

# Using ICT and Control Mechanisms in Project Management

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**How ICT Enables and Affects Control Mechanisms**

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June 13, 2011

Thesis

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**Contents**

**FIGURES..... 5**

**ACKNOWLEDGEMENTS ..... 7**

**EXECUTIVE SUMMARY ..... 9**

**1. INTRODUCTION ..... 10**

1.1. DEVELOPMENT OF USING ICT ..... 10

1.2. THE RISE OF PROJECT MANAGEMENT IN IT INDUSTRY ..... 11

**2. WHY PROJECT MANAGEMENT IN IT SECTOR?..... 11**

2.1.1. THE VIRTUAL TEAM..... 13

2.1.2. VITAL FACTORS OF IT PROJECT MANAGEMENT ..... 14

2.1.3. STANDARDS IN PROJECT MANAGEMENT ..... 17

2.2. PROBLEM DEFINITION ..... 18

**3. METHODOLOGY ..... 19**

3.1. LITERATURE SELECTION..... 19

3.1.1. STRATEGY AND PROCESS OF SELECTION..... 19

3.1.2. OVERVIEW OF THEORIES ..... 20

3.2. THE FIELDS OF STUDY ..... 20

3.3. THE ANALYSIS PROCESS ..... 23

3.4. THE LIMITATION OF METHODS ..... 24

**4. THEORY ..... 24**

4.1. PROJECT TEAM BUILDING WITH CONTRADICTIONS ..... 24

4.2. CONTROL CAN BE THE PROJECT MANGER’S MOST POWERFUL MANUAL TOOL ..... 24

4.3. ICT ENABLES THE VIRTUAL WORKING ENVIRONMENT OF IT PROJECT MANAGEMENT ..... 25

4.3.1. PROJECT TEAM AS GLOBAL VIRTUAL TEAM ..... 25

4.3.2. GENERAL PROJECT MANAGEMENT THEORY ..... 26

4.4. CONTROL MECHANISMS AND DESIGN OF CONTROL MECHANISMS ..... 31

**5. EMPIRICAL STUDY ..... 32**

<b>5.1. INTERVIEW OBJECT 1 .....</b>	<b>32</b>
5.1.1. COMPANY 1 BACKGROUND .....	32
5.1.2. INTERVIEW PERSON 1 .....	33
<b>5.2. INTERVIEW OBJECT 2 .....</b>	<b>36</b>
5.2.1. COMPANY 2 BACKGROUND .....	36
5.2.2. INTERVIEW PERSON 2 .....	37
<b><u>6. ANALYSIS .....</u></b>	<b><u>39</u></b>
<b>6.1. APPROACH .....</b>	<b>39</b>
<b>6.2. ICT ENABLES CONTROL STRUCTURE.....</b>	<b>40</b>
6.2.1. ELECTRONIC MONITORING AND CONTROLLING .....	40
6.2.2. MANAGEMENT BY FEEDBACK AND BY AD HOC .....	42
6.2.3. SELF-DIRECTING TEAM .....	43
<b>6.3. EFFECTIVENESS.....</b>	<b>45</b>
6.3.1. EFFECTIVENESS FACTORS INVOLVED WITH ICT TOOLS .....	45
6.3.2. ACTION PLANNING .....	46
6.3.3. PERFORMANCE EVALUATION AS CONTROL MECHANISM .....	47
<b>6.4. QUESTION RAISED.....</b>	<b>49</b>
6.4.1. E-MAIL AND E-DOCUMENT .....	50
6.4.2. OWN JUDGMENT .....	50
6.4.3. NOISE AND FREEDOM OF WORK .....	52
<b><u>7. CONCLUSION.....</u></b>	<b><u>53</u></b>
<b><u>8. REFERENCES.....</u></b>	<b><u>55</u></b>
<b><u>9. ANNEX .....</u></b>	<b><u>59</u></b>
<b>9.1. A TYPICAL JOB DESCRIPTION FOR A ICT COORDINATOR.....</b>	<b>59</b>
<b>9.2. DIFFERENT CONTROL MECHANISMS.....</b>	<b>60</b>

**Figures**

Figure 1.Global ICT developments, 1998-2009 (International Telecommunication Union, 2010) ..... 10

Figure 2.Perceived IT project success rates by paradigm 2010 ..... 12

Figure 3.Criteria of virtual team within project context ..... 14

Figure 4.The five basic parts..... 20

Figure 5.The five basic parts within the same ideology. .... 21

Figure 6. Project management team structure from PRINCE2 ..... 22

Figure 7. Simple network communication system..... 39

Figure 8. The traditional three-level communication system..... 40

Figure 9 Important factors for effective virtual team working (Bal, J., and P. Foster , 2000) · 45

Figure 10. The five basic parts by Mintzberg ..... 47



## **Acknowledgements**

I am heartily thankful to my supervisor, Tim Torvatn, whose encouragement, guidance and support from the initial to the final level enabled me to develop an understanding of the subject. I have benefited from the advice of him.

This thesis would not have been possible unless access of the rich NTNU database.

Lastly, I offer my regards and blessings to all of those who supported me in any respect during the completion of the project.

Lufeng Zheng

13. June. 2011





## Executive Summary

The causality of troubled ICT projects and driven force of more systematic project management approach within IT sectors is not easy to be defined in practice due to the variety of industry and business needs.

In this report, I will mainly focus on issues addressing to ICT tools providing voice, data and media services and information applications and systems tailored to specific functions in the IT- enabled industries which provide IT goods and services.

My main hypothesis is *“Using ICT enables and provides the most effective framework for control mechanisms of IT projects.”*

I found it was difficult to provide a clear conclusion, along with revealing the effects of using ICTs in the IT industry; there are more raising questions connected with using of ICTs which need more future research. But one thing is certain, using ICTs doesn't have an evolutionary impact on the project management as first thought; I can still see the clear footprint of the traditional and classical organization theories from Mintzberg.

The various ways of transmission of information and the increased speed and volume in the transmission of information, which are enabled by using ICTs have changed and affected the control system for the better and the worse.

# 1. Introduction

## 1.1. Development of using ICT

The last decades we have seen uninterrupted growth in terms of telecommunication and ICT infrastructure development and service uptake. Despite the recent economic downturn, the use of Information and Communication Technology (ICT) services, such as mobile phones and the Internet, continues to grow worldwide.

According to ITU World Telecommunication/ICT Indicators database 2010 (International Telecommunication Union, 2010), by the end of 2009, there were an estimated 4.6 billion mobile cellular subscriptions, corresponding to 67 per 100 inhabitants globally, and an estimated 26 per cent of the world's population (or 1.7 billion people) were using the Internet. At the end of 2009, there were an estimated 640 million mobile and 490 million fixed broadband subscriptions.

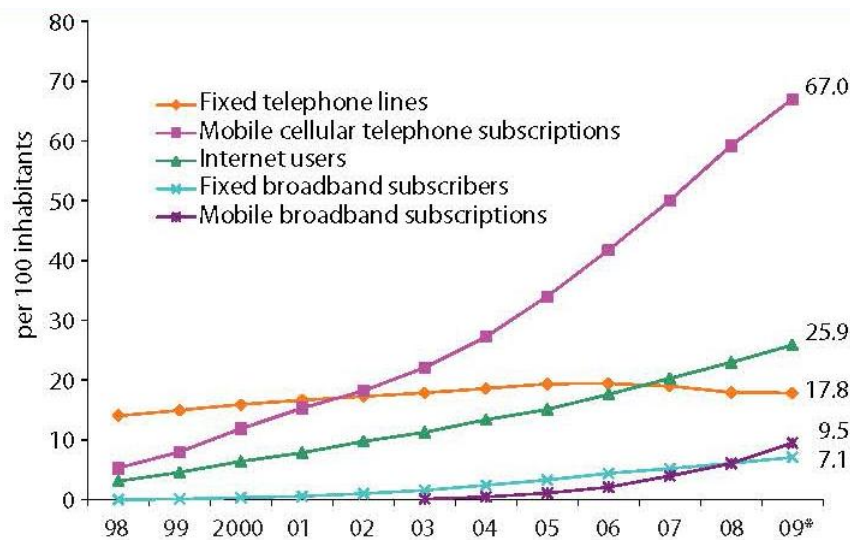


Figure 1. Global ICT developments, 1998-2009 (International Telecommunication Union, 2010)

It's been common to work in a geographically dispersed organization, communicating with others with various ICT tools. Most of researchers and practitioners call this phenomenon virtual organization or virtual team for a smaller size group of people.

Despite of the dominant existence of organization, and due to the dynamic environment organizations operate in, it is becoming even more common for organizations to develop their products (tangible and intangible) and generate revenue by developing specific projects.

Increasingly geographically distributed organizations are accomplished by work groups, often formalized as project teams. And team members are been selected most likely from multiple functional units, from different locations, and often from diverse demographic and cultural backgrounds.

The emergent virtual team is mostly enabled by ICTs. The precedent development of ICT in 1990s provided team members with possibilities of sharing rich information and complex collaboration in distance without physical presence. The significance of spatial distance and temporal asynchrony turn to less important.

### **1.2. The rise of project management in IT industry**

Executives are often haunted in pursuer of cost-reduction. In the past, we have seen massive cost-reduction programs being practiced; in order to accomplish the same amount of work with fewer resources, executives are investing more capital in physical equipment in an attempt to increase and improve productivity without increasing work force. However, there is limited in how much manpower can be reduced without running a high risk to corporate profitability. Investing in physical equipment is not always the answer.

Today's executives are forced to look elsewhere for a solution. In the IT industry, manpower is considered as one of the most critical resources of an organization, and it cannot be simply replaced by physical requirement.

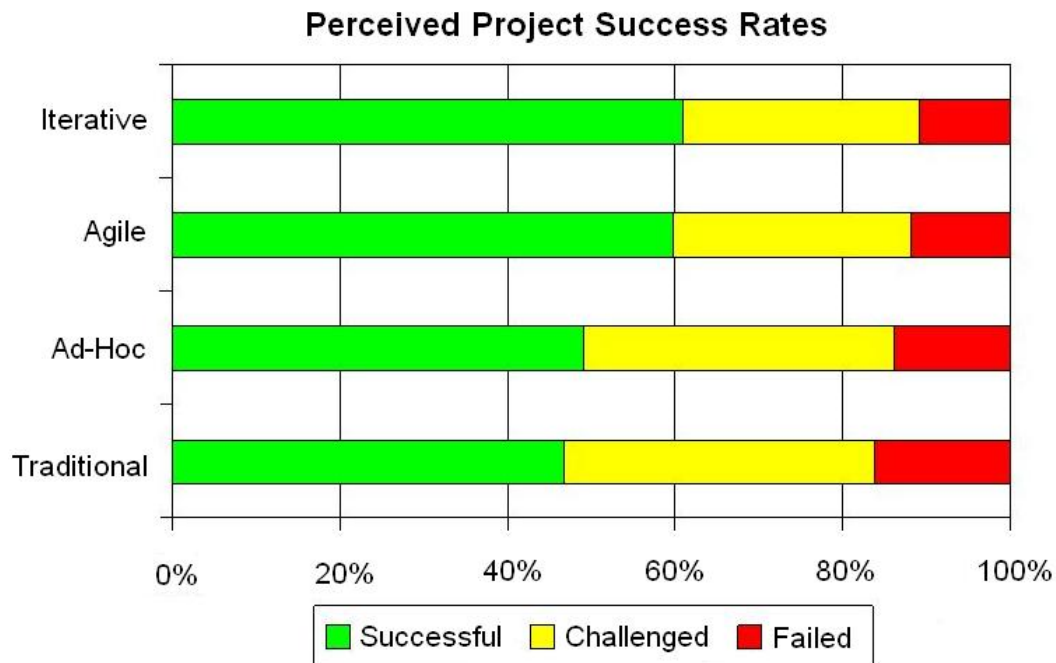
Executives are in agreement with the solution to the majority of addressing problems involving obtaining better control and use of existing resources, looking internally rather than externally for the solution. Project management is the way to go, by focusing more on how the corporate activities are managed. The project management approach is relatively modern, but optimizing and improving each day goes.

The rapid rate of change in technology and the marketplace has created enormous strains on the traditional organizational forms in the IT industry. The traditional organizational structure is highly bureaucratic; it shows its weakness in adapting to a changing environment. Thus, the traditional structure must be replaced by project management, or other temporary management structures that are organic and are capable to respond rapidly as situation changes internally and externally.

The purpose of project management and principal function of a project manager is to achieve all the set project objectives in spite of the risks.

## **2. Why project management in IT sector?**

The world we know is built up along with the pursuit of realization of materialism, therefore technical project are more common. Nowadays, many organizations are getting involved in IT based projects which bring high risk and costs, due to the nature of IT project, managers are taken into technical developments where they may not feel confident all the time.



Note: Accurate to within +/- 7%  
 Figures are "normalized" to add to 100%

Copyright 2010 Scott W. Ambler  
 Source: 2010 IT Project Success Survey, [www.amblysoft.com/surveys/](http://www.amblysoft.com/surveys/)

Figure 2. Perceived IT project success rates by paradigm 2010

According to the 2010 IT Project Success Survey (Ambler, 2010), all IT projects developments are defined as following four different paradigms:

- **Ad-hoc.** On ad-hoc software development projects the team does not follow a defined process.
- **Iterative.** On an iterative software development project the team follows a process which is organized into periods that are often referred to as iterations or time boxes. On any given day of the project team members may be gathering requirements, doing design, writing code, testing, and so on. Rational Unified Process (RUP) is an example of an iterative software process.
- **Agile.** On an agile software development project the team follows an iterative process which is also lightweight, highly collaborative, self-organizing, and quality focused. An example of an agile process is OpenUP, Scrum, and Extreme Programming (XP).
- **Traditional.** On a traditional software development project the team follows a staged process where the requirements are first identified, then the architecture/design is defined, then the coding occurs, then testing, then deployment. Traditional processes are often referred to as "waterfall", "classical", or simply "serial" processes.

Success rates are:

- **Ad-hoc projects:** 49% are successful, 37% are challenged, and 14% are failures.
- **Iterative projects:** 61% are successful, 28% are challenged, and 11% are failures.
- **Agile projects:** 60% are successful, 28% are challenged, and 12% are failures.
- **Traditional projects:** 47% are successful, 36% are challenged, and 17% are failures.

By simple calculation it shows that the total project failure rate is 13.5%, but contradictory reflection of a reasonable record of success: we haven't suffered from high profile project failures, especially IT project failures. When we summarize the "Challenged" and the "Failed", surprisingly the percentage is 45.75%. I am not going to discuss how to define these "Challenged" and "Failed" here, but I interpret this diagram as that a number of troubled projects has plagued the private and public sectors and driven the adoption of a more systematic project management approach.

### 2.1.1. The virtual team

Virtual team, as a recently popular project team form, has been identified with some widely accepted criteria including enabled by ICTs, geographically dispersed, boundary spanning and asynchrony, summarized by (Schweitzer, L., and L. Duxbury, 2010).

A virtual team varies along two primary dimensions (Martins, L. L., L. L. Gilson, and M. T. Maynard, 2004). First, a team which can be defined as a virtual team, it must co-act among team members with information and communication technology (ICT), but we have noticed that the way of using ICT is a matter of fact as a choice by the team members (Kirkman, B. L., and J. E. Mathieu, 2005). For instance, a team is physically located in a face-to-face environment, sometimes will still rely on different type of ICT to interact with each other and exchange information.

Second, physical dispersion of team members will require vitalized interaction among the team members, due to spatial distance and temporal asynchrony difficulties. The greater the geographic dispersion, the greater the temporal differences in team members (O'Leary, M. B., and J. N. Cummings, 2007). This is often defined as two different criteria by scholars as geographic dispersion and asynchronicity. The spatial distance seems to be easily managed, but the temporal asynchrony seems to cause more challenges more than ever. The spatial distance and temporal asynchrony will also refer to cultural diversity and boundary spanning in a virtual team.

As just mentioned above, furthermore literature review shows us two more criteria for defining virtuality. The boundary spanning of team members is more from an organizational point of view, that the organizational origin should not determine virtualness of the team. In a project environmental context, it often causes more management difficulties because of combining of boundary spanning with physical dispersion.

Also the cultural diversity is often described along with physical dispersion. Because of the physical dispersion, it is most likely different team members will carry with their own different cultural, national or organizational backgrounds consciously or unconsciously. However, only cultural diversity or boundary spanning alone is neither sufficient nor necessary to classify a virtual team or degree of the virtuality.

Finally, with the nature of project in concern, existing of a virtual team is also temporary. Virtual teams are typically more fluid in that the composition of the team can change readily and the entire team may form and dissolve relatively quickly (Mowshowitz, 1997).

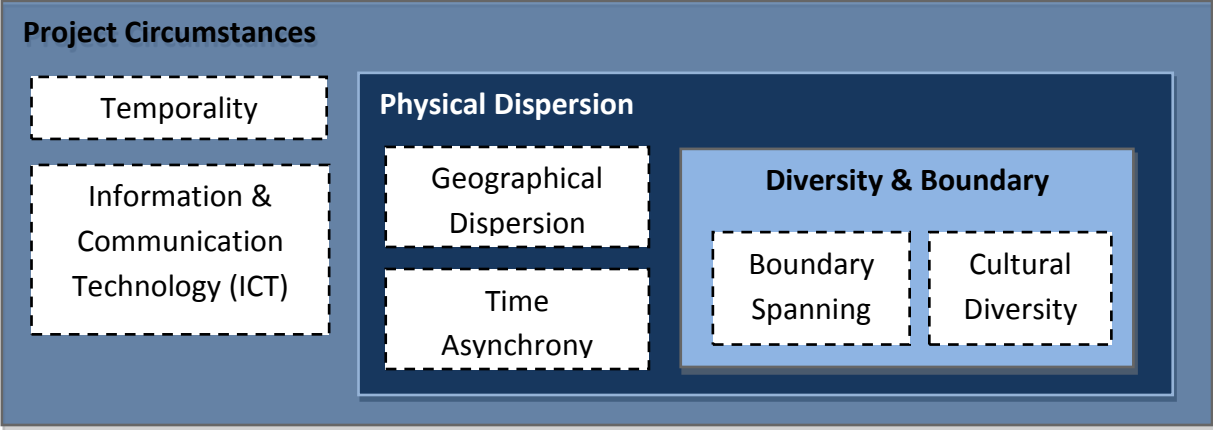


Figure 3.Criteria of virtual team within project context

**2.1.2. Vital Factors of IT Project Management**

In a general way, project management activities are to ensure the project execution within scope, time, cost and quality expectation. Traditionally, project manager monitor activities, track tasks and make sure everything is under control. However, nowadays, it’s been widely accepted that giving orders to team members doesn’t always receive positive response. Instead, people-oriented management style is valued a lot especially in knowledge competent teams.

People-oriented managers consider intellectual properties more important than others. Instead of managing processes and activities, project managers place great emphasis on establish shared vision and common sense in the team. Project management effects rely on shared value and established norms instead of giving orders or force to follow instructions.

Since a virtual team usually has multiple physical offices or requires team members to work asynchronously, it’s very hard to monitor activities and keep an eye on what you can’t see. Decisions always rely on reports and feedbacks from local members. Therefore, assigning a right person to handle proper tasks is more important and easier than giving a right order or perform direct controls.

The complexity and uncertainty of carrying out a project undoubtedly requires project management work. Conventionally, managing project means identifying requirements, addressing the various needs, concerns and expectations of stakeholders and balancing competitive project constraints such as scope, quality, schedule, etc. (PMBOK, 2008) The goal of managing project is to ensure the success according to various criteria. Usually, project is managed by means of monitoring and controlling. Tasks are assigned to team members and tracked by the project manager. Decision making process relies on collecting information actively and complemented by feedback from team members or collective wisdom. In one word, once the manager keeps everything on track and under control, the project should be in the right way.

However, people are not machines. Monitoring and controlling neither guarantee positive response nor motivation for the virtual team all the more. It's difficult to rely on direct control and coordination. Instead, they bind the organization through shared values and norms. Hence, we will look into the people-oriented project management style in this paper, trying to find out what and how project management practices fit into a virtual project team.

Among many different factors that may affect the effectiveness and efficiency of project management in virtual teams, we chose to make an intensive study of people, communication and knowledge. A lot of research had been done to related topics. For example beside these three terms itself, trust, leadership, motivation, decision making, conflict, etc.

### ***People***

People are the most important intellectual properties for a knowledge competent team. They are also the actors, information receivers and interpreters and decision as well as trouble makers.

Projects are developed, managed and implemented by people. These entail component processes and activities that require the services of competent professionals to work together as a team. Project managers have to understand the roles and participation of people in the project, including stakeholders and beneficiaries. They need to manage the expectations of the people involved in the project. Stakeholders' analysis will be useful to conduct during project initiation to ensure the magnitude of participation of people in the project. Ownership of the project by beneficiaries must be emphasized because ultimately, they will be the ones using, integrating and sustaining the products or systems developed by the project.

### ***Process***

A process that runs well relies on good procedural design by management and adherence to the process by the project implementers or staff. A well-designed and precise process can lead to the discovery of potentialities, and enhance the capabilities or competencies of project staff members resulting in self-propelling staff, which is vital to the success of internal project management. In most ICT projects, one of the work components is process re-engineering, which means that the activities and documentation are reviewed to remove redundancies or unnecessary processes. If this review is not done, the old process will produce the same inefficient or ineffective results.

### ***Communication***

Communication is said to be the life wire of any type of organization. It's even more crucial and unavoidable for a virtual team since lack of physical presence raised the barrier of understanding.

### ***Technology***

This refers to the machines and/or software that are available in the market that are used to support the needs and processes of the organization. Technology should not dictate or take the lead in addressing organizational or project needs. Instead, it should be used in support of the needs of the people in the organization. In ICT enabled community projects, technology should take the back seat until the needs of people and processes are defined. Projects that put technology before the users' needs and process requirements often fail, resulting in a waste of resources (time and cost). When it is selected well, appropriately used, and built on a stable platform, technology can make project processes efficient and accelerate the project work flow.

### ***Knowledge***

Knowledge, known as a vital competence, is another interesting factor. The efficiency of knowledge transfer and sharing is really a matter of competitiveness and sustainability at any level of organizations.

I believe that all these factors are interconnected and have positive effects on each other. They will together affect the project success on the inside. Ensuring the quality of them in the scope of a project is then an important mission of performing project management practices.



### 2.1.3. Standards in Project Management

Through the years, various schools of thoughts and approaches to project management have emerged and best practices and reference standards are offered. As government leaders, it is important to be aware of the common reference standards that are used and oftentimes mentioned by donors, vendors and suppliers of outsourced projects. Some of these standards include:

- The Project Management Book of Knowledge (also known as PMBOK) approach, which is presented in a 182-page compendium on project management published by the Project Management Institute (PMI) based in the USA. The institute encourages certification of project managers who will apply their standards (<http://www.pmi.org>).
- The Projects in Controlled Environments (Prince 2) approach developed in 1989 as a standard for IT project management by the UK government. Organizations are certified through standard examinations administered by the Association for Project Management group. Prince 2 is registered under the UK Office of Government of Commerce ([http://www.ogc.gov.uk/methods\\_prince\\_2.asp](http://www.ogc.gov.uk/methods_prince_2.asp)).
- The International Project Management Association was found in 1965 by a group of innovative people created a forum for project managers to network and share information. The result was IPMA, the world's first project management association. Over the years IPMA has developed the certification program and played a major role in the promotion and progress of project management. (<http://www.ipma.ch/certification/pages/default.aspx>).
- The International Cost Engineering Council (ICEC) is a nonpolitical and nonprofit organization which was founded in 1976 with the object of promoting cooperation between national and multinational cost engineering, quantity surveying and project management organizations worldwide for their mutual wellbeing and that of their individual members. (<http://www.icoste.org>).
- The Microsoft Solutions Framework (MSF) evolved out of best practices in software development. Microsoft claims that it has been successfully applied to infrastructure deployment projects as it is designed "to provide value in today's Internet era of computing". (<http://www.microsoft.com/technet/solutionaccelerators/msf/default.mspx>).
- The Rational Unified Process (RUP), which provides an amalgamation of constructs developed after the Rational Corporation. It is an iterative framework for software development that is now available as a product from IBM. It is a cousin of the Unified

Modeling Language, which is widely adopted in tools for object-oriented software design and development ([http://en.wikipedia.org/wiki/Rational\\_Unified\\_Process](http://en.wikipedia.org/wiki/Rational_Unified_Process)).

- Project Cycle Management (PCM), which describes the management activities and decision-making procedures used during the life cycle of a project (including key tasks, roles and responsibilities, key documents and decision options). Many organizations, including bilateral and multilateral aid groups, make use of PCM tools and processes ([http://ec.europa.eu/europeaid/multimedia/publications/documents/tools/europeaid\\_adm\\_pcm\\_guidelines\\_2004\\_en.pdf](http://ec.europa.eu/europeaid/multimedia/publications/documents/tools/europeaid_adm_pcm_guidelines_2004_en.pdf)).
- The Logical Framework Approach (LFA), an analytic, presentational and management tool developed by the US Agency for International Development and other donor groups. It establishes a logical hierarchy of means by which goals and objectives are reached, with the indicators, risks and assumptions, and inputs and outputs identified ([www.usaid.gov/ausguide/pdf/ausguideline3.3.pdf](http://www.usaid.gov/ausguide/pdf/ausguideline3.3.pdf)).

## 2.2. Problem definition

ICT is multifaceted and broadly defined, ranging from the rollout of telecommunications infrastructure—providing voice, data, and media services—and information applications tailored to specific sectors and functions (for example, banking and finance, public welfare, administration and business needs, land management, education and health) to the implementation of electronic government (e-government) and the development of information technology (IT) and IT-enabled industries (including IT goods and services). The causality of troubled ICT projects and driven force of more systematic project management approach within IT sectors is not easy to be defined in practice due to the variety of industry and business needs.

I will mainly focus on issues addressing to ICT tools providing voice, data and media services and information applications and systems tailored to specific functions in the IT-enabled industries which provide IT goods and services.

By describing and mapping of existing ICT tools and control mechanisms in project management within IT sector, my research aims to find out how using ICT enables and affects control mechanisms in IT projects at small and medium-sized IT firms.

My main hypothesis is *“Using ICT enables and provides the most effective framework for control mechanisms of IT projects.”*

### 3. Methodology

My approach is based on research at the traditional design of control mechanism structure. Identifying and summarize literature on control mechanisms and design of control mechanisms.

Conducting an empirical case study on how small and medium-sized IT firms work with control mechanisms and ICT tools. It will be combination of deep interview of key persons and direct observation.

Based on my established knowledge base of project management, I shall identify and describe alternative approaches and gaps in the literature regarding use of ICT tools and its effects upon control mechanisms and to give a suggestion of future research.

#### 3.1. Literature selection

##### 3.1.1. Strategy and process of selection

With the advice from my supervisor, Tim Kristian Andreas Torvatn, I built a baseline of the knowledge regards to organizational structuring from Structure in Fives: Designing effective organizations by Henry Mintzberg.

As Mintzberg mentioned in the Structure in Fives:

*Organizations have developed a whole set of devices to encourage liaison contacts between individuals, devices that can be incorporated into the formal structure. In fact, these liaison devices represent the most significant contemporary development in organization design – indeed, the only serious one since the establishment of planning and control systems a decade or two earlier.*

I found this statement still reasonable and suitable now. Later literature research was focused more on planning and control systems. I have due the better understanding of planning and control system to understand control mechanisms. Literatures regarding to “virtual” concept in organizations and to project as contemporary form of organizing revenue generation were paid a great attention.

It’s interesting that the trend of attention in “virtual team” is in accordance with the IT industry’s development, which supports the argument of “information technology is the key enabler of virtual team”. Along with the development of ICT, new issues and effects are showing in project activities. Scholars and practitioners have also noticed the phenomena.

This thesis doesn’t aim to review all findings and issues, but will provide a clear reasoning path of literature to my conclusion.

### 3.1.2. Overview of theories

The Causality Principle has played an important role in the development of the theory of knowledge and our scientific reasoning logic, and used often in daily life when we do not even realize it. Through the causality principle, we may come to the conclusion that “Designing effective organizations” address hence situation also in which all projects exist, as well as in which all organizations exist, due to project is one form of organizing.

**Five organizational parts** as Mintzberg defined five organizational parts, five coordinating mechanisms and five types of decentralization (Mintzberg H. , 1983), and each of these topics contains a set of factors which influences the emerging structure, but there is no dependent or independent variable in a system, everything depends on something else (Mintzberg H. , 1983).

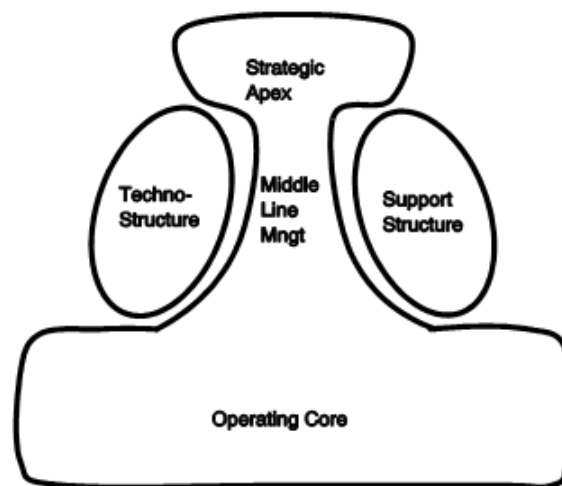


Figure 4. The five basic parts

Mintzberg stated that few organizations fit perfectly into this distinct structure model, due to complexity of dealing people and complex systems.

### 3.2. The fields of study

Once I have all the basic parts in place, then I can look closer into how the linkage between all the parts are effected by using of ICT, after all it is what mutual adjustment for coordination makes organizations and projects within the same ideology and goals.

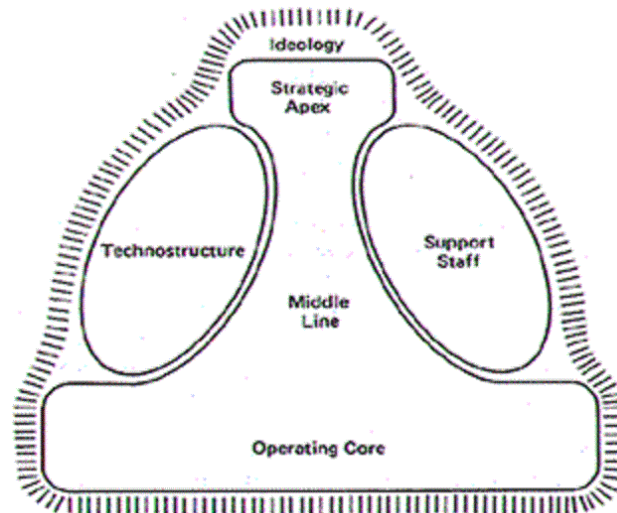


Figure 5. The five basic parts within the same ideology.

The Strategic Apex is comprised of the top managers and directors. They act as the brain of the organization, forming visions and strategic goals. Their primary job is to ensure and maximize the organization's return on investment.

The Middle Line Management contains all the employees who delegate the work to the operating core in concordance with the visions and strategic goals formed by the strategic apex. The height of the middle line varies due to the size of the organization. The purpose of the middle line managers' work is to manage the unit for which he has been given responsibility. Periodically he delivers performance feedback to his own managers. Project managers are most likely positioned in the part, and report to the top management team.

The Operating Core consists of all employees who directly work with producing the organization's products. This part of the organization is where the organization usually generates its business value. In the context of a project, the project team is considered as an operating unit as a whole.

The Technostructure represents the organization's analysts and specialists who define which techniques and tools should be used by the operating core, this is known as standardization, therefore they are not seen as a part of the operating core. For instance, it can be the quality insurance and testing unit for a project, which does not answer to the project manager. The technostructure can operate on all levels of an organization.

The Support Staff can include several groups of people in the organization; their primary purpose is to support the rest of the organization by ensuring them the optimal settings for doing their work, which in projects can be defined as project office. Tasks can vary from mail collecting to those who perform the organization's accounting on the behalf of the project manager.

In organizations and in projects, important interdependencies remain after all individual positions have been designed, the structure built, and the planning, monitoring and control systems set in place. The project team must turn to mutual adjustment for coordination.

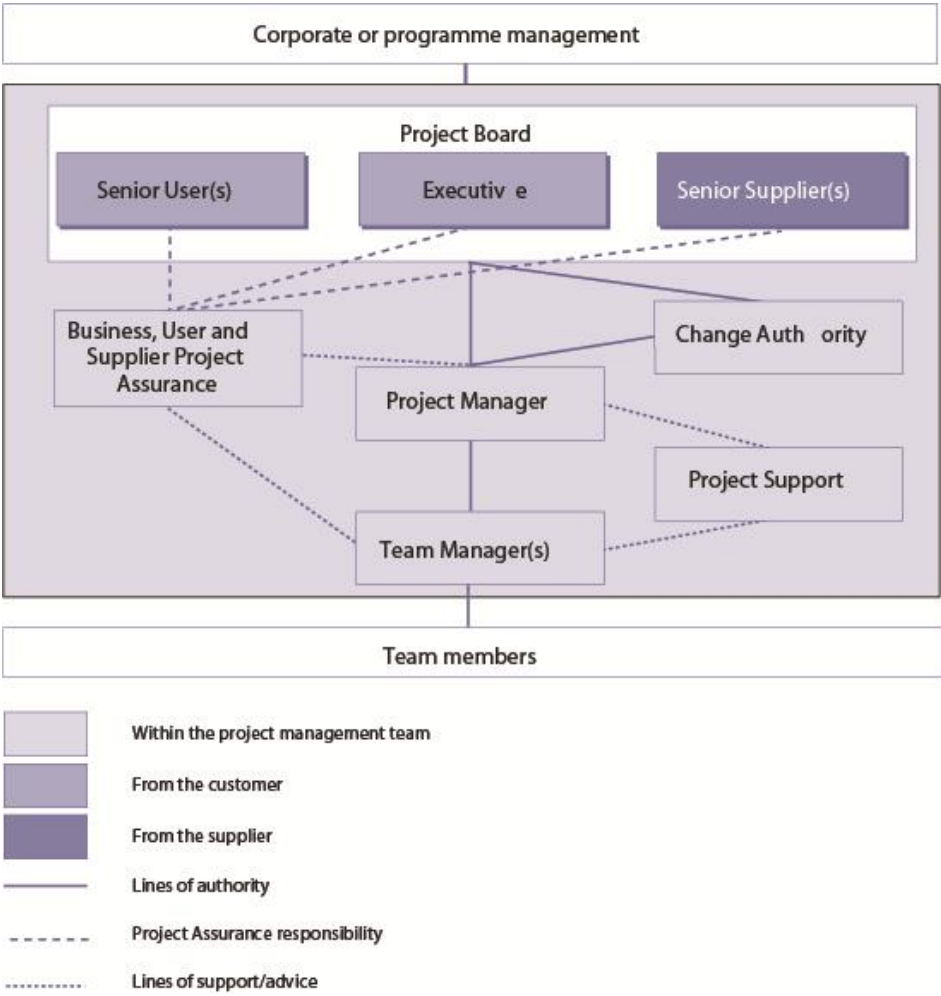


Figure 6. Project management team structure from PRINCE2

In order to achieve the targeted goal, every project needs to complete a number of tasks. Usually tasks are interdependent or at least required to be of a certain standard. This all requires coordination and again five possible solutions for doing this is presented: Directly supervision, Standardization of work, Standardization of outputs, Standardization of skills, Mutual adjustment.

Mutual adjustment includes five basic types of liaison devise: liaison positions, task forces and standing committees, integrating managers, and matrix structure (Mintzberg H. , 1983).

The complexity and uncertainty of carrying out a project undoubtedly requires project management work. Conventionally, managing project means identifying requirements, addressing the various needs, concerns and expectations of stakeholders and balancing competitive project constraints such as scope, quality, schedule, etc. (PMBOK, 2008) The goal of managing project is to ensure the success according to various criteria. Usually,

project is managed by means of monitoring and controlling. Tasks are assigned to team members and tracked by the project manager. Decision making process relies on collecting information actively and complemented by feedback from team members or collective wisdom. In one word, once the manager keeps everything on track and under control, the project should be in the right way.

However, it makes no sense with absence of ICTs; using of ICTs makes all these processes and activities possible. And all activities are performed by people, not by machines. Monitoring and controlling neither guarantee positive response nor motivation for the virtual team all the more. It's difficult to rely on direct control and coordination. Hence I am trying to find out what and how using of ICTs in context of project management practices fit into a virtual project team.

### **3.3.The analysis process**

Based on literature research as well as ongoing discussions with interview persons, I can build a working hypothesis of a significant influence of using of ICT on a project outcome in the context of:

- ICT using between the project team and the other stakeholders (project owners, users, suppliers, other internal unit within the organization, other project teams, etc.)
- ICT using within the project team.

Most research projects are focused on the analysis of ICT using between the project team and the other stakeholders, followed by attention on ICT using within the project team. In project management literature, ICT using/communication is hosting a great attention. (Maylor, 2003) (Cadle, 2004) (Schelle, 2006) (Lee-Kelley, 2008).

First, I attempt to identify and summarize literature on control mechanisms and design of control mechanisms.

Second, I attempt to summarize existing reasoning logics in the literature and try to identify and describe alternative approaches and gaps regarding use of ICT tools and its effects upon control mechanisms.

My research effort will enhance my knowledge of control mechanisms and design of control mechanisms, and try to reveal new questions regarding to my interview data. I will combine personal experiences into analysis and with those theories.

I expect to draw some conclusions to complement existing theory frameworks. I also expect to develop some practices for project management in the context of using of ICT to help to understand or overcome existing difficulties with control mechanisms within small and medium size IT companies.

### **3.4. The limitation of methods**

Based on the research questions on “what” and “how”, the current research is categorized as exploratory and descriptive approach. The strategy for this research is based on literature review that help to build understanding of using ICT within project management in IT sector.

My study is based on limited literature review and analysis as well as my own experience and knowledgebase. By conducting interview as empirical study with limited persons, can be affected by a particular situation where and when the interviews are conducted, and all projects are unique. However, it should provide reasonable practical value in a real world environment, regarding to the causality theory.

Besides, in processing of literature research, I will be inevitably influenced by some authors’ advocacy or opposition to an idea. And this may have affected my judgment and ideological logics unwittingly. However, by introducing interviews of practitioner, I will overcome this deficiency and conclusions of this research are based on estimates.

## **4. Theory**

### **4.1. Project team building with contradictions**

Project managers are in constant battle of dealing of contradictions; L. Mullins discovered one of the key contradictions that project managers require their project team members’ willingness to compromise and subordination while at the same time encouraging individualism and creativity.

According to J. Chaffee (Chaffee, 2000), most people lose their creativity and individualism during their professional career life, in preference of perform to the existing standards. This is the most common used argumentation why some leaders prefer to build their team with young people knowing their lack of experience. Although they realize that they are putting themselves in the position facing possible failure of project. The risk is high. Therefore IT project leaders need to combine these contradictions factors and build the project team to ensure overall project successes. J. Adaira mentioned three criteria that need to be taken into consideration when evaluating potential team members: competence, motivation and personal traits (Adaira, 1999).

### **4.2. Control can be the project manger’s most powerful manual tool**

Control can also be conducted in an activity that often goes on in addition to regular reporting, namely the speculation about results in the near future. In the empirical study, speculations were made during the planning; however, these speculations were no part of regular routine as all units would be measured against periodic budgets anyhow. Still, to the



external observer, it appeared that these informal speculations were pursued with energy and regularity. This activity could be brought into partial control in the project by requiring the project teams to submit their predictions of the nearest future in writing on a regular basis, often after project team meeting.

It is important to understand control in accordance with several theories. Intervention, such as face-to-face meeting and meeting enabled by ICTs can function as control mechanisms. The following three theoretical reasons converge on why this could be an effective approach:

(1) **Accountability:** by formalizing the predictions and resulting targets and evaluating their quality, the managers involved might feel more accountable, which has shown to be an important factor in effective management (Cummings, L.L. and Anton, R.J., 1990) (Hackman, B.K. and Dunphy, D.C., 1990) (Mitchell, 1993)

(2) **Goal setting:** specific, ambitious goals have a positive influence on performance, outperforming general motivation mind-sets like “do-your-best” (Locke, E.A. and Latham, G.P., 1990) (Locke, E.A. and Latham, G.P., 2002). When circumstances make budgetary deviations seem likely, specific targets are lacking and people involved may succumb to a “do-your-best” motivation. The intervention sought to replace this by having the groups reformulate specific alternative targets.

(3) **Team task reflexivity:** engaging in reflective actions in a way called Team task reflexivity has been shown by West (West M. , 1996) (West, M.A., Borrill, C.S. and Unsworth, K.L., 1998) (West M. , 2000) to be beneficial to teams on various performance measures. Reflexivity as defined by West consists of three factors: (a) reflection on the team’s own performance, (b) planning and (c) adaptation. The project managers would not be able to make good predictions on their own, but would have to base them on monthly discussions with their project teams. The intervention was aiming at stimulating this reflective event.

### **4.3. ICT enables the virtual working environment of IT project management**

#### **4.3.1. Project Team as Global Virtual Team**

Across the literature there is a common thread that virtual teams are generally temporary and are pulled together to take advantage of individuals expertise, regardless of their global location, to rapidly and efficiently solve customer problems.

Cohen and Bailey describe traditional project teams as being time limited, involving considerable application of knowledge, judgment and expertise drawn from members from different disciplines and functional units.

There are clear parallels between the two and in all of the literature reviewed the empirical studies, using either students or organizationally based virtual teams, were project based.

The projects varied in length from several weeks up to a couple of years; however all of the teams/projects were clearly finite in length.

This proposes the theory that Global Virtual Teams are in fact Global Virtual Project Teams. Further investigation would need to be done to determine if global virtual teams are sustainable over long (indefinite) periods of time or if they are an appropriate vehicle for non-project work.

#### **4.3.2. General project management theory**

Project management is the discipline of planning, organizing, securing and managing resources to bring about the successful completion of specific project goals and objectives. It is sometimes conflated with program management, however technically that is actually a higher level construction: a group of related and somehow interdependent projects.

A project is a temporary endeavor, having a defined beginning and end (usually constrained by date, but can be by funding or deliverables), undertaken to meet unique goals and objectives, usually to bring about beneficial change or added value. The temporary nature of projects stands in contrast to business as usual (or operations), which are repetitive, permanent or semi-permanent functional work to produce products or services. In practice, the management of these two systems is often found to be quite different, and as such requires the development of distinct technical skills and the adoption of separate management.

The primary challenge of project management is to achieve all of the project goals and objectives while honoring the preconceived project constraints. Typical constraints are scope, time, and budget. The secondary—and more ambitious—challenge is to optimize the allocation and integration of inputs necessary to meet pre-defined objectives. (PMI, PM BOK, 2008)

#### ***Main focus and the goal***

In a conventional team, a project manager is probably more focusing on the main activities of general project management; is more concerned on whether the project is on time, whether it is within the budget, and if the project is still on track and under control.

As long as the project is successfully initiated and the right planning has taken place, it is the responsibility of the project manager to ensure to execute the project according to the plan within the power of monitoring and control; using all the resources to deliver the expecting outputs, results and benefits from the project. Those things and activities are deeply rooted in people's mind, especially for a project manager.

In order to better understand project management, one must begin with the definition of a project. What is a project? According to PMI definition, a project is a temporary endeavor undertaken to create a unique product, service, or result. (PMI, PM BOK, 2008) It has three important elements, temporary, unique, and a definite beginning and end.

Project management, as mentioned in widely used project management standard, according to PMI, is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements. (PMI, PM BOK, 2008)

All these are the targets we want to meet for our project goals. What do we want to achieve? When do we want to achieve it? What are our specific aims? Why are these goals essential to the project?

Project Management, on the other hand, involves five process groups as identified in the PMBOK Guide, namely:

- Project initiation
- Project planning
- Project execution
- Project monitoring and control
- Project closure

Successful project management can be defined as having achieved the project objectives: (PMI, PM BOK, 2008)

- Within time
- Within cost
- As the desired performance/technology level
- While utilizing the assigned resources effectively and efficiently
- Accepted by customer

Related to efficiency, effectiveness and sustainability, I will look into the following five main focus of general project management.

### *Time management*

In general project management, time and schedule are probably the most important project successful criteria besides cost and quality, etc. A project manager has the crucial influence and his or her inescapable responsibility to perform good time management to the project,

and usually that's what most of project managers try to use all their power and influence to achieve.

To perform good time management to manage timely completion of the project, a project manager needs to identify all the activities in the project and sequence them according to the relationship among the project activities. Project managers could use certain technique or tools to help them to define activities, such as the Work Breakdown Structure (WBS).

For scheduling, to find the dependencies among the activities is crucial. It will help the project managers to decide how to manage these activities, find the critical path, also how to allocate the resources, which usually are limited. Certain tools and techniques could be used in sequence the activities, such as Precedence Diagramming Method (PDM) in Critical Path Methodology (CPM). The technique is also called Activity on Node (AON).

In order to perform good time management, project managers need a well initiated plan and estimation at an early stage, which including estimate activity resources and estimate activity durations. The more accurate the estimation is, the less uncertainty and risk it will be to develop the schedule. Using of ICTs eases this process and it also will lead better chances to execute and control the schedule, which means a better chance towards the timely completion of the project and project success as the final goal.

With a well-developed schedule plan, project manager also need to perform good control on the schedule. Performance reviews play important part during the control schedule, measure, compare, and analyze the schedule performance. Earned value management (EVM), schedule variance (SV), and schedule performance index (SPI) are used to assess the magnitude of variation to the original schedule plan or baseline. To see if the project is still on time, or will be on time, if it is not, what changes can be done in order to catch up, to the timely completion of the project.

### ***Resources allocation***

As a project is a major temporary (one-time) undertaking dedicated to create a unique product, service, result, (PMI, PM BOK, 2008) or some well-defined objective and involving considerable money, human resource, personnel, and equipment.

The project is usually initiated either by some needs of its parent organization or by a customer request. Starting with the proposal, in the project initiation phase, the objectives of the project are created and the project organization structure is selected. Whether it is a pure Projected project organization structure, a pure Functional project organization, or drop into the middle as a Matrix project organization structure, such as Weak Matrix, Balanced Matrix, Strong Matrix (PMI, PM BOK, 2008) project organization structure.

Thus, resources are assigned to the project, and different tasks along together with milestones activities are identified. Following with a time and resource estimation which provide the duration and resource requirements for each activity, as well as constrains and limitations between activities and based on the dependency of the relationships among those activities.

Project resources allocation can help project managers efficiently allocate their limited resources and thus help them achieve high levels of project performance (Jaselskis, E. J., and D. B. Ashley,, 1991)

The principle of resource allocation is focusing on the impact of the project team, planning, and control efforts as they relate to achieving overall project success (Jaselskis, E. J., and D. B. Ashley,, 1991). Besides it could maximize the project efficiency and effectiveness, together with other benefits, such as lower cost, better than expected schedule performance, and better-than-expected budget performance.

Furthermore, considering the individuals in the project team, and a people-orientated project management style, one could be more good as a high intelligent developer or technical engineer, one could be more efficient and self-motivated to work remotely and virtually, while others could be more efficient as a customer engineer or customer representative, who could more easily understand the customer's needs, feeling and fits perfectly with communicating and dealing with customers.

In short, it is all about choosing the right people in the right way.

### *Sustainable capability*

Sustainability, doing anything "... that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987).

Long-term commitment to integration of sustainable development principles and practices—proactive approach began at project level. (Lynn Crawford and Terry Cooke-Davies 2010) The sustainable capability in project management requires the attention to the entire life cycles of the products and to the specific and changing needs of the customers. This sustainable capability in project team could be essential to achieve the organization strategic goals. The project level sustainable capability now is transitioning from a "project based approach...to a strategic group wide activities-focused approach" (Lynn Crawford and Terry Cooke-Davies's lecture, 2010).

In order to achieve this long-term sustainable capability, the Knowledge Management system, individual development and assessment play an important role. It is all about sharing, learning and improving.

**Knowledge Assessment:** An assessment of an organization's knowledge management capacity in key areas such as knowledge processes, leadership, culture, technology and knowledge metrics including assess these knowledge areas, Scope, Time, Cost, Quality, HR, Communications, Risk, Procurement, and Integration. Then the project team will identify the average knowledge areas and the weakest knowledge area, knowledge-leveraging capability to seek, build, use and leverage strategically its organizational knowledge as well.

**Best Practice:** Basing the knowledge base, the project team will identify the best practice to apply for the whole project or organization. This best practices to provide the necessary information to allow for development of recommended next steps.

**Identify the Gap:** Comparing to the baseline the project team have established, the project team will identify the gap and the weakness and then to set up our new goals, where the project team want to go next.

**Improving and decreasing the gap:** Setting up scheduled and regular meetings, expert consulting, auditing, benchmarking, the project team will improving the performance and try to close the gap.

**Summarize:** Summarize the best practices and record all the lesson learned and experience.

**Individual Performance Assessment: Developing a skilled workforce (project level) (Lynn Crawford and Terry Cooke-Davies's lecture 2010)**

- Individual Performance
- Team Performance
- Availability, retention and development of best team members
- Performance Appraisal / Assessment
- On-the-job / training, rewards etc.
- Rewards and recognition (informal)
- Team Review

Project management is about effective use of resources, which is fundamental to sustainability. Project Leadership for Sustainability "...if corporations are to achieve their sustainability goals, project leaders must contribute by looking beyond the short term and incorporating sustainable practices in the products they produce and the processes and practices they use to produce them" (Lynn Crawford and Terry Cooke-Davies's lecture 2010).

### ***Transformational vs. transactional leadership***

Transformational and Transactional leadership styles are two well-studied leadership styles and both the styles are linked to the achievement of some goals, the difference lies in their process of motivating followers and the type of the goals set. Transactional leaders set definitive goals and motivates followers to achieve these goals by clearly assigning roles as per task requirements through rewards and punishments to promote performance whereas transformational leaders focus on stimulating, motivating and empowering the followers to achieve the overall organizational goals through creating new pathways within the organization.

It could be noticed that transactional leadership is more practical in nature because of its emphasis on meeting specific objectives, they uses the power and authority that already exists in the organization to meet the set objectives but not necessarily open to innovation as in case of transformational leaders inspires followers to be innovative through openness to new ideas.

Transactional leadership motivates followers by appealing to their own self-interest in the form of rise in pay, giving them promotions, the transformational leader attempts to raise followers needs (following Maslow's need theory) to higher levels of needs in order to develop followers into leaders, they are more concerned with the personal development of the follower.

In short, transformational leadership is based on the concept of bringing about change weather in organization or in followers for betterment, it is effective way to lead to the future whereas transactional leadership is effective in managing an existing organization, its objective is not to bring about any form of change.

James Mac Gregor Burns first used the term transformational leadership in 1978. According to Burns, Transactional leadership can be seen when "Leaders and followers make each other to advance to a higher level of morale and motivation". The idea of transformational leadership was later expanded by (Bass, B. M., and P. Steidlmeier, 1999).

Transformational leadership style fits in the virtual team perfectly. Some researchers found out most of the Successful virtual project managers are more people oriented, more relationship-oriented (Weems-Landingham, 2008). They use formal and informal network, personal influence, leadership style to influence the projects and the team members. They try to build up a good network and relationship with all the team members in the virtual team. With this trust and good relationship will lead the projects towards success.

#### **4.4. Control mechanisms and design of control mechanisms**

According to Mintzberg, planning and control systems measure and evaluate the organizational system, its outputs and processes, to determine everything goes as planned

or if tighter control is needed. This is a typical feedback loop which involves several parts of the organization. Two types of planning and control systems exist. Performance control focuses on regulation of performance and results of the monitored unit. The primary purpose of performance control systems is usually to measure and motivate, measurement can be based on financial, efficiency or throughput interests. Motivation comes from trying to live up to the performance goals, and reaching them. Performance control is often a key design parameter in market based structures.

Action planning is used when specific decision and actions are predetermined for the outputs. This makes it a lot more concrete compared to performance control. Due to this it is most often used in functional based structures. But it is also often seen used when the organization is in a state of crisis and it needs to stabilize its structure and production.

And on a personal level, conducted by interpersonal skills, control mechanisms usually fall in one of four categories, dividing people into one of four personality types:

*Intimidator*: Somebody who controls others by overwhelming them, commanding them, telling them what to do.

*Interrogator*: Somebody who gets information from others in order to find something wrong with it. Getting others to do or say something and then finds weaknesses in it.

*Aloof*: Somebody who doesn't volunteer information, but controls others by having them reaching for the hidden information. Staying above others by not reacting, but waiting for them to make a mistake.

*Victim*: Somebody who makes others feel sorry for them. Talks about and demonstrates how they are particularly unlucky or persecuted. Controls others by getting them to feel pity or guilt.

## **5. Empirical study**

### **5.1. Interview object 1**

#### **5.1.1. Company 1 background**

Company 1 develops, sells and supports project management software to its customers through a network of subsidiaries and partners throughout Europe and North America.

The company focuses on the development and sale of this software, along with associated consulting, training services and customer support.



This product is optimized for use in Professional and Business Services-oriented organizations worldwide. Its use is intended to help our customers with the planning and execution of their projects, on both a time and financial basis.

### 5.1.2. Interview person 1

The following table shows the numbers of various activities for a project manager in a smaller company on a random day:

Interview person is stated as PM1.

Time	Notes	Comments
09:12	Local train delayed. Got on the train.	
10:00	Arrived at work.	
	Coffees, small chat with director.	
10:25	1 <sup>st</sup> phone call from customer.	By phone call, I mean incoming calls with ringing.
	Conversation with one operation colleague about a programming issue.	Morning meeting starts at 10:40
10:35	2 <sup>nd</sup> phone call from customer.	
10:36	3 <sup>rd</sup> phone call from customer. Discussion with colleague.	
10:49	4 <sup>th</sup> phone call from customer with an emergent bug of program.	PM1 was busy with the same programming issue while the morning meeting was proceeding.
10:53	Bug solved and PM1 joined the morning meeting.	
11:15	Morning meeting is done.	
11:56	5 <sup>th</sup> phone call, but no connecting	
12:15	Short directing from director and short briefing about summer vacation	
12:21	Short talking among colleagues.	
12:25	Lunch	
12:55	Back from lunch, conversation with colleague.	
13:03	New order, multi-client	
13:05	PM1 makes a phone call in order to gather information	Phone meeting
13:18	6 <sup>th</sup> phone call	
13:30	7 <sup>th</sup> phone call, one colleague made an appointment for PM1	PM1 is still on the phone line.
13:37	PM1 ends his phone call	
13:43	8 <sup>th</sup> phone call	
13:44	PM1 talks to one operation colleague. Ends at 13:47	
13:48	9 <sup>th</sup> Phone call	
13:56	PM1 makes a phone call	
14:01	PM1 ends phone call	

14:02	PM1 makes a new phone call	
14:03	PM1 ends phone call, small discussions with operation colleague afterwards for 5 minutes.	
14:08	Director comes for a configuration question. Conversation lasted for 8 minutes.	
14:34	The operation colleague talked to PM1 lasted for 2 minutes.	
14:37	Director comes for a	
14:39	10 <sup>th</sup> phone call, PM1 took it and ended after 25 minutes	
15:04	PM1 talked to operation colleague for 3 minutes.	
15:18	Incoming cell phone calls, PM1. Ends at 15:26	
15:28	PM1 makes a phone call. Ended 15:48	
15:29	11 <sup>th</sup> phone call.	
15:45	Small talk with me	
16:00	PM1 is back to work.	
16:39	PM1 makes a phone call about business travel. Ended 16:43	
16:59	PM1 makes a phone call. Ended 17:10	
17:30	PM1 finished his Monday.	
	From 13:19 13:36 14:07 14:48 15:26 15:45	Client Support
	How many e-mails did PM1 get today?  No Skype today, since outsourcer had a free day today.	PM1 meant it was not a busy working day. PM1 meant himself that an e-mail which came in today, was been taken care of, expects the testing part.

*Question 1: How do you think about using of ICTs?*

Answer: I think ICT enables a more flexible work environment where ad-hoc solutions and just-in-time decision making can be utilized better. I feel ICTs are best utilized when the end product is not well understood or the goals are constantly amended. I can, however, only think of one part of my day where ICTs are not helpful, and that is at keeping noise to a minimum.

*Question 2: Dose using ICTs help you to manage control?*

Answer: Yes. ICT enables me to apply pressure and guidelines, and to serve the right information to the right person at the right time. ICT also enables each resource to query information and guidelines from any person at any time.

*Question 3: How do you conduct your work with using ICT?*

Answer: I use mainly Skype, Outlook and GoToMeeting internally. A lot of communications with customers are done by telephone. "Larger" projects (maybe 50-500h) are often initiated by writing a simple document that lists demands and sketches up the user interface. It may also, when critical for achieving success, highlight a preferred developmental path. All involved resources read this document and have an online meeting with screen sharing to discuss the project. Demands are added or removed to the document throughout the projects lifetime. Questions are answered by email and Skype when they arise. If possible, we try to hold an online meeting each week to review the progress and discuss problems.

*Question 4: What are the main challenges faced when using of ICT in daily business?*

Answer: Misunderstandings arising from ambiguities, a limited interface, differing (sometimes practically non-existent) English skills (ICT enables an international organization), and information not made readily available. ICT makes processes "disembodied" which can be frustrating.

*Question 5: How do you overcome these challenges?*

Answer: Attention to details, repetition, clear rules and responsibilities, testing, analysis of results and the work process; and time.

*Question 6: Who provides the guidelines when you are facing these challenges?*

Answer: All rules and guidelines come from the manager.

*Question 7: Who defines the control structure and design of control mechanisms? (Quality system, Quality control)*

Answer: The manager.

*Question 8: Do you think using ICT is necessary to be able to follow up the projects?*

Answer: Our organization is international, so I cannot see how we could uphold the same productivity without it.

*Question 9: How important is your own judgment in processing control?*

Answer: My judgment brings disambiguation, problem solving (and detection) and information to the process. How important this is depends on the complexity of the project and the assigned resources' experience in the company.

*Question 10: Do you think you can do all the work somewhere else besides at work place?*

Answer: Yes, but I am dependent upon good tools and comfortable surroundings: Large and many screens, headsets, a good desk and chair, etc.

Other comments:

Here are some ICTs tools I use: editors, debuggers and profilers for analysis. (SQL server management studio, SQL server profiler, visual studio, notepad++, firebug –firefox, logparser, powershell (scripting code, little use for analysis.)

Google, forums, api, for information.

Word, excel and project help for communication and reporting.

Mostly using outlook, Skype and phones. (Email can be overflowed with too much information, unnecessary reporting.

Knowledge barrier due to direct information transforming, work force need to be trained up properly, it takes time. Sometime it is required to have direct controlling and giving project team direct order.

Recent system/product with more than 3 million code lines, therefor it takes time to get known the product and work with it. And at the early stage mistakes are often made by the outsourcer. Most customer contact is done through the phone.

Sometime, the work force just delivered stuff which doesn't fit to requirement or specification, but only to meet the dead line.

I have everything on my laptop, so I can work everywhere with my cell phone.

## **5.2. Interview object 2**

### **5.2.1. Company 2 background**

Company 2 is the leading provider of business software and services for accounting and administration. The group comprises five business areas which are Software, BPO Accounting & Payroll, Commerce Solutions, Retail and Projects & Consulting.

As one of few suppliers yet to combine software and BPO, Company 2 has been a Nordic and European consolidator as the products and services have become increasingly popular among the company's more than 240 000 customers.

Today, Company 2 is known for developing leading software solutions and high-quality services for satisfied customers in combination with financial strength and solid growth. The

objective is to make the customers more efficient and competitive through freedom of choice between software solutions and outsourcing services.

*Projects & Consulting:* Provides value-adding IT solutions, and supplies customer tailored, business-critical IT solutions by offering a broad range of competencies and services.

### 5.2.2. Interview person 2

*Question 1: How do you think about using of ICTs?*

Answer: Basically it becomes a part of the daily work. It saves time and makes things easier to plan, organize and track. It creates the possibility of working remotely.

*Question 2: Dose using of ICTs help you to manage control?*

Answer: Yes. ICTs enable me to gather real time data and to apply the guidelines.

*Question 3: How do you conduct your work with using ICT?*

Answer: I use mainly Office communication (Microsoft), Skype and Video conference. All these systems are intergraded with firm system, and with my pc desktop at work, basically Daily report, project process report and burn down chart are done with help of using software Kankan.

I use project management software to plan, organize and keep things on track. And we use ICTs to communicate and remote.

*Question 4: What are the main challenges faced when using of ICT in daily business?*

Answer: One thing I have to mention is that no matter how advanced the video tool is, and it can't replace a regularly face to face meeting.

*Question 5: How do you overcome these challenges?*

Answer: Besides the on-line meeting daily, we travel to meet each other on regular base during the project.

*Question 6: Who provides the guidelines when you are facing these challenges?*

Answer: The Company has groups such as Quality board, Architecture board, etc. to handle those things. Based on the requirements, the various groups will give advice of what right tools will be chosen.

*Question 7: Who defines the control structure and design of control mechanisms? (Quality system, Quality control)*

Answer: Again, the Company has groups such as Quality board, Architecture board, etc. to handle those things. Based on the requirements, the various groups will give advice of what right tools will be chosen.

*Question 8: Do you think using ICT is necessary to be able to follow up the projects?*

Answer: You can follow up the project by using a pen and paper, but of course using ICTs will save the time and make things easier.

*Question 9: How important is your own judgment in processing control?*

Answer: The goal of running a project smoothly is to make it not dependent on any particular person but the process, therefore, process control is very important to a project.

*Question 10: Do you think you can do all the work somewhere else besides at work place?*

Answer: For a short period, yes, but for long run, I don't think so, a very important part of a project is communication, and a face-to-face communication will save lot of misunderstandings, thus go to the work place, meet and talk to people is very necessary.

Other comments:

My work day starts at 9 o'clock and ends 17 o'clock. I usually start my day with Scrum Meeting.

It is important to have direct communication with marketing department, in order to develop from abstract idea to tangible specifications.

During this process face-to-face meeting is important, same as I am trying to keep face-to-face meeting on a regular base, it is very important to have face to face meeting during the team building at scrum iteration point.

Stakeholder do not necessary know what and how they need. During a project the customers can change their minds about what they want and need.

During the Interactive Sprint Planning Meeting, when we need to figure out how and what time is needed to complete one given case. I often let the team decide. For example, among 5 programmers through meeting and face to face discussion to determine what really needed. I am trying to create internal mentally competition; I cannot fire people, because they don't perform properly.

Team meeting with QA, programmers, and determine what specifications should be, stakeholder can join but without speaking out.

Some of the system tools: BUGZILLA and Vista CRM.

# 6. Analysis

## 6.1. Approach

The analysis is based on interviews of project managers. I was not participated in any one these projects. The size of projects teams which interview objects refer to is defined as small and medium sized team. According to the resulting success rates for each development paradigm, by team size, (Ambler, 2010) were:

- Ad-hoc projects: 74% for small teams, 58% for medium-sized teams, and 40% for large teams.
- Iterative projects: 80% for small teams, 68% for medium-sized teams, and 55% for large teams.
- Agile projects: 83% for small teams, 70% for medium-sized teams, and 55% for large teams.
- Traditional projects: 69% for small teams, 61% for medium-sized teams, and 50% for large teams.

Small and medium-sized teams scored relatively high in all four different paradigms as described, I assume the control mechanisms must be beneficial to projects in all four different project management processes to ensure the high success rates.

Referring to interviews, all project teams were cross-divisional, which allow me to take two different communication systems into consideration: the network-based system and the traditional hierarchical communication system.

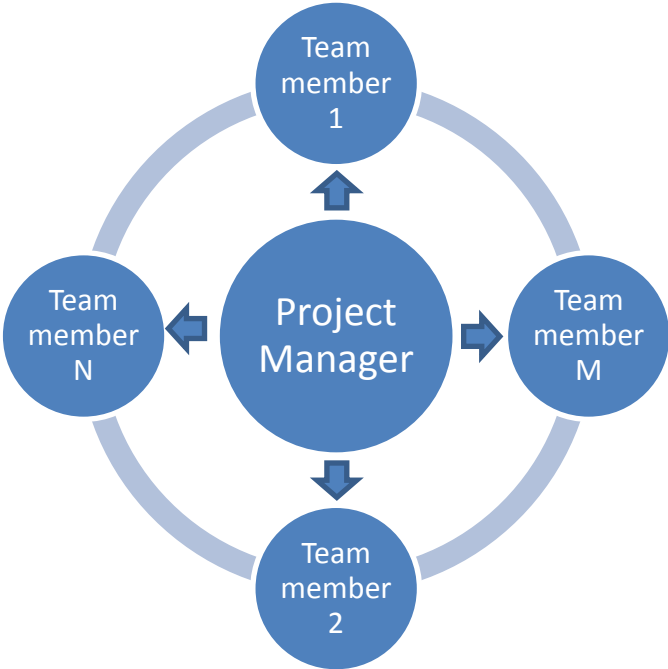


Figure 7. Simple network communication system

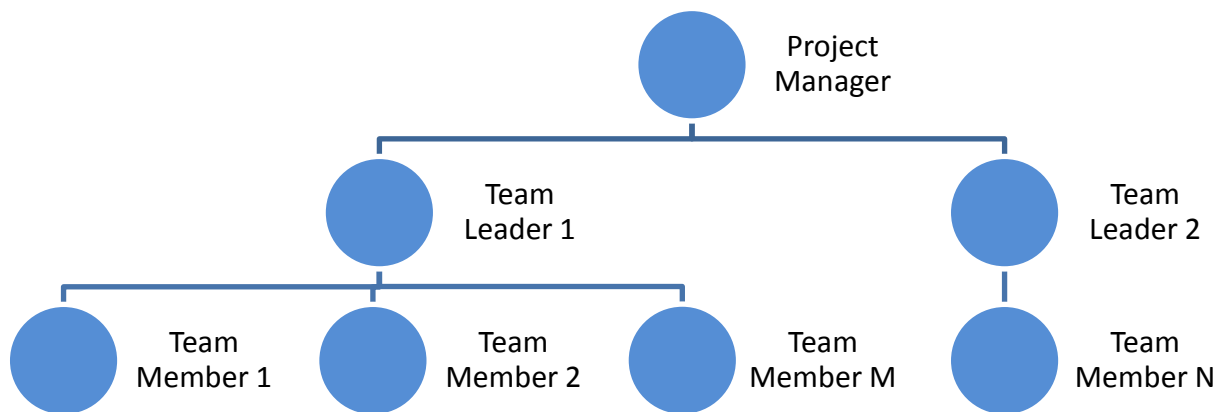


Figure 8. The traditional three-level communication system

Regardless of communication method, according to interviews all projects were using various ICTs: Internet, e-mail, on-line cooperation, databases, and computer aided system engineering.

I attempt to address the challenges and phenomena stated in the interviews by referring to existing theories.

## 6.2. ICT enables control structure

### 6.2.1. Electronic monitoring and controlling

It is common known as Electronic Performance Monitoring (EPM) is based on performance recordings by the computer hardware (number of keystrokes, claims, log-in hours etc.) and/or service observations by a supervisor (e.g., on the telephone) of qualitative aspects such as courtesy tone and accuracy of information (Lund, 1992). Using network technology, EPM systems allow managers to control employees' working pace, degree of accuracy, log-in and log-off times, and customer orientation at any moment (Aiello, J.R.; Kolb, K.J., 1995).

According to the interview 2, the company 2 conducts their projects in the manner of Scrum approach. The PM2 functions as ScrumMaster conducts Daily Scrum Meeting: (Schwabe, 2009), and most of those meetings are conducted by ICTs, since most of programming work is outsourced to the third part which in geographically located differently.

Each day during the sprint, a project status meeting occurs. This is called a daily scrum, or the daily standup. This meeting has specific guidelines: (Schwabe, 2009)



- The meeting starts precisely on time.
- All are welcome, but normally only the core roles speak
- The meeting is timeboxed to 15 minutes
- The meeting should happen at the same location and same time every day

During the meeting, each team member answers three questions: (Schwabe, 2009)

- What have you done since yesterday?
- What are you planning to do today?
- Do you have any problems that would prevent you from accomplishing your goal? (It is the role of the ScrumMaster to facilitate resolution of these impediments, although the resolution should occur outside the Daily Scrum itself to keep it under 15 minutes.)

This is a direct transforming of behavior control in a virtual setting, enabled by the same technologies which supporting the virtual teams, it allow the team managers (project managers) direct interference and control team members` work pace, degree of accuracy and amount of communications by controlling the real virtual presence in the manner of time. It is similar to conventional team setting.

I have it conformed also to interview 1, it stated as: *I use mainly Skype, Outlook and GoToMeeting internally.... "Larger" projects (maybe 50-500h) are often initiated by writing a simple document that lists demands and sketches up the user interface. It may also, when critical for achieving success, highlight a preferred developmental path. ...Demands are added or removed to the document throughout the projects lifetime. Questions are answered by email and Skype when they arise. If possible, we try to hold an online meeting each week to review the progress and discuss problems.*

The negative effects of this kind of control are also similar to the conventional setting. It is linked to increased stress experience by the team members (Aiello,J.R.; Kolb,K.J., 1995).

However, EPM increased performance speed of high skilled workers but decreased performance speed of low skilled workers (Aiello,J.R.; Kolb,K.J., 1995); (Rick Davidson, Ron Henderson, 2000)Moreover, participation and control over the monitoring system seem to be suitable means to decrease stress due to EPM systems ( (Douthitt, Elizabeth A., Aiello, John R. , 2001); (Stanton, Jeffrey M.,Barnes-Farrell, Janet L., 1996)). The few studies that have investigated the effects of EPM at the group level revealed that cohesive teams can buffer stress experiences due to EPM (Aiello,J.R.; Kolb,K.J., 1995).

With consideration of the negative effects of EPM on stress and work satisfaction, and authentication of effect on performance, we suggest that applying EPM with care.

### 6.2.2. Management by feedback and by ad hoc

Another delegating management approach is more towards to coaching and moderating functions. One example of this is management by objectives (MBO), as a group of management practices with an emphasis on goal setting, participation, and feedback about task fulfillment. (Odiorne, 1986)

A field study that explored effects of MBO in existing virtual teams (Hertel, G., Konradt, U., & Orlikowski, B., 2004) showed a significant correlation between the quality of goal setting as perceived by the team members and the effectiveness of the teams as rated by the team manager.

According to interview 2, "...that during a project the customers can change their minds about what they want and need..." (Often called requirements churn) (Schwabe, 2009).

Scrum adopts an empirical approach—accepting that the problem cannot be fully understood or defined, focusing instead on maximizing the team's ability to deliver quickly and respond to emerging requirements. (Schwabe, 2009).

By strictly conducting Scrum approach, the PM2 is able to manage the feedback both internally and externally frequently by conducting Daily Scrum, Sprint Planning Meeting, Sprint Review Meeting, and Sprint Review Meeting.

Sprint Planning Meeting: At the beginning of the sprint cycle (every 7–30 days), a "Sprint Planning Meeting" is held.

- Select what work is to be done
- Prepare the Sprint Backlog that details the time it will take to do that work, with the entire team
- Identify and communicate how much of the work is likely to be done during the current sprint
- Eight hour time limit
  - (1st four hours) Product Owner + Team: dialog for prioritizing the Product Backlog
  - (2nd four hours) Team only: hashing out a plan for the Sprint, resulting in the Sprint Backlog

At the end of a sprint cycle, two meetings are held: the "Sprint Review Meeting" and the "Sprint Retrospective"

Sprint Review Meeting:

- Review the work that was completed and not completed
- Present the completed work to the stakeholders (a.k.a. "the demo")

- Incomplete work cannot be demonstrated
- Four hour time limit

Sprint Retrospective:

- All team members reflect on the past sprint
- Make continuous process improvements
- Two main questions are asked in the sprint retrospective: What went well during the sprint? What could be improved in the next sprint?
- Three hour time limit

Feedback is an important element of MBO. Feedback should be processed frequent, concrete and timely both on the individual and the team level. It can help to build up trust and preventing to feel social isolation, which will lead to decreased motivation, again will affect the work performance in a virtual team.

As well in interview 1 it show the recognition of the importance of feedback; PM1 stated:

*“I think ICT enables a more flexible work environment where ad hoc solutions and just-in-time decision making can be utilized better. I feel ICTs are best utilized when the end product is not well understood or the goals are constantly amended...”*

On the other hand a lack of process feedback led to a reduction in social exchanges (M. Losada, P. Sánchez and E.E. Noble, 1990)

Negative feedback based system theory allows team to work in a greater autonomy environment and allow team manager (project manager) to apply ad hoc management without significant negative effects on motivation and satisfaction.

### **6.2.3. Self-directing team**

First, delegating management approach relies on a formal team leadership as well as in the context of conventional team. Self-directing does not mean no-directing. As we defined one of the most advantages of virtual team is its flexibility, however, in order to reap the benefits of flexibility required a great deal of structure in communication and processes, which are also familiar to us in a form of conventional team.

In another words, we need clear defined objectives and detailed actives plans, standardized communication and documentation processes, and selection of suitable workforce for the virtual context.

Indeed, the initial intentions of virtual team are emphasized on cost-effectiveness in form of high performance and cost saving. While cost saving is mostly operational, higher performance is associated with customer satisfaction, which reflecting the benefits of flexibility. Both interview persons are in the same position as outsourcing most of the programming work to the third part in pursuing of cost saving, however they are striving to keep customer satisfying.

*As PM2 stated as: "During the Interactive Sprint Planning Meeting and when we need to figure out how and what time is needed to complete one given case, I often let the team decide. For example, among 5 programmers through meeting and face to face discussion to determine what really needed. I am trying to create internal mentally competition; I cannot fire people, because they don't perform properly."*

This face-to-face meeting can be defined as control mechanism, referring to the theories of accountability, goal setting, and team task reflexivity as mentioned earlier in theories. By formalizing the predictions and resulting targets and evaluating their quality, the project team members involved might feel more accountable, which has shown to be an important factor in effective management. The specific, ambitious goals have a positive influence on performance, outperforming general motivation mind-sets like "do-your-best". As no one programmer wants to admit he is no better than the others. When circumstances make budgetary deviations seem likely, specific targets are lacking and people involved may succumb to a "do-your-best" motivation. By engaging in reflective actions in a way called Team task reflexivity has been shown by West to be beneficial to teams on various performance measures. Reflexivity as defined by West consists of three factors: (a) reflection on the team's own performance, (b) planning and (c) adaptation. The project manager would not be able to make good predictions on his own, but would have to base them on monthly discussions with his project team. The intervention was aiming at stimulating this reflective event.

Term of self-organizing is used when the virtual team is able to envision itself internally, develop and dissolve by itself without influences from external structure.

Term of self-managing is used when team management leadership is delegated internally, and the responsible person for those delegated managerial functions is work within the team and with external parts of parent structure. While the team goals are still defined externally from parent structure, the team has great autonomy over the work processes and decision-making.

Both terms are included in self-directing. As the way of building up our understanding of virtual team, I believe structural guidance and managerial support from external structure is necessary for virtual team success and effectiveness.

There are standardized processes in a virtual context, but it is also necessary to leave the open possibility of how to adapting to the virtual team members. It is understood rather fine

balance than contradiction. The requirement of managing the fine balance can be addressed by selection of suitable workforce for the virtual context.

I recognize both structured and flexible existing correlational in virtual teams.

### 6.3. Effectiveness

#### 6.3.1. Effectiveness factors involved with ICT tools

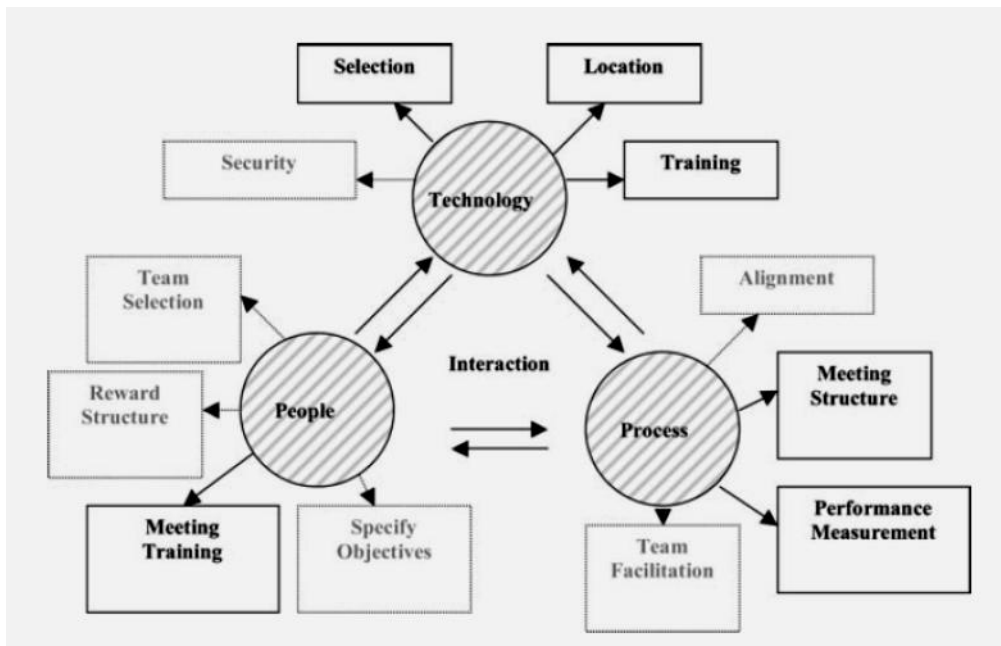


Figure 9 Important factors for effective virtual team working (Bal, J., and P. Foster , 2000)

According to Bal & Foster (2000) and Stefan & Monika (2008) (Stefan Trzcieliński, Monika Wypych-Złotowska, 2008), these six factors of virtual teams' effectiveness are (1) selection and (2) location of technology, (3) training on using new tools, (4) meeting structure and (5) performance management with reference to the process, and (6) meeting training for team members.

From a cost aspect there is a way to calculate and monitor the effectiveness of virtual team.

The mathematical model of cost calculating for forming and working of virtual teams

$$KVT = KK + KN + KS + KP + KU + KD$$

Where

KVT = cost of forming and working of the virtual teams

KK = communication cost

KN = cost of purchased tools indispensable for virtual team working

KS = cost of additional software

KP = cost of work (cost of training on using new technologies, cost of time devoted to team working, and/or cost of work of hired specialists)

KU = cost of acquiring specific skills and/or competences indispensable for virtual team working

KD = other unexpected additional costs

(Stefan Trzcieliński, Monika Wypych-Ziółowska, 2008)

By the mathematical model the project manager is able to take advantage of this method of calculating and monitoring made it possible to immediately evaluate the effectiveness of all teams after completing the project. Regarding to the project circumstances some cost elements can be tailored.

The effectiveness of virtual team work within a project is determined by the performance of team work according to the predefined goals and objectives, which are defined externally from the parent structure rather than within the virtual team internal structure. This model fits well to the initial intention of establishing virtual team, which is cost saving, also is suitable to the manner of traditional project management.

The limitation of this model is an end-result oriented model which emphasizes on the material and tangible costs, which leaves little room to interfere the work processes during the project, which is not ideal in an ever change environment. This model has no focus on neither cognitive nor motivational mechanisms which influence significantly on the performance at a team level, which reflects the team effectiveness.

### **6.3.2. Action planning**

Mintzberg concluded a depiction of how control is spread out over a continuum of the decision process. The decision process breakdown illustrated how power usually not rests at a single position, although project team members tend to regard powerful positions as the places where “Go” and “No Go” order is given. However this is formal power, a lot of the decision process also involves informal power. The “Choice” and “Authorization” steps are gripped by formal power, whereas the “Advice” and “Execution” of decision is influenced by informal power. Managers may dictate certain actions, but in the end the workers could ultimately disregard these and do it their own way.

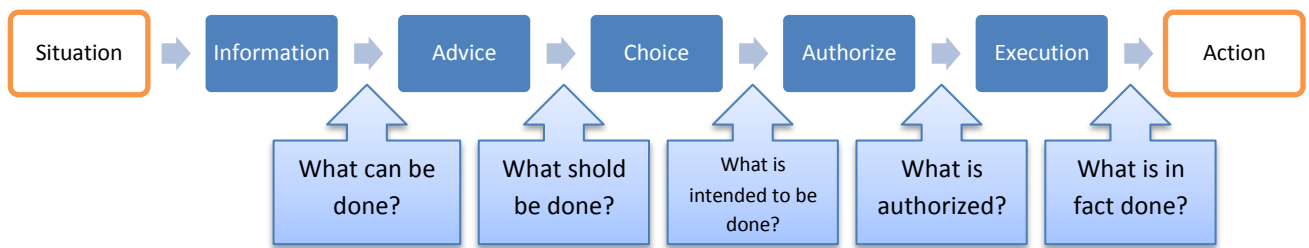


Figure 10. The five basic parts by Mintzberg

Distribution of organizational power is the centralization/decentralization problem, as well as in project management. If the decisions are made by a single person (Project Manager), or a group (Project board), the project team is strictly centralized. Often, mainly because of human limitations with grasping complexity and vastness, distributing the power yields better results. This solution is known as decentralization, and depending on the degree of implementation. Depending on how power is dispersed, decentralization can become either horizontal or vertical. The power distribution is at the same time determined by the structure, and influences it. But decisional power tends to rest at the level in the project team where the necessary information is needed.

Most people are motivated by a sense of responsibility and the ability to decide, at least, over themselves. So decentralization is closely related with the popular term empowerment.

Decentralization can be divided into two categories; Selective Decentralization happens when power over different kinds of decisions rests in different parts of the organization, and Parallel Decentralization is when decisional power for many kinds of choices are placed in the same part.

When the organization is being vertically decentralized, decisional power is delegated down the line of authority, from the Strategic Apex all the way down. Horizontal decentralization is basically the shift of power from managers to none managers. Depending on the organization's demographic composition, horizontal decentralization brings power to analysts, experts, owners and members.

### 6.3.3. Performance Evaluation as Control Mechanism

According to the cybernetic control process, three control steps can be distinguished: monitoring, evaluation and feedback. (Simons, 2000).

Monitoring refers to the collection of information on performance. The following step – evaluation – involves the comparison of the performance status quo to the pre-established goal (Günther, T. and Grüning, M., 2002). Accomplishments are detected and deviations are identified. The third step consists in rewarding good performance and sanctioning poor

performance (Hrebiniak, Lawrence G., Joyce, William F., 1984). Corrective actions might be initiated for improving performance in the future (Lorange, P. and Scott Morton, M.S., 1974).

Evaluation is one important control step, but it is not restricted to measurement.

Performance measurement refers only to the measurement of the degree to which the objective is achieved (Flamholtz 1979: 293). Evaluation not only incorporates the comparison of the actual results and the expected results, but also implies a further weighing up of the circumstances and significance of possible deviations (Hrebiniak, Lawrence G., Joyce, William F., 1984)(Macharzina, 2003). Evaluation incorporates a subjective element which is disregarded in measurement. In a concise control process, evaluation is closely linked to the other two elements of the control process: The content monitored is the same as that which is to be evaluated and provided feedback upon. Similarly, goal setting should be interrelated with the control process (Lorange, P. and Scott Morton, M.S., 1974) (Hrebiniak, Lawrence G., Joyce, William F., 1984) Unless targets are set or agreed on in advance, it is impossible to monitor, evaluate and reward performance properly ( (Hrebiniak, Lawrence G., Joyce, William F., 1984), (Otley, 1999). Despite these interdependencies, goal setting is not further addressed in the following since the focus of this dissertation is on performance evaluation.

Performance evaluation does not require a specification of the exact means that lead to a certain performance. As performance is reached when objectives are achieved, it can be interpreted as being similar or identical to output. Some authors, such as Mintzberg, actually refer to output control as performance control (Mintzberg H. , 1983).

Within the control system, performance evaluation can play a rather important or a rather subordinate role compared to other control mechanisms. The efficient use of performance evaluation as a control mechanism depends on specific conditions which are required for the use of output control.

If the requirements for output control are met, performance evaluation is expected to play an important role within the control system. If behavior control or input control is required, performance evaluation only plays a complementary role within the control system.

There are quantitative and qualitative performance measures (Günther, T. and Grüning, M., 2002). Most quantitative measures are considered to be objectively measured, while qualitative measures imply a certain degree of subjectivity.

According to Mintzberg, performance control system can serve two purposes: to measure and to motivate. (Mintzberg H. , 1983)

There are three types of control: formal, personal and cultural. As evaluation is one important step of the control process, the three types of control can also characterize the process of performance evaluation: Formal, personal and cultural performance evaluation.



Formal performance evaluation is based on codified rules, regulations and procedures. (B.R. Baliga and A.M. Jaeger, 1984) Examples of formal performance evaluation are written performance reports and/or performance management systems.

The second type of performance evaluation is personal whereby performance is evaluated personally. Meetings, such as management audits and feedback sessions, take place at project manager's location or at subsidiary level or via phone conferences or video conferences.

At interview 1, it stated: *"... we try to hold an online meeting each week to review the progress and discuss problems."*

And at interview 2, it stated: *"...I am trying to keep Face to Face meeting on a regular base, it is very important to have face to face meeting during the team building at scrum iteration point..."*

Cultural performance evaluation does not rely on codified rules or personal interaction, but on shared values and standards within a project team. (B.R. Baliga and A.M. Jaeger, 1984) Workshops, trainings, superordinate as model and adequate individual or group rewards may foster this shared performance culture, which later has been defined as term "normative integration". (Kutschker, M. , Schmid, S, 2005)"

PM2 stated as: *"... during the Interactive Sprint Planning Meeting, when we need to figure out how and what time is needed to complete one given case. For example, among 5 programmers through meeting and face to face discussion to determine what really needed..."* PM2 described it as: *"...I tried to create internal mentally competition among the programmers, as giving programmers a say in the establishment of these objectives, so that they will be committed to them and striver harder to achieve them..."*

This fits well as Mintzberg stated that performance control systems can serve to measure and to motivate.

#### **6.4. Question raised**

PM1 stated in interview 1: *"... however, only think of one part of my day where ICTs are not helpful, and that is at keeping noise to a minimum."*

The advantages of the using ICTs are evident and quite astonishing. Project managers can keep in current touch with the project team all over the world in the ways that were unthinkable. They can also share large amounts of information with a great many team members. These advantages enable them to greatly extend their informational network and easily conduct their affairs across the world.

Using ICTs makes better-informed project managers, able to plan and control better, able to communicate more quickly, able to act faster and more productive project team, only so long as they can handle these changes. Many are able to handle well; others will be drawn into acting more quickly and less thoughtfully, such as conforming more and considering less, which is fatal combination within project management.

#### **6.4.1. E-mail and E-document**

There are various aspects of using ICTs, I will focus mainly on e-mail and e-document which produced by various project management control tools here, because of that seem to be having the most direct impact on the practice of controlling.

Like conventional mail and document, e-mail and e-document is restricted by poverty of words alone: there is no tone to hear, no gestures to see, no presence to feel. E-mail may simply limit the user's "ability to support emotional, nuanced, and complex interactions" (Jeffrey Boase, Barry Wellman, 2006). Controlling for project managers are these things as it is about the factual content of the messages and documents.

As PM1 stated: *"Misunderstandings arising from ambiguities, a limited interface, differing (sometimes practically non-existent) English skills (ICT enables an international organization), and information not made readily available. ICT makes processes "disembodied" which can be frustrating."*

The danger of e-mail and e-documents is that it may give a project manager the impression of being in control of the project and being in touch while only thing actually being controlled and touched is the keyboard.

The illusion of control is created from day one using ICTs, the danger is always there. The project managers must recognize that what appears on the screen may not be enough to understand the situation.

#### **6.4.2. Own judgment**

On the telephones, people can interrupt and correct: in face-to-face meetings, people can agree by nodding. Oral communication and body language give provide the project manager extra information—feeling.

When there is absence of information of feeling, it seems that project manager relies more on their own judgment.

As PM1 stated: *"My judgment brings disambiguation, problem solving (and detection) and information to the process. How important this is depends on the complexity of the project and the assigned resources' experience in the company."*

And PM2 stated: "The goal of running a project smoothly is to make it not dependent on any particular person but the process, therefore, process control is very important to a project."

Two project managers gave two different answers due to their different project circumstances and the complexity of projects. One thing is in common that both projects outsourced most part of its programming work to third part. The mutual adjustment lets individuals coordinate their own work. And as the mechanism name implies, communication between peers are the crucial activity which makes this possible.

As I understand with PM1, he conducted direct supervision and standardization of outputs and PM2 mainly focused on standardization of work processes. I assume mutual adjustment is taking place at the outsourcing third part among programmers.

According to Mintzberg, standardization of work means that every work process follows a predefined path and a set of rules. Standardization of outputs sets up measures for the outcome of the work. And finally standardization of skills can be deployed to ensure that everyone has the same knowledge and qualifications. This implicitly should lead to the same result as standardization of both work and outputs, but is often used when standardization of these are not possible.

My question is what can be controlled here, standardization of outputs, standardization of work processes, or standardization of skills? There is danger of control system enabled by using ICTs may provide the impression of being controlled.

For instance, in the process of selecting the third art for outsourcing, there is always defined time interval of selecting. Time pressures limit the depth, scope and reflection of the measurements being made by the organization, which stated by PM2: *"The Company has groups such as Quality board, Architecture board, etc. to handle those things. Based on the requirements, the various groups will give advice of what right tools will be chosen."*

How well this process is managed and conducted remains uncertain to the project manager. As PM1 stated: *"Recent system/product with more than 3 million code lines, therefor it takes time to get known the product and work with it. And at the early stage mistakes are often made by the outsourcer."*

The PM1 was striving to control the standardization of the outputs, and conducted direct supervision, it seemed to have little impact on the results, unless the third part programmers became competent to handle the task.

However, by spending resource on checking on relevant references and standardization of skills can improvise situation. Due to limited resource, there is always a battle to keep the fine line between resource using and risk management, which is the aim of control. It is not easy to do as said, as long as cultural beliefs shape both management behavior and the appreciation of measurement. Due to this part of decision making does not involve the

project team and often kept withheld in a very small group of people at the top management. It is not always being of beneficial influence to the project.

### 6.4.3. Noise and freedom of work

PM1 stated: “I can, however, only think of one part of my day where ICTs are not helpful, and that is at keeping noise to a minimum.”

I may characterize the project manager’s position as the neck of bottle, sitting between a network of outside contacts and the internal project teams being managed. And thanks for the using ICTs the project manager receives all kind of information and requests from insiders and outsiders, which is shown by the record of activities of a PM1’s random day at work.

It seems all the contacts are the work of project manager, but it is not. However, the project manager’s productive outputs mostly being formalized in terms of the information he transmits orally enabled by ICTs or by e-mail. And it seems the project manager deals first with the things that are required as next.

The interruptions increases the pace and pressure of managing. The project managers are interrupted more than ever, thanks for the using ICTs. Of course, the project manager can go wherever he wishes, but no escaping from the information network. On the other hands, it also enables the possibility of being independent of physical working place.

*Question 10: Do you think you can do all the work somewhere else besides at work place?*

Both PM1 and PM2 have given a positive impression of it.

*“Yes, but I am dependent upon good tools and comfortable surroundings: Large and many screens, headsets, a good desk and chair, etc.”, according to PM1.*

*“For a short period, yes, but for long run, I don't think so, a very important part of a project is communication, and a face-to-face communication will save lot of misunderstandings, thus go to the work place, meet and talk to people is very necessary.”, according to PM2.*

So what does it keep them coming to the physical workplace?

With limited managerial time available, as I assume here. Time in front of the screen is the time not spent in front of someone. Indeed, the social dynamic is different from when people communicate through technology; once the new culture is formalized rising along with the new Facebook generation with the competence of asynchrony media, rather than the e-mail generation whom are mainly focused here. Will that still be discussion of using of ICTs, or whether it becomes the best way of doing things?

Once individuals are able to support their own professional life with their own resource, and with their individual intellectual capital, will that still be need for organization as company or working place?

Once the whole society becomes a giant and highly complex organization, only through mutual adjustment, it lets individuals coordinate their own work for the better of the community. How will the organizing and controlling look like? Or there is no difference as being at work or being at home?

## **7. Conclusion**

My main hypothesis is “Using ICT enables and provides the most effective framework for control mechanisms of IT projects.”

My conclusion is yes and no. Yes, because the ICTs may be most reinforcing the very characteristics that have been prevalent in the project managers’ work, even sometimes are necessity. No, because using ICT must be enhanced by traditional means such as oral and face-to-face, otherwise, the project will face greater risk.

The project organization is one determinant of the project management information system (PMIS), including planning and control. In turn of effectiveness of the PMIS will strongly influence the effectiveness of the project organization structure.

The form of organization structure used can strongly influence human behavior, including individual and group motivation, team development and extent of conflict. The planning and control system can influence teamwork and the motivation of individuals and groups. Achievement motivation, goal theory and feedback on performance are intimately connected with the planning and control system, which can be the project manger’s most powerful manual tool.

The suitable designed planning and control system can facilitate the use of different project teams. The need of the human behavior system or man-management can influence the design and effectiveness of both the project used and the project information system.

The new intervention may be seen as an improvisation on the preceding one. In its rationale, it combined the same mechanisms of goal-setting, reflection on dynamic relations and accountability.

ICT tools enable the project team members’ independence of the work location and extend the existence border of the organization. And ICT enables the real time reaction based on the assessable information which enhances the flexibility of the organization in the ever dynamic environment, also make the processes of iterations possible in a time-and cost

effective way, despite the weak causality due to increasing indeterminacy in greater complexity.

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## 9. Annex

### 9.1. A typical job description for a ICT coordinator

Senior ICT coordinator

The role:

- Responsible for IT and AV solutions for our simulation and visioneering center
- Responsible for implementation, execution and troubleshooting of new and existing installations
- Functions as advisory partner with customers and project managers globally

Qualifications:

- Experience and knowledge from Audio and Video solutions
- Experience in the Display and Dome Technology
- Experience from products like Lightware, Extron and Nexia.
- Knowledge of Microsoft solutions
- Knowledge of IT technical hardware solutions
- Technical education preferable
- Relevant experience can compensate for lack of formal education

The person:

- Solution oriented, analytical and methodological
- Constantly looking for new and better ways of solving challenges
- Flexible and creative
- Independent, but likes to work in project teams, both as a participant and as the driving force
- Honest, responsible and shows initiative
- Customer oriented and service minded
- Good verbal and written presentation skills and a representative manner

Comments:

- Exciting job opportunities with a great potential for professional development
- Competitive pension and personnel insurance schemes
- Attractive welfare benefits

Work place: Oslo, Norway

## 9.2. Different control mechanisms

The examples below are simplifications to exemplify different mechanisms.

- An implemented standard (Adobe)
- A strong position in the value network (Coca-Cola)
- An end-customer interface (Microsoft)
- Scale of users and partners (Google)
- Scale in purchasing (Wal-Mart)
- A customer base with switching costs (Microsoft)
- A large development community (Linux)
- A strong brand (Louis Vuitton)
- A development lead (Intel)
- A short product development cycle (Zara)
- A strong IPR portfolio (IBM)
- A cost advantage (Ikea)
- Contractual agreements (Apple)