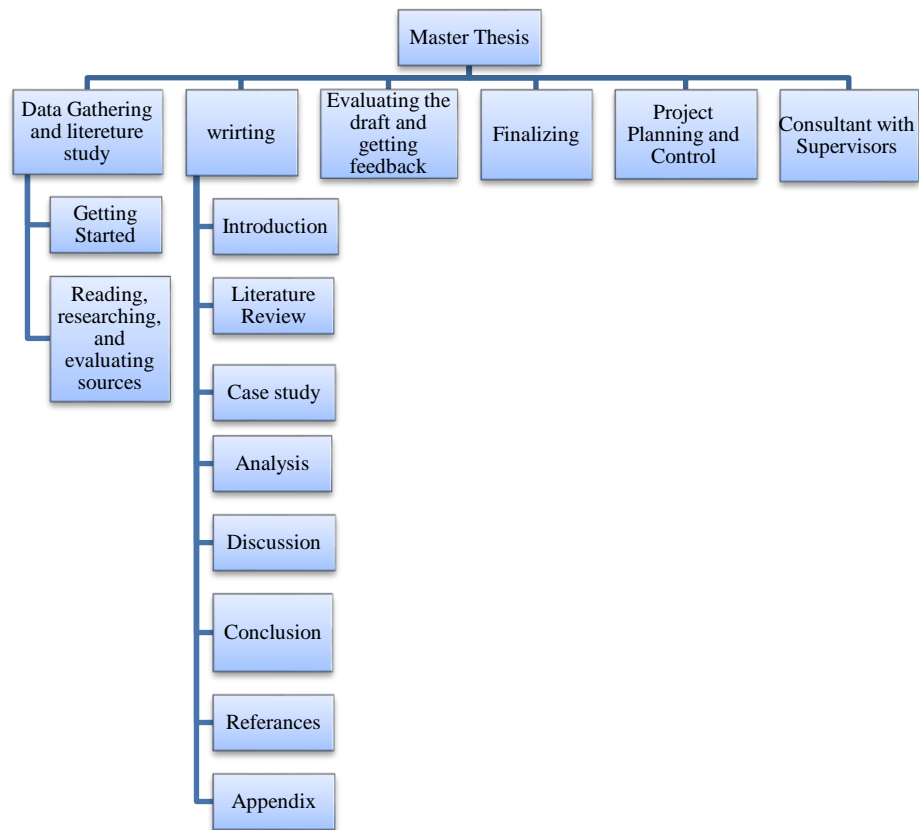
It should be mentioned that only main activities are shown in the above Structure, the deliverables are mentioned in the attached time schedule (plan).
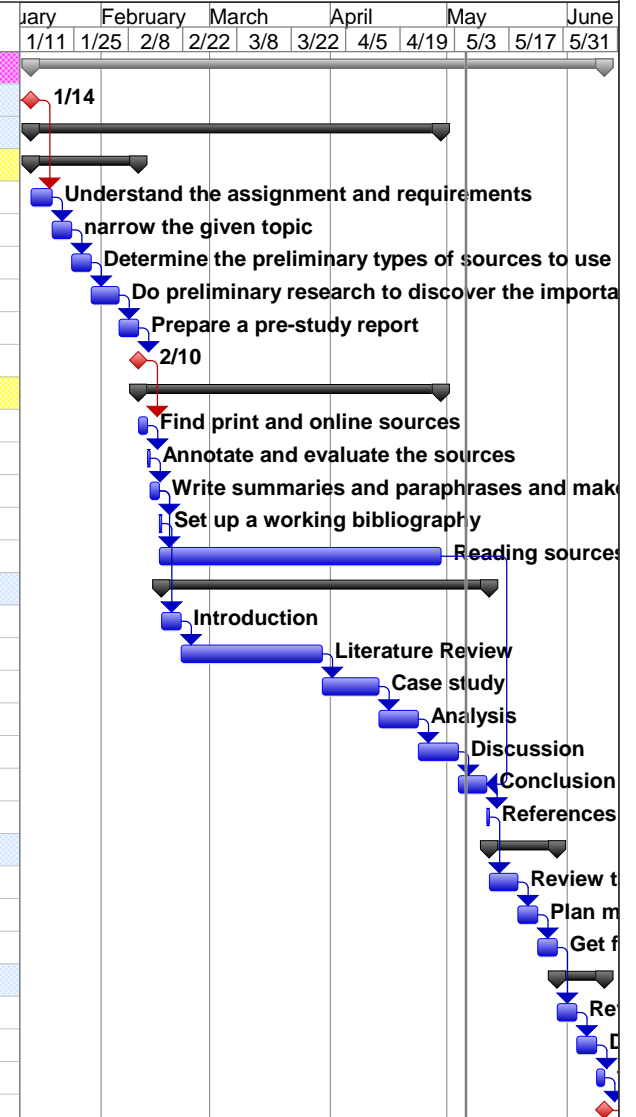
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APPENDIX

Thesis schedule
"Barriers of identifying early warning signs"

ID	WBS	Task Name	Duration	Start	Finish
0	0	Master Thesis	203 days	Tue 1/14/14	Tue 6/10/14
1	1	Start	0 days	Tue 1/14/14	Tue 1/14/14
2	2	Data Gathering and literature study	145 days	Tue 1/14/14	Tue 4/29/14
3	2.1	Getting started	38 days	Tue 1/14/14	Mon 2/10/14
4	2.1.1	Understand the assignment and requirements	7 days	Tue 1/14/14	Sun 1/19/14
5	2.1.2	narrow the given topic	7 days	Sun 1/19/14	Fri 1/24/14
6	2.1.3	Determine the preliminary types of sources to use	7 days	Fri 1/24/14	Wed 1/29/14
7	2.1.4	Do preliminary research to discover the important issues	10 days	Wed 1/29/14	Wed 2/5/14
8	2.1.5	Prepare a pre-study report	7 days	Wed 2/5/14	Mon 2/10/14
9	2.1.6	submit the prestudy report	0 days	Mon 2/10/14	Mon 2/10/14
10	2.2	Reading, researching, and evaluating sources	107 days	Mon 2/10/14	Tue 4/29/14
11	2.2.1	Find print and online sources	3 days	Mon 2/10/14	Wed 2/12/14
12	2.2.2	Annotate and evaluate the sources	1 day	Wed 2/12/14	Thu 2/13/14
13	2.2.3	Write summaries and paraphrases and make notes	3 days	Thu 2/13/14	Sat 2/15/14
14	2.2.4	Set up a working bibliography	1 day	Sat 2/15/14	Sun 2/16/14
15	2.2.5	Reading sources	100 days	Sat 2/15/14	Tue 4/29/14
16	3	Writing	116 days	Sun 2/16/14	Sun 5/11/14
17	3.1	Introduction	7 days	Sun 2/16/14	Fri 2/21/14
18	3.2	Literature Review	50 days	Fri 2/21/14	Sat 3/29/14
19	3.3	Case study	20 days	Sat 3/29/14	Sun 4/13/14
20	3.4	Analysis	14 days	Sun 4/13/14	Wed 4/23/14
21	3.5	Discussion	14 days	Wed 4/23/14	Sat 5/3/14
22	3.6	Conclusion & Recommendation	10 days	Sat 5/3/14	Sun 5/11/14
23	3.7	References	1 day	Sun 5/11/14	Sun 5/11/14
24	4	Evaluating the draft and getting feedback	24 days	Sun 5/11/14	Thu 5/29/14
25	4.1	Review the draft and Edit if necessary	10 days	Sun 5/11/14	Mon 5/19/14
26	4.2	Plan more research as necessary to fill any gaps	7 days	Mon 5/19/14	Sat 5/24/14
27	4.3	Get feedback from supervisor	7 days	Sat 5/24/14	Thu 5/29/14
28	5	Finalizing, presenting	17 days	Thu 5/29/14	Tue 6/10/14
29	5.1	Review and Quality check	7 days	Thu 5/29/14	Tue 6/3/14
30	5.2	Design the format of the paper	7 days	Tue 6/3/14	Sun 6/8/14
31	5.3	finalizing	3 days	Sun 6/8/14	Tue 6/10/14
32	5.4	Submitt the final draft	0 days	Tue 6/10/14	Tue 6/10/14
33	6	Meeting with supervisors	181 days	Tue 1/14/14	Sun 5/25/14

Project: Master Thesis
Date: Tue 5/6/14

Task
Milestone
Summary
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ID	WBS	Task Name	Duration	Start	Finish
34	6.1	Meeting1	0 days	Tue 1/14/14	Tue 1/14/14
35	6.2	Meeting2	0 days	Mon 1/20/14	Mon 1/20/14
36	6.3	Meeting3	0 days	Mon 1/27/14	Mon 1/27/14
37	6.4	Meeting4	0 days	Sun 2/2/14	Sun 2/2/14
38	6.5	Meeting5	0 days	Sat 2/8/14	Sat 2/8/14
39	6.6	Meeting6	0 days	Fri 2/14/14	Fri 2/14/14
40	6.7	Meeting7	0 days	Fri 2/21/14	Fri 2/21/14
41	6.8	Meeting8	0 days	Thu 2/27/14	Thu 2/27/14
42	6.9	Meeting9	0 days	Wed 3/5/14	Wed 3/5/14
43	6.10	Meeting10	0 days	Tue 3/11/14	Tue 3/11/14
44	6.11	Meeting11	0 days	Tue 3/18/14	Tue 3/18/14
45	6.12	Meeting12	0 days	Mon 3/24/14	Mon 3/24/14
46	6.13	Meeting13	0 days	Sun 3/30/14	Sun 3/30/14
47	6.14	Meeting14	0 days	Sun 4/6/14	Sun 4/6/14
48	6.15	Meeting15	0 days	Fri 4/11/14	Fri 4/11/14
49	6.16	Meeting16	0 days	Fri 4/18/14	Fri 4/18/14
50	6.17	Meeting17	0 days	Thu 4/24/14	Thu 4/24/14
51	6.18	Meeting18	0 days	Wed 4/30/14	Wed 4/30/14
52	6.19	Meeting19	0 days	Wed 5/7/14	Wed 5/7/14
53	6.20	Meeting 20	0 days	Tue 5/13/14	Tue 5/13/14
54	6.21	Meeting 21	0 days	Mon 5/19/14	Mon 5/19/14
55	6.22	Meeting 22	0 days	Sun 5/25/14	Sun 5/25/14
56	7	**Finish**	**0 days**	**Tue 6/10/14**	**Tue 6/10/14**

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8.2 Project planning and Control

8.2.1 Project schedule

8.2 Project planning and Control

8.2.1 Project schedule

Thesis schedule
"Barriers of identifying early warning signs"

ID	WBS	Task Name	Duration	Start	Finish
0	0	Master Thesis	203 days	Tue 1/14/14	Tue 6/10/14
1	1	Start	0 days	Tue 1/14/14	Tue 1/14/14
2	2	Data Gathering and literature study	145 days	Tue 1/14/14	Tue 4/29/14
3	2.1	Getting started	38 days	Tue 1/14/14	Mon 2/10/14
4	2.1.1	Understand the assignment and requirements	7 days	Tue 1/14/14	Sun 1/19/14
5	2.1.2	narrow the given topic	7 days	Sun 1/19/14	Fri 1/24/14
6	2.1.3	Determine the preliminary types of sources to use	7 days	Fri 1/24/14	Wed 1/29/14
7	2.1.4	Do preliminary research to discover the important issues	10 days	Wed 1/29/14	Wed 2/5/14
8	2.1.5	Prepare a pre-study report	7 days	Wed 2/5/14	Mon 2/10/14
9	2.1.6	submit the prestudy report	0 days	Mon 2/10/14	Mon 2/10/14
10	2.2	Reading, researching, and evaluating sources	107 days	Mon 2/10/14	Tue 4/29/14
11	2.2.1	Find print and online sources	3 days	Mon 2/10/14	Wed 2/12/14
12	2.2.2	Annotate and evaluate the sources	1 day	Wed 2/12/14	Thu 2/13/14
13	2.2.3	Write summaries and paraphrases and make notes	3 days	Thu 2/13/14	Sat 2/15/14
14	2.2.4	Set up a working bibliography	1 day	Sat 2/15/14	Sun 2/16/14
15	2.2.5	Reading sources	100 days	Sat 2/15/14	Tue 4/29/14
16	3	Writing	116 days	Sun 2/16/14	Sun 5/11/14
17	3.1	Introduction	7 days	Sun 2/16/14	Fri 2/21/14
18	3.2	Literature Review	50 days	Fri 2/21/14	Sat 3/29/14
19	3.3	Case study	20 days	Sat 3/29/14	Sun 4/13/14
20	3.4	Analysis	14 days	Sun 4/13/14	Wed 4/23/14
21	3.5	Discussion	14 days	Wed 4/23/14	Sat 5/3/14
22	3.6	Conclusion & Recommendation	10 days	Sat 5/3/14	Sun 5/11/14
23	3.7	References	1 day	Sun 5/11/14	Sun 5/11/14
24	4	Evaluating the draft and getting feedback	24 days	Sun 5/11/14	Thu 5/29/14
25	4.1	Review the draft and Edit if necessary	10 days	Sun 5/11/14	Mon 5/19/14
26	4.2	Plan more research as necessary to fill any gaps	7 days	Mon 5/19/14	Sat 5/24/14
27	4.3	Get feedback from supervisor	7 days	Sat 5/24/14	Thu 5/29/14
28	5	Finalizing, presenting	17 days	Thu 5/29/14	Tue 6/10/14
29	5.1	Review and Quality check	7 days	Thu 5/29/14	Tue 6/3/14
30	5.2	Design the format of the paper	7 days	Tue 6/3/14	Sun 6/8/14
31	5.3	finalizing	3 days	Sun 6/8/14	Tue 6/10/14
32	5.4	Submitt the final draft	0 days	Tue 6/10/14	Tue 6/10/14
33	6	Meeting with supervisors	181 days	Tue 1/14/14	Sun 5/25/14

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Thesis schedule
"Barriers of identifying early warning signs"

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8.2.2 Project S-curve

S-curve (Project progress)

	14.01.2014	28.01.2014	11.02.2014	25.02.2014	11.03.2014	25.03.2014	08.04.2014	22.04.2014	06.05.2014	20.05.2014	06.03.2014	10.06.2014
Plan	0.00%	12.17%	19.00%	31.10%	38.30%	45.10%	52.50%	62.16%	72.40%	86.20%	97.11%	100.00%
Actual	0.00%	12.17%	19.00%	40.00%	50.00%	60.00%	70.00%	80.00%	90.00%	95.00%	100.00%	100.00%