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Improving Time to Market Interval of Projects

Helsinki Metropolia University of Applied Sciences
Master's Degree in Industrial Management
Master's Thesis
5 May 2011
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PREFACE

This has been an amazing journey. After ten years of daily work, changing my mindset to be a part-time student has been demanding and rewarding at the same time. I have learned so much new and found the joy of learning again. I would like to thank my company for giving me this opportunity to participate in Industrial Management Master's Programme. I greatly appreciate the support from my supervisors from Metropolia University for guiding me through all the details related to this Thesis. Their help has been absolutely invaluable. I would like to express my deepest gratitude to my great love Pia. Without her understanding and support I would not have accomplished this Thesis on time.

5th May 2011, Kauniainen

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Metropolia

Abstract

Author(s) Title Number of Pages Date	Niko Ryhänen Improving Time to Market –Interval of Projects 76 pages + 1 appendices 5 May 2010
Degree	Master's degree
Degree Programme	Industrial Management
Instructors	Marja Blomqvist, Lic Sc (Tech) Marjatta Huhta, DSc (Tech)/Principal Lecturer

Products' life cycles have shortened significantly, and the competitive landscape has forced companies to gain competitive advantage via short time to market intervals. A time-to-market means a period of time between the opening of a new product development until the moment when this product is ready for sales. Time to market in new product development has become more important than ever before.

The aim of this Thesis is to explore reasons for long time to market intervals in a case company. This Thesis mainly looked at the problems from the project execution point of view and other delay mechanisms like supply chain or logistics were left out of the scope. The research question was as follows: How to improve time to market interval of projects? The Thesis starts with an analysis of the current literature of time to market interval delays.

Based on the questionnaire, expert workshop and data analysis this Thesis conducts current state analysis of the issues concerning projects in the company. The research method used in this Thesis is qualitative and some quantitative elements were used partly in order to support findings from the questionnaire and the expert workshop session.

The outcome of this Thesis enables the company to set up an action plan for the key focus areas in order to improve time to market interval. Based on the results the company suffers for instance from poor multitasking, many parallel projects and communication problems. As an action plan the company should emphasize lessons learned utilization and staff training and limit the number of active projects to improve time to market interval in the future.

Key words	Time to Market, New Product Development, Student Syndrome, Lessons Learned, Resource Allocation.

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Tiivistelmä

Työn tekijä Työn nimi Sivumäärä Päivämäärä	Niko Ryhänen Projektien läpäisyaikojen nopeuttaminen 76 s. + 1 liite 5.5.2010
Koulutusohjelma	Tuotantotalous, Ylempi AMK
Työn ohjaajat	Marja Blomqvist, Lic Sc (Tech) Marjatta Huhta, DSc (Tech)

Tuotteiden elinkaari on lyhentynyt ja kilpailu on lisännyt tarvetta supistaa tuotekehitys-projektien läpäisyaikoja. Läpäisyaika tarkoittaa yleisesti ottaen aikaa projektin aloituksesta, kunnes projektin lopputuotos on valmis markkinoille. Nopeasta tuotekehityksestä on tullut etu, joka yleisesti parantaa yrityksen kilpailukykyä ja mahdollistaa nopeamman vasteajan uusiin asiakasvaatimuksiin.

Tämän opinnäytetyön aiheena on tutkia tuotekehitysprojektien läpäisyaikoja tuotteen markkinoille tuloon asti, ja etsiä mahdollisia parannusehdotuksia joilla projekteja pystytään nopeuttamaan. Aihetta käsitellään projektihallinnan ja organisaation näkökulmasta ja muut mahdolliset viiveet johtuen logistiikasta, toimitusketjuista tai muista syistä on jätetty pois. Päätutkimuskysymys on: Kuinka tuotekehitysprojektien läpäisyaikoja voidaan nopeuttaa?

Lopputyö koostuu kirjallisuusosiosta ja tutkimusosiosta. Kirjallinen osio tutkii projektiviiveiden syitä olemassaolevasta kirjallisuudesta. Tutkimusosio kartoittaa projektien nykyisiä ongelmakohtia kohdeorganisaatiossa perustuen projektipäälliköiden ja henkilökunnan näkökulmiin. Nykytilanteen kartoitus perustuu kvalitatiivisiin tutkimusmenetelmiin ja kvantitatiivisia tutkimusmenetelmiä on käytetty osittain tukemaan havaintoja ryhmätyöstä ja projektipäälliköille lähetetystä kyselystä.

Perustuen projektipäälliköille lähetettyyn kyselyyn, henkilökunnan ryhmätyöhön ja vuosina 2009 ja 2010 toteutuneisiin projekteihin, lopputyö tarkastelee kohdeorganisaatioon ja projekteihin liittyviä ongelmia, joiden takia projektit viivästyvät.

Lopputyön tulos antaa yritykselle muutamia kehityskohteita, joita parantamalla kohdeyritys voi lyhentää tuotekehitysprojektien läpäisyaikoja. Parantamalla mm. työntekijöiden koulutusta, vähentämällä projektien kokonaismäärää ja panostamalla virheistä oppimiseen, yritys voi lyhentää projektien kestoaikoja huomattavasti tulevaisuudessa.

Key words	Tuotekehitys, Projektien läpäisyaika, Virheistä oppiminen, Resurssienhallinta.

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ABBREVIATIONS / ACRONYMS

B2C	Business to Customer
CCPM	Critical Chain Project Management
CSA	Current State Analysis
FB	Feeding Buffer
IT	Information Technology
NPD	New Product Development
PLC	Product Life Cycle
PM	Project Manager
RB	Resource Buffer
TOC	Theory of Constraints
TTM	Time to Market

1. INTRODUCTION

In the era of industrialization, a time to market (TTM) interval in new product development has become more important than ever before. In 21st century, products life cycles have been significantly shortened, and competitive landscape in every industry has forced companies to re-think their processes and resource allocations. These changes have become necessary in order to gain competitive advantage through faster product developments. Trying to meet market requirements, companies strive to improve TTM performances on a sustained practice level. As a result, the importance of TTM interval has called for new tools, such as rapid prototyping and agile development processes. Accelerating TTM interval, however, has also its side effects, and it cannot take place without some fundamental changes in organizational and internal processes.

In general terms, TTM interval means a period of time between the opening of a new product development (NPD) until the moment when this product is ready for sales. Different companies measure TTM interval in different ways and therefore it is not standardized. For some companies, it means the time after “front end development” (i.e. time when new product concept is defined) to mass production, while for others it means the time from the idea stage up to their first commercialized product. At present, reducing TTM interval is strategically important especially in businesses where product life cycle is short, but it also promises competitive advantages for slow cycle product providers.

1.1 Speeding Up the Time to Market Interval

Understandably, there is always a price for decreasing TTM interval. A company has certain capability to launch a new product or service into the market and accelerate that performance cost one way or another. Developing intangible resources, such as staff training, hiring more personnel or improving its processes can speed up the development, thus making significant impacts on the overall costs in the company. There is also another factor for companies to take into account. For example, if in order to gain faster TTM interval, some product features are seriously reduced or its quality limbed, the cost will eventually be seen indirectly via increased field failure rates or lost market shares (Smith, 2004: 174).

There is a difference, however, how TTM may affect business with long and short development cycles. A short development time gives possibility to gain market feedback faster, thus generating next or third generation products based on customer needs much earlier. Small projects with short lead time enable companies to meet customer needs more quickly and improve old products faster, which leads to increased customer satisfaction. Their modularity, late customization and incremental development cycles, all reduce TTM interval because these projects are generally small (Melsa, 1999: 18).

Long term mega projects may have a problem with the stability of customer requirements because customers usually do not know in advance what they will want in three or four years. It is easier and safer to predict needs for some shorter periods of time, for example, one or two years from now. Another dilemma of mega projects is that product must be perfect if the company launches it only at longer intervals. This leads to a situation when the financial risk of failure is so high that top management wants to control the project progress very tightly, thus slowing it down further on (Melsa, 1999: 22).

Companies must also pursue new product innovations to stay edge of competitiveness and manage these innovation projects relatively short TTM intervals. Companies have a reason to separate new technology project from the normal incremental innovation project. It usually happens that poorly tested technology brings many unexpected surprises to project lead time. Nowadays short product life cycles and hyper competition often force companies to introduce new innovative products, which is often evident in the increased field failure rates and non-working functionalities.

It is well known that the development speed has an inverted U-shape relationship to the new product profitability and thus some projects benefit about faster development speed, while some others may suffer from acceleration, if scrutinized from the profitability point of view (Langerak and Hultink, 2006: 205). The need for the project acceleration is, therefore, not so unambiguous and profitability and development speed are linked overall to product innovativeness or to a particular type of product improvements.

Figure 1 illustrates that projects normally have patterns how fast they should be executed in order to gain maximum profits (Langerak and Hultink, 2006: 205). According to this observation, the projects on the left side from optimal point will benefit if the development speed is accelerated. At the same time, the projects on the right side will become less profitable if their development speed is increased.

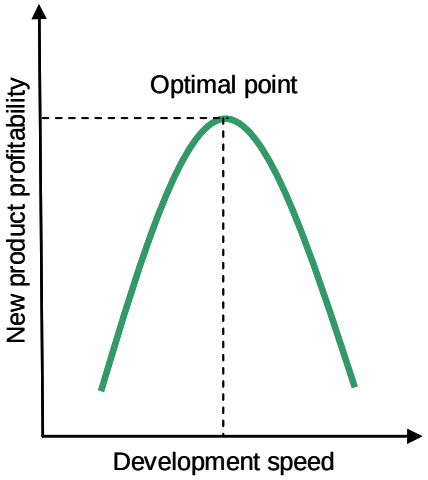

Figure 1. The new product profitability and development speed (Langerak and Hultink, 2006: 205).

1.2 Case Company

The study is conducted for a case company. The case company has five different business units which are divided to smaller sub-units based on activities or geographic regions. This study is conducted for one sub-unit department that has about 100 employees in four different countries. The case department has had problems in the past with time to market interval and it has suffered long project lead times. This Thesis explores the reasons for project lead time slippages and in the end it proposes some remedies for future use.

1.3 Objective of the Study

The objective of this study is to identify reasons for project time to market delays and to describe most common time to market delay mechanisms from literature. The study also compares case company's previous years' project performances and points out the average duration of the projects and possible slippages from the initial timetables.

The main research question is as follows:

How to improve the time to market interval of projects?

It is important for any company to understand root causes for the time to market delays, because it might have an essential role in project profitability, market share and resource allocation. The root cause for long project lead time is normally linked to several reasons and one action point or improvement idea is difficult to conduct. This study gives a holistic view for future use and it explores improvement points in for example project planning and process implementation to gain better TTM interval. Main research question has been studied from the case company's one business unit point of view. Figure 2 illustrates the research structure of this Thesis.

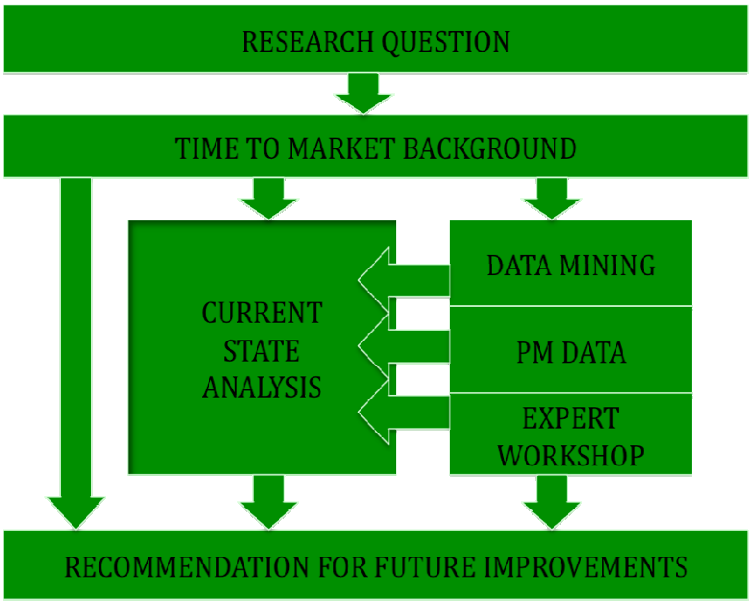

Figure 2. Research structure of the Thesis.

1.4 Limitations of the Study

The scope of the study is limited to the case company's one department that has around 100 employees and 11 project managers in four different countries. The study concerns organizational and project managerial issues of that specific department and is not transferable to other departments in the same company because of their different backgrounds.

The time to market indicators and performances are investigated from the project lead-time perspectives, and some other influences such as manufacturing and the supply chain related delays are left out of the scope. The study concentrates in TTM delay issues on a general level and gives the reader a holistic view of the topics based on the literature review. Although TTM delays can arise from multiple reasons, this Thesis concentrates only in few phenomena such as student syndrome, resource allocation and communication.

This Thesis consists of five different sections. The second section (2) focuses on the most common time to market delay mechanisms in current literature. The third (3) section describes how companies can improve time to market delay via organizational, managerial and process point of view. The fourth and fifth (4,5) sections explore the research question and the results from the case company perspective and compare the results with the literature findings. The last section (6) proposes recommendations for the future on how the case company can improve the time to market interval.

2. TIME TO MARKET DELAY MECHANISMS

In this section, TTM delay mechanisms are described from the project execution point of view and its implications to project costs and the future revenues. In order to provide coherent view from current literature, background section is divided into two parts. The second section introduces the possible causes for project delays and the third section introduces the best practices and other methods to improve TTM interval. TTM delay mechanisms are well known and there is plenty of literature available on this topic. Selected TTM delay mechanisms presented in this section are chosen based on most common reasons described in literature.

2.1 TTM Delay Implications

Short TTM interval gives competitive advantage for companies that compete in the middle of competitive market landscape. Long lead times impact company's share price, resource allocations and profitability and long project lead-times might ruin good product ideas or innovations if product introduction occurs too late. Today it is important that companies can meet market needs more quickly and select the right projects for execution to gain above average returns and increase market shares more quickly. Why projects are late or fail has been studied for decades. Poor leadership, wrong user inputs, wrong skills and competencies are some reasons but more fundamental issues can be found (Blackstone et.al. 2009: 7030); the specifications change, people leave and join the project and tacit knowledge disappears and grows. It is not a surprise that on average 38 % of new innovative product projects fail (Tidd, et. al. 2002: 16) or they suffer serious quality meltdowns.

Long TTM delay may have great influence on the stock price, and for a large multinational company a few weeks' delay from initially announced launch date may have an impact on the whole company value. For instance Nokia informed that the new N8 smart phone launch will be delayed by two weeks because some improvements were needed in September 2010. On the same day, Nokia's stock price decreased by 4,5 % (Helsingin Sanomat, 2010). As a result, Nokia's competitors earned a few weeks' extra time to gain more revenue with smart phones already available on the market.

On the other hand, it is also crucial for companies to have well designed product without any major defects already in the first wave. In the introduction phase, is important to gain market's approval for new product, and usually there is no space for errors. Poor product design can ruin the whole business before it has even started properly and restoring customer trust afterwards is very difficult, or at least costly. As a consequence, sometimes TTM delay is justified although it is not desired.

The time to market interval has a significant effect on the company's revenue. Christopher and Towill (2000) pointed out that "*Sales lost are gone forever"* and catching the market shares back is difficult if competition has started. To find correlation between the impact of project delays and the long term revenue is not simple because it is always related to company business type and market behavior. A high-growth business has different TTM rules compared to the slow cycle business and competition is one of the dimensions that has an effect on the long term profitability. One general formula for time to market delays and it implications on revenue does not exist.

One approach to explore TTM impact on the revenues can be analyzed from the product life cycle point of view. In general, the product life cycle (PLC) has four different stages. The cycle starts with an introduction phase and ends up with a declining phase. Figure 3 illustrates how the product life usually develops during the time and how PLC shapes companies' revenue.

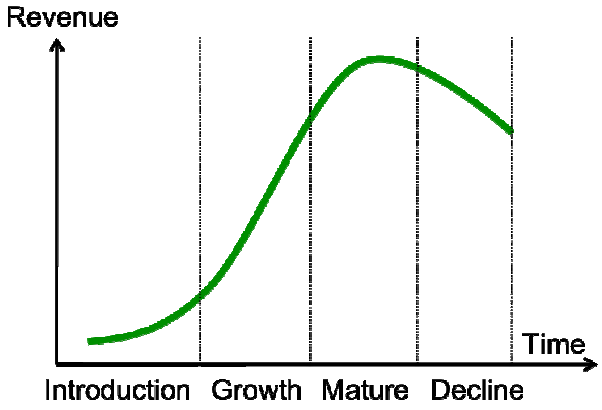

Figure 3. Product life cycle curve (Proctor, 2000: 23).

In the introduction stage when a new product offer is just released, the competition is minimal or non-existent. The creation of demand is the main goal at this stage. The product cost is generally high due to low sales, and the company does not gain any profit with the new product at its introduction stage. The main goal is to increase customers' awareness of the new offer.

The second stage in the product life cycle is the growth stage. At this stage, the product volume and the company's revenue start growing rapidly. Customers' awareness about the product has increased and the product quality has improved based on introduction phase feedback. The product cost decreases due to higher production volumes. Competition will start and therefore marketing has a key role in keeping the sales growing.

A short-term implication of delayed introduction for revenue is facile to calculate from lost sales if competition is not involved. The complexity of the long-term profitability calculation lies in competition. The introduction date for the competitors' substitute product is impossible to know beforehand and its effect on the market is also unclear at the beginning. Figure 4 presents the consequence of the time to market delay and how it decreases product revenue over the product life cycle if competition starts at some point.

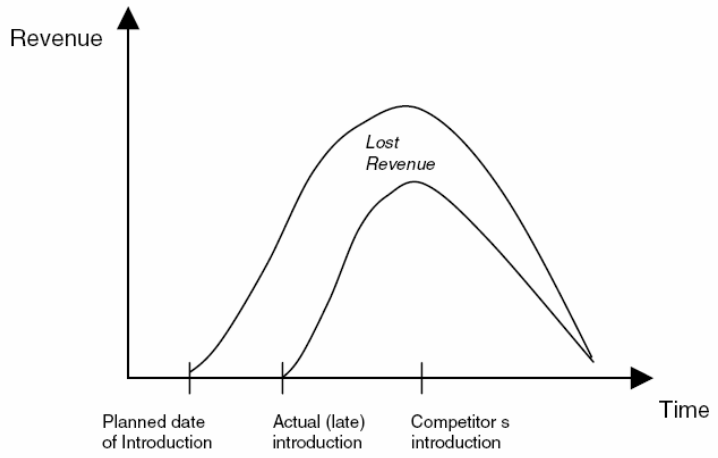

Figure 4. Impact of time to market delay (Rosenthal, 1992).

The assumption in Figure 4 is that the competitor product clips the highest peak of the planned revenue and creates shorter growth period for the initial offer. Second assumption in the figure is that competition will start at some point. Hence the chart is made from the first mover perspective (Savin and Terwiesch 2005: 28). In fast cycle product development such as mobile phone business, late introduction has more dramatic influence on revenue than in slow cycle business. If the initial product introduction prolongs itself to the maturity or the decline stage, the market opportunity has usually passed. In general, Figure 4 approach fits best to business to customer (B2C) with high competition involved.

The second perspective is described from reduced time to market interval point of view and its implications to company's profits. In general, shorter TTM interval has a positive impact on revenue, but in some cases the forerunner companies might face a problem with too early introduction. As a consequence, markets nor customers are ready to adopt the new product (Savina and Terwiesch 2005: 29). This problem occurs usually with the very innovative products or a new type of business that has not yet performed in the past. Figure 5 emphasizes the impact of a short time to market performance on a company with disruptive technology projects.

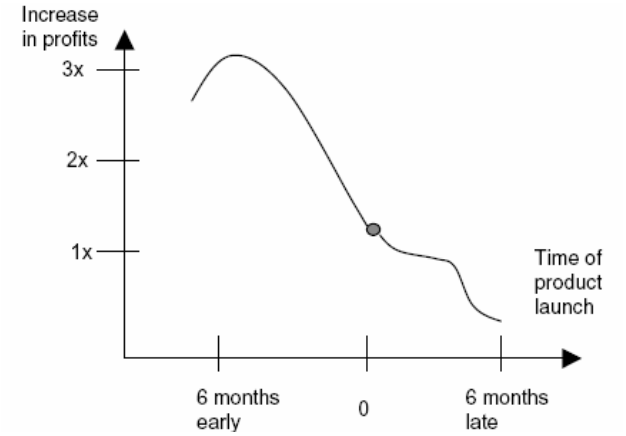

Figure 5. Product early introduction impacts to profit (Wheelwright and Clark 1992).

Figure 5 refers to the fact that a phenomenon that erodes time to market (TTM) interval too much has negative impact on revenue, and companies should be aware of the possible risks related to that. Reducing TTM interval has always a price as argued at the beginning and if this is combined with too early introduction it will conduct double failure, lost profits and for instance high development costs.

Melsa (1999) argues that it is crucial for any company to notice when the “market clock” starts ticking. At the time when market opportunity is greatest the company should also have great sense of urgency even if this appearance is often ignored. As soon as the company notices that it’s behind from the market, the sense of urgency increases rapidly but competitors’ products decrease the market opportunity parallel at the same time (Melsa, 1999: 19).

In special type of businesses with little competition or high switching costs involved, the company may acquire estimated sales volume despite of reasonable TTM delay. In this case, lost revenues create only short-term impact on company profitability. However, although product revenues may remain the same, delay in the TTM creates other problems.

First, the company’s overall profit margin falls in a short term because it cannot realize profits from its delayed projects. This might reduce the company’s stock price and the whole company value due to the reason that companies are often measured each quartile. Second, the resources are bound to the delayed project and the cash flow direction is outwards. This postpones the project break even point to the future until the cash flow changes its direction.

Finally, the importance of TTM has proportional relationship to the product life cycle and sometimes predictability of the new product launch is more prominent than fast product development. Companies should investigate possible impacts on revenue if TTM interval is accelerated. Speeding the development time has generally a positive impact on profits but in some cases it may also have opposite effects. The product life cycle shapes the need of speed; in slow cycle business, consequences are not so dramatic than in fast cycle business.

In addition, the company competition strategy may be based on the follower position. Occasionally it is possible to learn from pioneers’ mistakes and gain more money with the second or third generation products on markets (Cooper and Edgett, 2002: 5).

TTM Delay and Project Costs

This section assesses TTM delay's implications to project cost. In order to give a holistic view about the possible links between project costs and development time, aspects are scrutinized in general level only. The TTM interval is linked strongly to project costs and accelerating the development speed has consequences to project profitability.

The short time to market (TTM) interval impacts to project costs. A new product development (NPD) includes the classical trade-offs about six forces linked to a project and product performances as illustrated in Figure 6. The speed of development has an implication to the time to market interval and improving that has consequences to other trade offs.

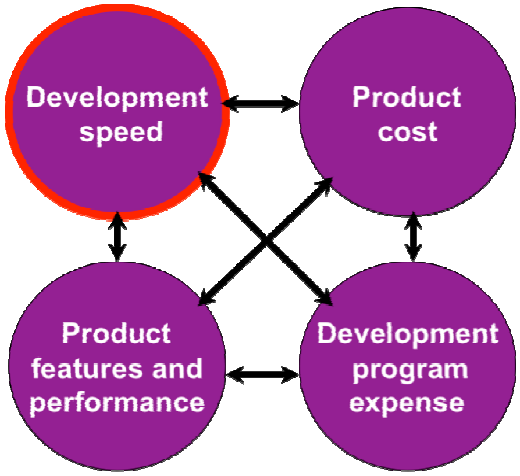

Figure 6. New product development trade-offs (Smith, 2004: 175).

Figure 6 illustrates the relationships between the development speed, product cost, company's expense on a development program, and product features and performance. The most common trade-off in NPD is development speed vs. project expense. Decreasing the development TTM factors such as hiring more personnel, using external partners and investing in technology tend to increase the overall project costs, thus reducing its competitive advantages. It is therefore crucial for companies to investigate thoroughly before taking any actions, whether it is worthwhile to invest in the development speed if there is a risk that the investment may never reach the break-even point.

Figure 7 illustrates the different dimensions that are connected to project profitability over the product lifetime. The base assumption in Figure 7 is that the market growth rate is 20 % annually with 12 % annual price erosion and the product life cycle is five years (Melsa, 1999: 19). This chart explores the time to market delays from a high growth market point of view and is not comparable to the slow cycle business at the same scale.

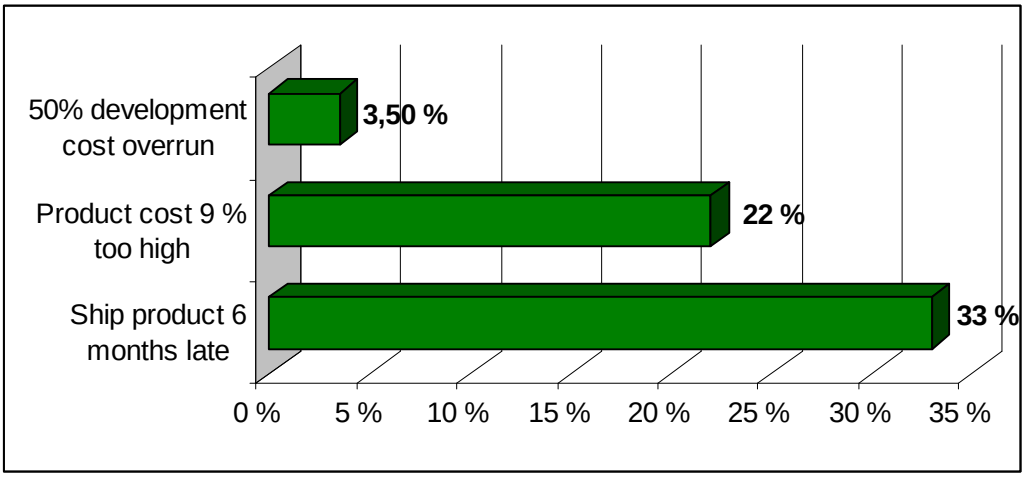

Figure 7. Example of TTM impacts to revenue in a high-growth market (Melsa, 1999: 20).

As discovered from Figure 7, the most significant factor influencing the project profitability is time to market delay. A six month delay decreases project profitability by 33 % if product life cycle is expected to last five years. The development cost has a minor role, thus investing more into development speed is justified in order to get a product on the market in time. Today, TTM delay in some high growth businesses has even more dramatic consequences due to the reason that product life cycles on the market have become shorter.

At the beginning, the project has mainly costs and it does not generate any money. Emphasized importance of TTM and its implication for project revenue and project costs could be analyzed partly from an investment point of view. Figure 8 illustrates the project costs if TTM interval is reduced. The speed increases project costs, but it has also proportional influence on the break even point (i.e. payback time) in a project.

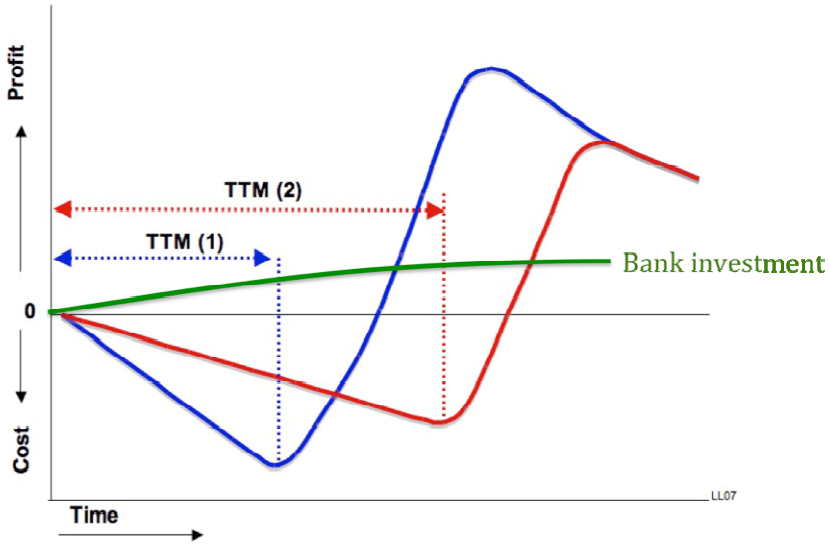

Figure 8. Time to market implications to project costs (Adapted from Lieshout, 2007).

Comparing these two TTM curves to the bank investment that starts to generate profit from the first day, project profitability has an important role. If it seems that the project is late and the project gross margin is low there might be a possibility that the bank investment produces more profit than an investment for a new project ever will. In this case, the project prioritization has an important role in the managerial level and resources must be allocated wisely to projects that have good gross margins and good profit expectations.

This idea is only explored from the project profitability perspective and some projects or organizations might have other goals than producing profit. Some quality improvements for existing products may never reach the break even point. The company carries those out for example to maintain existing customer base for the new product developments and future projects. Secondly, Figure 8 illustrates also a paradigm that a shorter time to market interval does not reduce project costs.

Finally, a large number of projects fail, overrun the budget, or project output is delivered late (Leach, 2004:1). Project success or failure is in the end strongly linked to project costs. An excellent product from the technical point of view may be a business failure if the costs are heavily overrun and the project never reaches its break even point. In general, the most successful project is that which makes most money (Westney, 1997). As a result, management should invest in speed in the projects which are most likely successful in the future. However, selecting the right project for acceleration is demanding because future prediction and market behavior may vary to great extent.

2.2 TTM Delay Reasons

Although TTM interval is studied and analyzed in the past, companies still suffer from the same symptoms as described before. In general, the project delays are usually linked somehow to humanity and human behavior like skills, planning and the way how people usually handle the tasks in daily life. The company's organizational culture and processes have an impact on TTM interval, but the root cause can often be linked to individual behavior. This section presents some of the root causes linked to TTM delays.

Decision making process

The speed of decision-making process has an essential role in time-to-market performance in a company. Therefore the project managers should have authority to make all decisions which are linked to the project and its progress. The project manager and the project team have the best knowledge about the project performance and if the project is going to wrong direction they should have power to utilize all necessary actions (Smith, 2004: 180).

In multinational projects, employees often work in a matrix type of organization with different line managers. As a result, the project manager's authority is often limited to accomplish effective decisions inside a team. Each department has their own area of expertise, and usually a project manager cannot make trade-offs between the different departments in order to achieve shorter TTM interval. This is highlighted especially in situations when the project is delayed, but from the process point of view shortcuts cannot be made due to the reason that it might backfire for instance the quality department. The different departments may protect themselves from future risks and sometimes TTM is sacrificed. Sometimes the risk taking should be justified in order to gain competitive advantage.

Complex organizational structures and bureaucracy complicate the decision making process further on. The middle managers may become gatekeepers who pass or prevent information flow to upper managerial levels because their creditability depends on the projects they support (Langley, 1995: 66). These communication barriers i.e. gate keepers work also to another direction; all necessary information from upper managerial level is not shared with the employees in lower organizational levels.

It is also possible that information is considered a tool against other employees to secure for example career continuity in the company. This develops an atmosphere where decision making process must reach all necessary gatekeepers or other information preservers before decisions can be implemented.

A complex organizational structure creates also a need for formal analyses about current state of the projects because information is needed for example for communication and control (Langley, 1995: 64). In general, the formal analyses are justified for upper managerial levels to allow them to be able to make the right decisions. Analyses become poor if they include too much information than is needed for the decision-making process, because collecting data always consumes energy in lower organizational levels. The formal analysis becomes very unsatisfactory if information is not used for the decision-making at all and the analysis reflects only symbolism (Langley, 1995). This de-motivates employees and creates resistance when subsequent formal analyses are needed.

Langley (1995) argues that fluid organizational structures donate more power to employees and might reduce unnecessary and time consuming discussion between different organizational levels. However, fluid organization may create its own problems. If the fluid organization is not established with clear responsibilities and limits it can become as poor as the organization it replaces (Langley, 1995: 67).

By promoting openness in team level and lowering hierarchy, companies could improve communication which reflects to the decision making process. Figure 9 illustrates two kinds of team organization models. Communication via manager slows the decision making process and makes the team inflexible. The project team that utilizes common decisions and communicates to each other freely increases the speed of decision making process and agility.

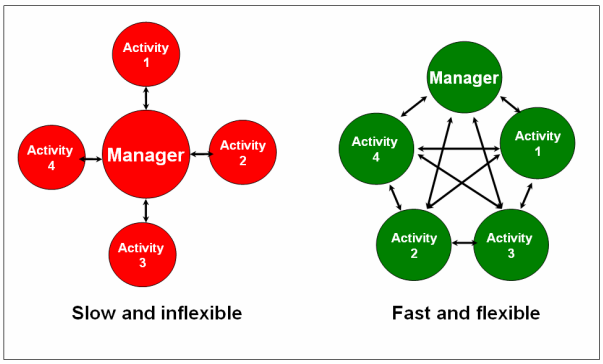

Figure 9. Inflexible vs. Flexible Teams (Rohweder, 2010).

The company culture influences the decision making and problem solving capability in broader terms. Salaman (2002) defines six different characteristics related to the case companies' problem solving ability in the book Decision Making for Business.

An i*solationism* grows in large companies due to the fact that the organization structures are divided to divisions and multiple sub-units, so called silos. The vertical and horizontal communication links between the employees are weakened and the protectionism for one's own area of expertise is present. This might lead to a situation where problem solving proceeds in individual level only and the problems are not likely to be seen from another perspective at all. As a result, there is a risk that available expertise from other departments or teams is not utilized for problem solving. Finally, information about the decision is difficult to find and it is not distributed to employees afterwards (Salaman, 2002: 201).

A Subordination slows down the decision making time in the lower employee level especially in highly hierarchic organizations. The employees are expecting that their managers solve the entire problems top-down basis and initiative does not exist. The subordination is also seen as a phenomenon where the employees do not want to take lead in the problem solving process. It is safer and easier to ignore the problem even if it might be related to the employee's own work task (Salaman, 2002: 199). The employees expect that the problem solving decisions belong only to managerial level and in some cases this is even boosted by the company. However, in a knowledge worker organization, initiative and risk taking should be promoted to enable learning from mistakes.

A matter that also has a negative influence to decision making process is *conservatism.* This means that employees' mind set has already turned to the point where they think that "things will never change" or the current situation can turn only for worse. A staff that is skeptical about their managers' decisions cannot fully commit to those either (Salaman, 2002: 201).

All in all, the organization culture has an impact on TTM interval in the new product development projects concerning decision making process. Changing the culture of the organization in a multinational company might be an insurmountable work task, but some actions can be implemented in the team or the department level to improve the decision making capability in the long run. An effective decision with short lead-time enables the whole organization to improve TTM interval.

Inappropriate Multitasking

Multitasking refers to a problem when the employee works with many parallel tasks at the same time and the prioritization between tasks varies during the time. Multitasking is not always a bad thing due to the reason that over the project there are time slots where the whole project team involvement is not needed. However, multitasking always makes task duration longer than it should be (Elder, 2006: 3). Multitasking complicates the project if the output from the first task executor is delayed because of multitasking, and the next task executor is already anticipating this input to start the next activity. In the worst case, the inappropriate multitasking may delay the whole project.

Multitasking creates problems for knowledge workers because they have to shift their mindset between different topics and get back on track with a task that was interrupted. Poor multitasking creates also quality problems for example in a design process if the designer has many parallel tasks at the same time with tight deadlines. The designer may try to manage a task as fast as possible and there is a risk that all details are not investigated and small mistakes need to be fixed later on. This leads to re-work. Smith (2004) points out that one way to reduce time to market delays is avoiding mistakes and re-works during the design process.

The re-work leads to wasting resources because the same design cycle needs to be repeated and resources cannot be released for the other projects or needs (Smith, 2004: 176). Figure 10 illustrates how tasks suffer from bad multitasking.

Every time an employee switches the task a new “setup time” is needed to get back on track with the task that was interrupted.

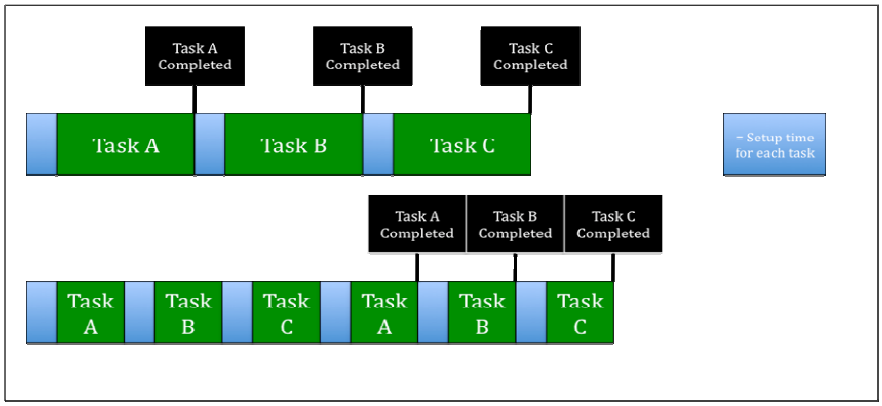

Figure 10. Multitasking and task completion. (Elder, 2006: 4).

Figure 10 illustrates that setup time is needed only once if the employee starts and finishes one task at the time. In poor multitasking, tasks are divided due to different reasons that create need for multiple setup times. One setup time for one task accelerates the TTM interval and this is one of the main principles in a Critical Chain Project Management (CCPM) approach introduced in section 3.

Second aspect that is closely related to multitasking is task dependency. Task dependency is normal in a project work with several different activities. One way to examine this is to estimate how often project tasks which are dependent on each other are on time. If we say for example that 90 % of the tasks are usually on time and the project completion needs five tasks which are linked together, overall possibility that the whole project is on time is: 0,9 x 0,9 x 0,9 x 0,9 x 0,9 = 59 % (Blackstone et.al., 2009: 7031).

In general, the employee should execute a task as soon as possible and hand over the output to the next person without any delays. The next task should be started as soon as the previous one is completed to avoid any slack in the chain. One dilemma in this approach is how the next person knows that the previous task is really completed and does not need any re-work which might cause TTM delay later on. One solution is to establish a command chain where the next person audits the output of the first one and gives an approval when the task is completed and does not need any re-work.

Student Syndrome

"Nothing gets done without deadlines" refers directly to so called student syndrome. This syndrome has acquired its name from how students handle their homework (Elder 2006: 7). Even though the deadlines are well known beforehand, the job is normally done last night or the day before it, which gives no space for errors. For the students this approach to work is fine and the tasks are completed on time. In real project work, this might have implications to quality and together with multitasking it will delay the project lead time. Figure 11 illustrates a typical work pattern, especially concerning the stage gate project model.

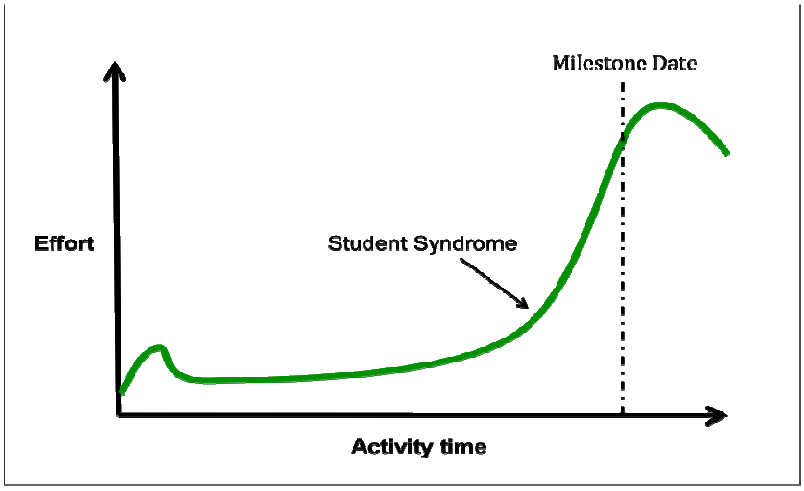

Figure 11. Typical work pattern. (Leach, 1999: 43).

This figure shows that employees work between the gates without any sense of urgency but just before the due date all missing activities have to be handled at once. This may create chaos inside the project team and affect project quality and TTM interval. As a consequence, this kind of approach reflects to TTM if after the milestone the next task leader must re-work the task again to achieve the intended output.

"Work expands so as to fill the time for its completion" is known as Parkinson's Law. It refers to individual behaviour of how human beings execute a task that has certain predetermined timetable (Gutierrez and Kouvelis, 1991). For example if an assignment's actual execution time would be two hours but it is scheduled to last one week it will last one week. As much extra time is given as buffer time, quite likely as much time is also used. The lazy employees postpone tasks until the last day (student syndrome) and

diligent people execute tasks immediately and start doing something else to fill the remaining time. A perfectionist can improve the design a bit more which might however be unnecessary from the project point of view. The task complexity grows during time and the focus on adequate task execution disappears.

The initial problem in student syndrome is that every task usually contains some safety time which gives the employees a possibility to postpone initiation. The project schedules are normally conducted based on the project employees' expertise and feedback. Each team member adds a safety buffer to their own tasks and the project manager does the same.

As a result, the schedule is not anymore related to the real work time and in the end, employees have used all the planned time although there was a slight chance to be faster. Mr. Murphy "what can go wrong will go wrong" is one reason why employees add buffer time although Murphy doesn't appear in every task (Elder, 2006). Resulting from multitasking and the student syndrome, all the time that was reserved is wasted and the project lead-time is delayed. Figure 12 demonstrates how tasks are handled if buffer time is not controlled in any way.

Figure 12. Safety buffer usage with the Student syndrome (Elder, 2006: 8).

Figure 12 illustrates that project task is usually planned to start at a certain date and some buffer time is reserved for its completion. If a sense of urgency is not present, people usually postpone the task startup as long as possible and the buffer time is wasted before any concrete action for managing the task is implemented. In case of problems during the task execution, no time is left to manage any corrective actions. Removing this safety time from individual task level and creating a sense of urgency inside a project team normally helps to get things done more rapidly.

Finally, the TTM delays are usually connected to several different factors and companies should explore what kind of symptoms they suffer from. TTM delays may occur also in too complex internal processes but often the root cause is linked to appearances mentioned in this section. Speeding the TTM interval has either a positive or a negative effect on project profitability. Accelerating the best projects brings additional value for project revenue, whereas accelerating the wrong projects may ruin the whole project profitability. Therefore, speeding the right project is important in order to gain competitive advantage.

3. REDUCING TIME TO MARKET INTERVAL

This section discusses the existing knowledge on how TTM interval can be improved in different ways. First, this section starts with a general overview of the topics. Second, resource allocation is scrutinized from the organizational and the task execution point of view. Third, communication and how to utilize the lessons learned are discussed because these are often the most problematic areas especially in multinational teams. Finally, this section introduces concisely the Critical Chain Project Management (CCPM) model in order to give a perspective for other possible project management methods.

The most challenging tasks in project work today are new product development, product launch in the given time frame and budget discipline. The products should include customer inputs, have a superior quality and be strategically important to gain competitive advantage for the company (Tzokas, et.al., 2004). In the slow cycle business, the key emphasis is rarely on the development speed and more important is the predictability of the new offer and especially that the offer fullfills the customers' needs and requirements. The organization that executes the wrong things rapidly dies quickly as is illustrated in Figure 13. The company's competitiveness and success is related to the paradigm that the company knows what the customer wants and the employees act towards a common goal. This should be emphasized in every organizational level because companies that become very inefficient may in the end drown to their own complexity.

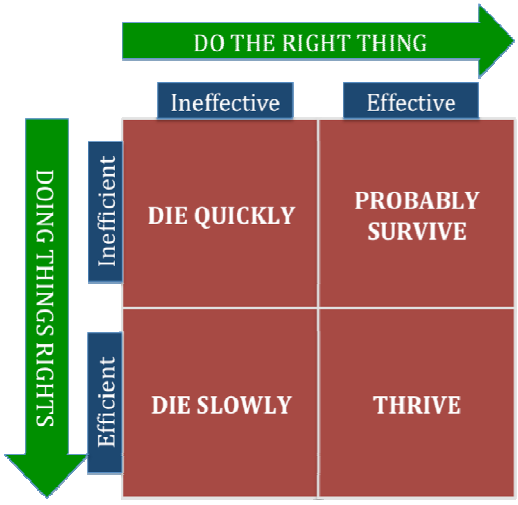

Figure 13. The Brown's efficiency/effective matrix (Adapted from Adcock 2002 in Ruokonen 2010).

Different companies should use different approaches to accelerate the development process because business type, novelty, and complexity of the products shape the need of TTM speed and require different approaches (Langerak and Hultink, 2008). The most important decision is to decide what needs to be improved and everything else follows from that decision. (Leach, 2004: 61). Defining the weakest links in projects and improving them has a key role in accelerating TTM interval. Before speeding the time to market interval by reducing the project lead time, metrics for task duration measurement should be available. Without proper coding of task durations it is complicated to improve the processes later on and to find bottlenecks for future improvements. Often the companies know very well the capability and the capacity of the factories but the project organization capability to produce new products or innovations is often unclear (Melsa, 1999).

Measuring innovativeness and problem solving capacity in organizations is usually based on past projects, best practices and lessons learned from experiences and turning that information to hard fact is challenging. As a consequence, deep analysis about the bottlenecks should be scrutinized. After that, an action plan for TTM interval improvement should be established. The organization that already works with full capacity to improve TTM interval requires fundamental actions such as organizational changes, decreasing the number of projects and increasing resources or investments for better technologies. The management cannot expect different results if things are made same way as before.

The initial project opening data at the time when the project is opened should be ground solid as early as possible (Datar et.al., 1997: 452). This means that customers' voice (e.g. needs) and initial specifications are correct so that the project can avoid false starts. This is one approach to reduce TTM interval (Donovan, 2006: 167). The false start has an impact on TTM interval later on because all extra modifications during the project have usually negative impacts on project timetable. Unpredictable changes for example in product requirements have implications to overall project duration.

Investing in the engineers' learning to turn customer needs to products and developing cross functional teams for concurrent engineering decrease time to market interval (Datar et. al. 1997: 452). As a starting point, the organization and especially its managers should explore if the staff is capable of executing the project from the knowledge and skills point of view. Skills that were needed ten years ago might be outdated today. The company can outsource some design activities to increase efficiency if external companies have more relevant expertise available (Swink, 2002: 50). Although outsourcing is widely used in today's business it may have side effects to TTM interval because outsourcing increases

the need of coordination in projects. Some companies can improve TTM by sticking to the project schedule as planned at the beginning (Smith, 2004: 176). This requires discipline from the management and project team to stick to plans and all stakeholders should have common understanding of what delays might cause to project revenue. Companies should change the mindset of the employees to be more time based (Melsa, 1999: 18) and clearly communicate possible TTM delays to employees.

Swink (2002) argues that making project goals more explicit helps to reduce time to market interval. Swink's (2002) study points out that best practices for TTM reduction are cross functional design teams, computerized project scheduling and rapid prototyping. Less beneficial are co-located or isolated teams and rewarding the employees for speed (Swink, 2002, 58). Swink's study combines the best practices from 131 new product development (NPD) projects conducted in both small and large companies.

Finally, before the managers implement any special tools or tactics to decrease TTM they should be aware of the possible side effects related to that (Swink, 2002: 58). All time-to-market tactics do not fit in every organization equally and companies should estimate what kind of TTM approach fits best to their strategy. In addition to Swink's list, TTM can be reduced in another ways that are for example improving agility or productivity and eliminating schedule variations (Smith, 2004: 176).

3.1 Resource Allocation

The company has tangible and intangible resources. The tangible resources are defined as machines, products and equipment. The intangible resources refer for example to companies' internal processes, skills and knowledge (Osterloff, 2003). Knowledge work such as new product development is mainly based on intangible resources and tangible resources such as machines support its progress. The company competitiveness may rest only on employees' knowledge and their competencies and they should be treated as the most valuable asset of the company.

A "*lack of resources*" is a common statement in an organization that endures massive workloads and capacity problems and sometimes the organization has simply too much work to do. The competitive landscape forces companies to improve the cost structures that often reflect also to the headcount in the company. This may lead to a situation where there is nobody left to do the actual work (Cooper and Edgett, 2002: 3). A common trend today is also that companies flatten the organizational structure to operate more

effectively. If an organization is not operating with an optimal number of employees hiring more staff could reduce project lead time and TTM (Pareekh and Sabyasachi, 2006: 11). However, this does not always bring the desired benefit because some project tasks are not visible or they are too complex. As a result, placing more staff does not help to execute the project any faster and extra staff only delays task further on (Levitt and Kunz, 2002: 13). The new staff must be familiarized to the on-going tasks and gaining deep understanding about the activities may take a while. This phenomenon is also known as Brook's Law which states that "adding manpower to a late software project makes it later" (Brooks, 1995: 25). Figure 14 illustrates this phenomenon.

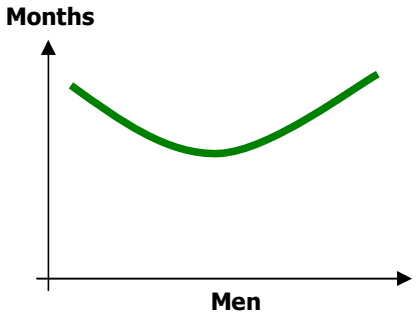

Figure 14. Time versus number of workers – task with complex interrelationships. (Brooks, 1995: 19).

A balance between the available resources and the on-going project should match clearly the TTM needs and maintain employees' work load in balance. The sense of urgency is mainly a good thing in a project but it cannot be excessive. The staff needs also respites to avoid burnouts that in the end lead to brain leakage from the company. Every time someone leaves the company, a part of tacit knowledge disappears if knowledge transfer is not utilized well.

Projects generate multiple tasks and activities which are divided in resources based on their capabilities and availability. The project with less resources should concentrate in allocating the available resources as effectively as possible. Removing waste time (or actions) facilitates the project to proceed more quickly. Consequently, the department with fewer resources should concentrate in small and easier projects and "pick low hanging fruit" first (Cooper and Edgett, 2002: 5).

In general, product modularity and late customization help to maintain project size small, but from time to time the company also needs radical innovations to stay competitive. The company cannot survive only with small improvements because someone else will invite disruptive product or technology sooner or later.

Hidden Effort

In general, the project plans based on direct work estimations and schedules do not include time for re-work or coordination needed during the task. As a result, employees work as hard as they can but still projects suffer from long lead times because “hidden effort” is not planned or it is not visible. The traditional project management models concentrate only to direct work and hidden effort is usually ignored (Levitt and Kunz, 2002: 1).

New product development is mainly knowledge work and it includes plenty of information processing and coordination, which can be seen as hidden effort (Levitt and Kunz, 2002: 1). This effort is complicated to manage because during the project people learn how to act more effectively. The lessons learned utilization decreases the hidden effort and in the next projects it might be scarce. Also experienced project members consume less energy to coordination and re-work compared to for example trainees.

Figure 15 illustrates hidden effort in a single project task. Coordination may take place if in the beginning of a task some input is needed from another person. If the correct person is not reachable when the information is needed it might take days before work can actually start. Communication especially in multinational teams consumes plenty of energy if proper communication channels or virtual workspaces are not established. The decision making process prolongs also the whole task duration if some approvals are needed before work can be transmitted forward.

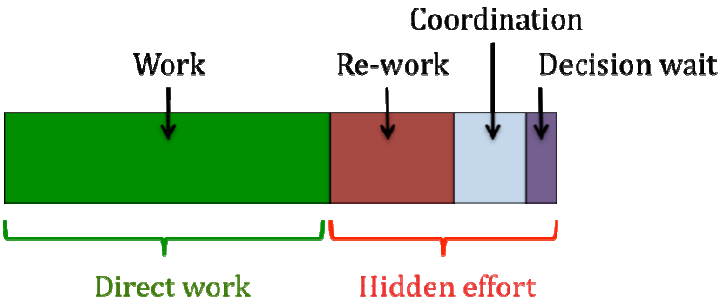

Figure 15. Total task time in project work (Levitt and Kunz, 2002: 11).

The re-work, coordination and decision waiting time e.g. hidden effort is somehow included in total task time based on employees' experiences from the past projects or individual tacit knowledge. It is not visible in project plans but each member adds this part to the tasks automatically. The more mature the employee is the more accurate estimation the managers can get. All in all, the employees add safety buffer to tasks and in the end the total task duration looks as demonstrated in Figure 16 with safety buffer included.

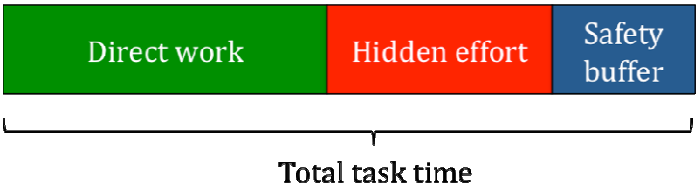

Figure 16. Total task duration with safety buffer.

As a consequence, if student syndrome consumes (wastes) the safety buffer at the beginning and the amount of direct work can be measured quite accurately by project members, the task delay is most likely linked to hidden effort. Hidden effort is not usually visible and the error margin for its estimation is high. This is most likely the place where task delay occurs in individual task level.

Exploring previous project performances and looking into the total time consumption of each past activity helps to cope with hidden effort. Defining the tacit knowledge of resources that executed the task before facilitates more precise time estimation in the future. It is important to explore whether they were experienced or novices and what kind of challenges the teams have faced in the same work phase before. This information

helps both managers and employees to estimate together more precise timetables for the whole project. The safety buffer can be removed from individual task by using different project management models or by creating a sense of urgency inside a team.

Ambidextrous Organization

In product based business, offer on the market needs slight improvements and constant incremental innovations to preserve the customer value and efficiency (Reilly and Tushman, 2004). Today, companies are forced to improve their productivity and quality continuously to stay competitive for example against low cost rivals or other competitors. This kind of action requires resources and unfortunately the resources are often simultaneously used in ongoing new projects.

As a result, this might lead to a situation where during new NPD project some kind of quality issues in the market allocate the NPD project resources partly or fully to execute this more important quality issue first. Resulting from this, the new product development has lost its resources for a while and the project lead-time suffers. Depending on the NPD project timetable and the reserved buffers for its execution the unpredicted tasks may jeopardize TTM interval and lead to postponed product introduction. In the worst case, this kind of phenomenon shifts the new product introduction to the extent that the market opportunity has passed or it is dramatically reduced.

One approach to avoid the situation where resources for existing business and NPD projects are mixed is ambidextrous organization. In the ambidextrous organization model, the current business maintenance such as slight improvements or incremental innovations are managed by own organization. The NPD projects and radical innovations are carried out by a separate organization. Both organizations are linked in the top management level and they have no other common nominator. The NPD organization e.g. emerging business unit has its own working methods, culture and best practices and their tasks are not linked in day-to-day business (Reilly and Tushman, 2004).

The ambidextrous organization does not mean that one team from R&D is separated to its own unit or some cross-functional team with great independency. It means that the whole organization has its own structure as in Figure 17.

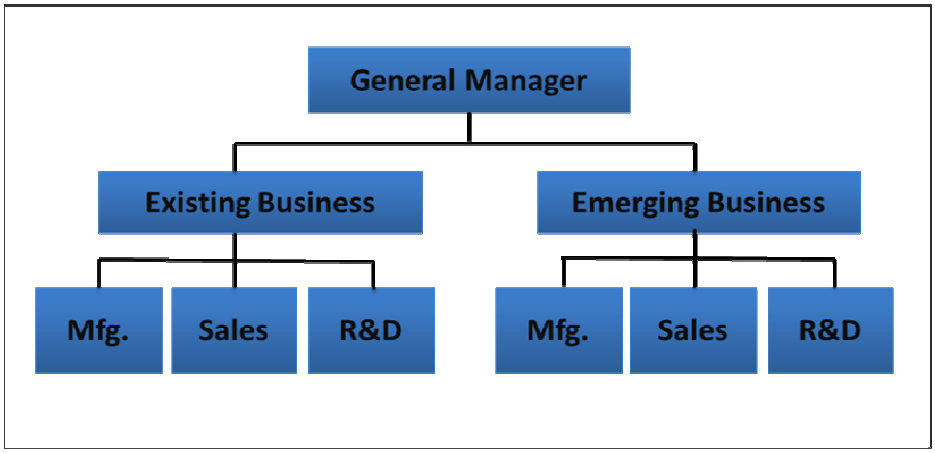

Figure 17. The Ambidextrous Organization (Reilly and Tushman, 2004: 79).

The ambidextrous organization requires more resources than the conventional organizational model and in small or medium size companies it may be complex or too costly to manage. The ambidextrous organization model fits best for large multinational companies that are struggling with resource issues between the existing and emerging businesses. The initial resource problem between new and old business still exists if ambidextrous organization cannot be utilized. As a result, second approach would be to establish a project team that includes a dedicated team and shared staff to handle the innovations in a company as Govindarajan and Trimble (2010) point out in Figure 18.

Shared staff consists of employees from ongoing business activities (i.e. performance engine). They execute routine tasks in a project such as supply chain related issues in the NPD project. The dedicated team is fully committed to one specific innovation project and executes non-routine tasks in a project. The dedicated team has no tasks inside the performance engine and the whole project team is linked together via partnership (Govindarajan and Trimble, 2010).

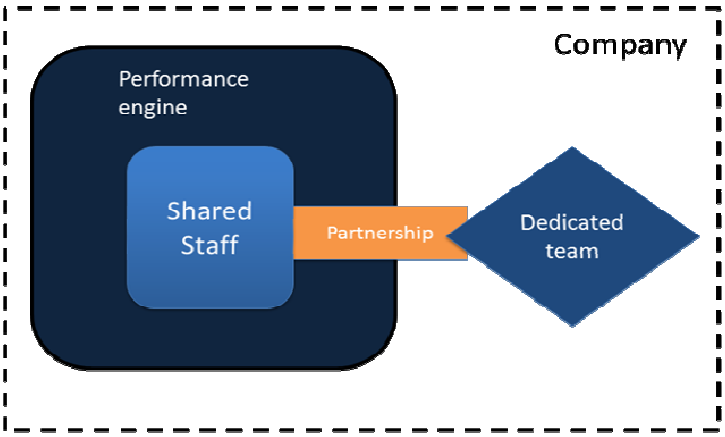

Figure 18. Shared staff and dedicated team (Govindarajan and Trimble, 2010: 28).

This same concept can also be adapted to normal project work. A project team that can concentrate only to one specific task improves TTM interval. Creating a barrier between the daily problems and the NPD project team helps to avoid multitasking. A special team in a performance engine needs to be established to carry out daily tasks related to company business. Both teams should have enough skills and knowledge to execute their own specific area of work and the managers should be well aware of the competencies needed for both activities because they differ from each other. The performance engine concentrates mostly on the efficiency, cost and profits in the company and the NPD team's main goal lies in innovation, growth and future. Consequently, the competencies should be divided based on both demands.

In the end, the organizational model has an impact on TTM interval if the existing business remarkably disturbs the ongoing project activities. To avoid this from happening the companies could concentrate in separate activities so that collisions do not happen between the old and new business. This means fundamental changes in the organizational structure and it requires the right competencies in right places. In addition, it may require more resources.

3.2 Communication in Geographically Remote Teams

A cross-functional team is a small group of individuals with complementary skills who work towards a common goal. Smith (1997) observes that the cross-functional team has some special characteristics. It consists of knowledge workers and their background varies from manufacturing engineers to finance experts. The cross-functional team is usually involved in the development of an innovative or new product and its main goal is basically to get things done effectively in a given time frame (Smith, 1997: 49). In general, the team works more effectively than an individual and collective learning and knowledge sharing is one of the team's key assets.

Due to globalization, the innovative products rarely come from only place or unit and generally there are several sub-units in different locations involved. One of the challenges nowadays in cross-functional teams lies in communication between the team members because they usually are geographically distributed. Communication is one of the most important elements in project execution and often the success or failure of projects depends on this especially in multinational teams (Malhotra and Majchrzak, 2004).

Communication between the team members that are not co-located (i.e. geographically distributed) should be as good as possible, which requires good IT infrastructure, norms and trust between each team member. Trust in multinational teams is a key element for project success and the lack of face-to-face meetings due to geographic, economic or time considerations complicates building trust comprehensively (Malhotra and Majchrzak, 2004: 77). It is not unusual that project members work only in virtual environments and they have never met each other. The team leader's responsibility is to establish a work environment or a virtual work space where all the employees can work towards a common goal. Table 1 demonstrates some best practices for communication for teams that are geographically remote.

Project communication norms inside the project team should be defined at the beginning of the project. These include information sharing, responsibilities and each member's area of expertise. The project members are often isolated from each other and this hinders communication (Malhotra and Majchrzak, 2004: 80). Defining the e-mail answering times

(e.g. 4 hours or during the day) inside the project group and defining virtual databases for documentation facilitates the information sharing further on.

Project members should have access to the latest versions of documents and it is important that document updates are made systematically to right versions. The lack of coffee room discussions in multinational teams can be replaced partly by using virtual project blogs and instant messaging to share and receive feedback about tasks' progress. Easy access to this kind of social media should be de facto for all members without too complicated password creation or access rights.

Communication between each function should be visible to everyone and one-to-one e-mails should be avoided. This can be assisted by replacing e-mail communication with a project blog and deciding in the team level that everyone communicates only via blog to each other. The blog tags help team members to follow the project progress. They can write down their own comments and get help for problems from others. As a result, this kind of project blog facilitates the storing of project history.

The importance of cooperation and communication with different project functions can never be promoted too much and this should be prioritized in the project plans. The design engineers' and production engineers' collaboration at the beginning of the project is important in order to avoid conflicts for example in the industrialization process later on.

Communication has a proportional relationship to TTM interval and often misunderstandings between project members create delays to development process. In projects, it is important to identify who knows about specific issues. Every organization has a formal organization chart but in reality there is also an informal organization behind this concerning how people really work with each other (Smith, 1997: 51).

Issues	Best Practices
Reducing conflicts through: • Frequent communication within team • Decentralized communication • External communication	• Synchronize conversations at least once a week among all team members (if team is small) or among liaisons if large. • Establish norms in which all members informed of progress of each member. • Identify critical knowledge resources (who knows who) that team members have access to. Establish a communication plan identifying contingencies in which these resources will be approached.
Creating common understanding about: • Goals and objectives • Task requirements and interdependencies • Roles and responsibilities • Communication and information flow • Progress and availability of members • Expertise of each member • How meetings will be run	• Explicitly communicate each other's areas of shared understanding. • Educate members about the pitfalls of failing to share the situational information and making assumptions about remote partners, instead of seeking information. • Ensure that all members have the same access to information (no e-mail /teleconference one-to-one communication). • Analyze breakdowns as a team. • Use explanations without local jargon. • Explicitly communicate individuals' and over all teams' progress. • At onset establish norms about meeting agendas, minutes, attendance, technology to be used, scheduling, and preparation.
Building trust between team members	• Establish norms for constructively commenting on other members' inputs • Ensure proactive information exchange and encourage participation of all team members • Ensure explicit verbalization of commitment, excitement and optimism • Encourage active listening for ideas of all members

Table 1. Best practices for communication in a de-centralized team (Malhotra and Majchrzak, 2004: 80).

3.3 Lessons Learned Utilization

The competitive advantage in knowledge work is mainly based on employees' skills and knowledge. The core competence of the firm is the specific set of skills or processes that differentiates the company from the competitors and makes imitating more complex (Osterloff, 2003). Maintaining the existing knowledge and increasing the whole company's intangible assets such as know how is one way of keeping the company in the edge of competitiveness. Sharing the best practices and promoting free communication in a company facilitates the learning process further on because every project increases employees' tacit knowledge. Utilizing this knowledge in coming projects has a positive impact on TTM interval.

Individual knowledge can be divided into two categories as described with more detail in table 2. *Explicit knowledge* (i.e. information) is easy to identify, explain and capture. In general, access to this kind of information is simple for instance via common databases that are open for employees in a company. *Tacit knowledge* refers to employees' problem solving capability and to how people carry out the tasks. This knowledge is difficult to capture or share and it is strongly linked to learning process during the projects (Goffin, et.al, 2010). The companies use databases for lessons learned and best practice leveraging but the problem is how the learning process can be recorded reliably for future use. The output of the thinking process is quite easy to capture but how the team ends up to a judgment may be more complex to extrapolate. Even when databases are used, plenty of learning process information is lost because the recorded information in database is too shallow or it does not reflect the problem solving process itself.

To exploit the lessons learned effectively, companies should try to convert tacit knowledge into explicit information. (Goffin, et.al, 2010: 41). The companies should promote project-to-project learning and distribute the tacit knowledge as widely as possible. Every time a key person leaves the company, their knowledge and problem solving capacity is lost forever if their information is not saved or shared properly. (Goffin, et.al, 2010: 47).

	Explicit Knowledge	Tacit Knowledge
Nature	• Easily identifiable • Relatively easy to share • Intrinsically incomplete; lacks context and requires interpretation	• Within-person knowledge • Difficult to articulate • Hard to share • Can be shared only indirectly
Typical Examples	• Information • Know-that • Theoretical knowledge	• Intuition and insight • Practical intelligence, skills and practice • Know-how and heuristics • Rules of thumb • Mental models and beliefs
Mechanism for generating for sharing	• Codification • Documentation • Databases and search engines • Blogs, wikis and intranets	• Practice • Personal and team reflection • Drawing mental maps • Apprenticeships • Social interaction and mentoring • Story telling and metaphors • New codification systems can make some tacit knowledge easier to share, through converting some elements of it into explicit knowledge
Key issues in New Product Development (NPD)	• Manage the creation, storage, and retrieval of explicit knowledge • Motivate R&D personnel to produce thorough documentation • Capture explicit knowledge generated in lessons learned reviews	• Recognize people as source of tacit knowledge • Create space for networks, informal interactions and trust • Stimulate knowledge flow between teams • Use tacit knowledge for competitive advantage • Encourage knowledge sharing so that knowledge is not lost • Facilitate lessons learned reviews to support the generation of tacit knowledge • Integrate lessons learned reviews with other mechanisms

Table 2. Differences between explicit and tacit knowledge. (Goffin et.al, 2010: 41).

The databases are not the best way to exploit lessons learned experiences and thus they should be *socialized* and promoted via word of mouth. Nominating one person at the beginning of the project to act as a "knowledge broker" to record and sense the best possible practices helps the organization to prevent the same mistakes in the next projects (Goffin, et.al, 2010: 40). Experiences that are spread verbally often include more information and enable the project team to ask questions about previous project problems. Secondly, in this kind of meetings everyone gets the same information and it is distributed equally. In addition, the management should encourage employees to document their work well because over the time, information that is saved in databases will remain.

The lessons learned and best practices utilization is mandatory for a company that wants to improve its TTM performances. Sharing the positive and negative experiences from the past projects facilitates TTM acceleration and effectiveness to manage similar projects better in the future. Together with skilled communication, lessons learned practices are one of the key elements towards becoming a learning organization with high performing teams.

3.4 Alternative Process Models

The project management or new product development process has an effect to TTM interval. Some organizations try to build up watertight processes in order to eliminate all possible mistakes but these actions have straight implications to the project lead time. As a result, watertight process prevents the opportunity to move on more quickly (Smith, 2004: 185), because bureaucracy is increased.

In general, the processes can never remove all mistakes and some project management models are based on this approach. The design processes can be based on fast iteration cycles where product is developed in small steps together with the customer (i.e. Agile). The mistakes and new customer requirements are fixed "on the way" basis.

Nowadays it is popular to use a kind phase gate approach where the project is divided to stages and at end of each stage there is a management review (e.g gate review) where the management inspects the project before giving approval to go forward. This gives good control for the management of project progress but the speed suffers due to the reason that NPD process usually contains several different activities that are linked together. Because of the stage gate approach, some project activities may stay on hold until the stage is passed (Smith, 2004) even if there could be a chance to continue as

soon as the last task is finished. Figure 19 illustrates this within timeline. One approach to fix this particular problem is to have fewer gates during the NPD process or no gates at all because the management has always the power to stop the project at any phase (Smith, 2004).

If the project progress is informed to management in a different way than via gate reviews there may be a chance to reduce the number of gates or to remove those permanently and give full power to the project team to run as fast as they can. In reality, if organization has problems with project lead times none of the tasks are executed beforehand and gate reviews push people to keep the project on time (Figure 11). Stage gate reviews create a sense of urgency to team if the project manager is not able to do that. From that perspective, the stage gate approach fits especially to organizations that suffer from the lack of discipline and “lets do it” attitude.

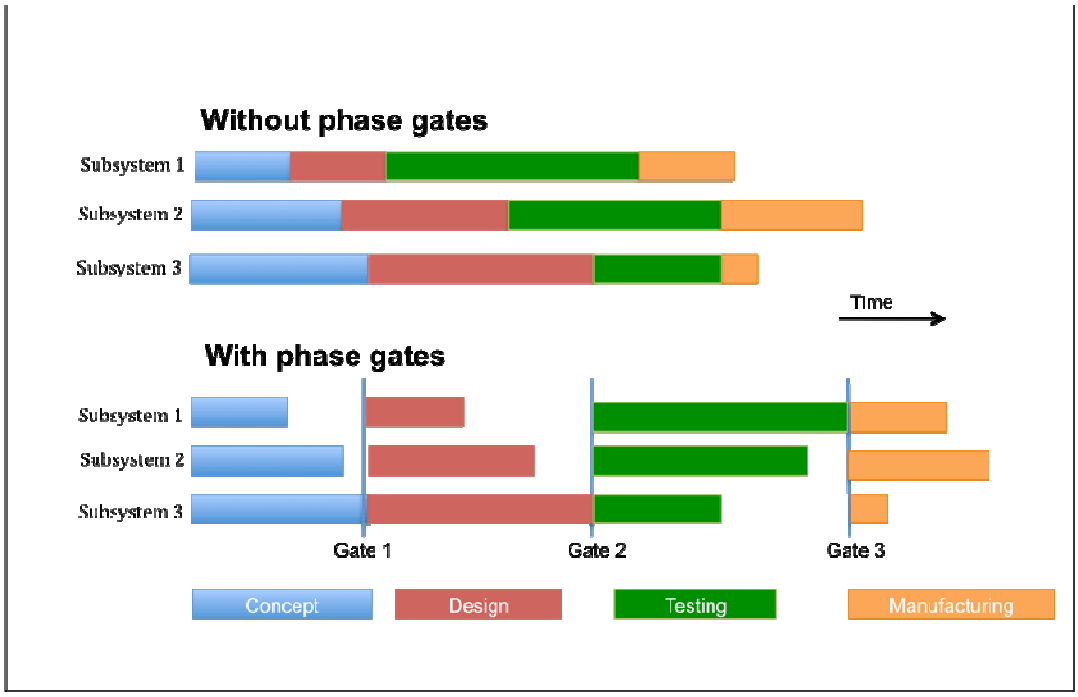

Figure 19. Project duration with phase gates and without (Smith, 2004: 178).

Finally, every project management model has its strengths and weaknesses and one “golden model” does not exist. Time-to-market can be reduced in several ways and changing the process could be one approach to achieve better TTM interval. Organizations should evaluate the different project management models and not to settle for the old one if it does not work as desired. An Agile project management model could fit if the most important matter for company is speed. If there are problems in meeting deadlines and issues with resource allocation then perhaps Critical Chain approach would be more suitable.

3.5 Critical Chain Project Management

Critical Chain Project Management (CCPM) is one approach to improve TTM interval in a company. The CCPM model was developed by Eliyahu M. Goldratt. It is based on Theory of Constraints (TOC) approach. The TOC argues that every system has a constraint that limits its output (Leach, 2004: 45) such as bottlenecks in project work. The system is as strong as its weakest link and improving other links besides the weakest does nothing to improve the strength of the whole chain (Leach, 2004: 46). Thus it is important to identify bottlenecks in a project work and secure resources for these critical activities.

The CCPM has some advantages compared to the conventional project models and delay visibility is one of the key elements in it. Many large companies such as ABB and IBM (Blomqvist 2006: 16, Blackstone et.al. 2009: 7044) use CCPM. If CCPM does not fit in the case company’s strategy it may still offer some takeaways to utilize in project work elsewhere. The CCPM has its cons like every project management model. However, it expands the perspective to the project scheduling if project lead times disturb TTM interval too much.

The CCPM is based on a list of tasks, duration estimations and their dependencies (Raz, et.al, 2001: 2). The CCPM concept defines the project schedule and task duration so that the resources and buffer times are utilized effectively and thus the actual project lead-time is reduced. Figure 20 illustrates the simplified CCPM framework.

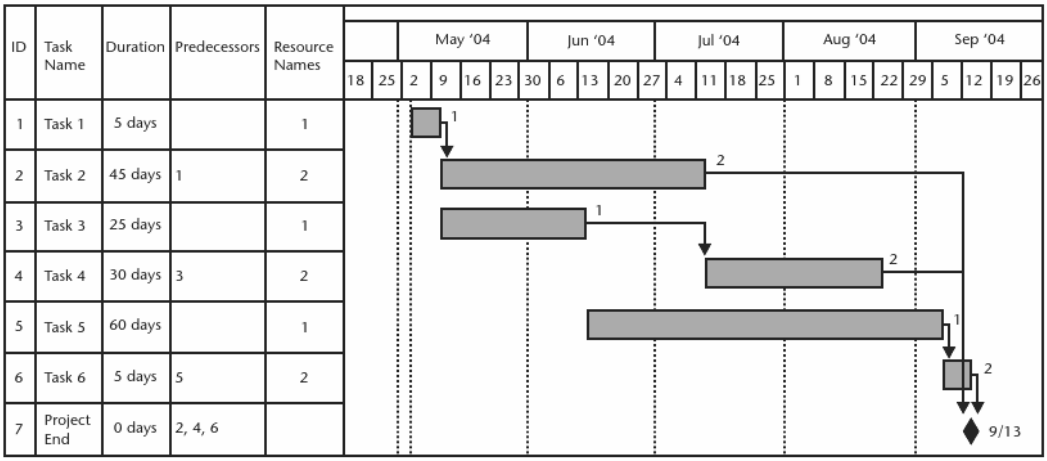

Figure 20. The critical chain is the longest path thorough the project after resource leveling (Leach and Lawrence, 2004: 65).

Each task in project work contains some level of uncertainty. The employees add safety margin to timetables in order to meet future deadlines as discovered in previous section. If all tasks include some additional safety time, the project timetable is not comparable to real task durations anymore. The Parkinson law and the Student Syndrome waste reserved time if it is not needed (Raz, et.al, 2001: 2).

In CCPM, the buffer time is emphasized from the point of view of the whole project and safety time is removed from individual project tasks. The CCPM synthesizes the estimated safety buffers from each task to the end of the project to one pool and the actual project due date is after the entire buffer. The planned time storage e.g. project buffer is not a sum of its derivatives but it is normally defined more minor because all tasks do not need additional buffer every time. Based on normal deviation some tasks take longer than planned and another will be executed before due date. With this assumption project buffer can be set smaller. (Raz, et.al, 2001: 3).

Figure 21 illustrates a conventional project schedule and CCPM schedule relationships. In CCPM, the buffers are not hidden inside the individual work tasks but instead are made explicit for the whole project team and for the project management. The knowledge workers usually estimate that one particular work task may last for example 2-4 weeks. In CCPM, the task is planned to last 2 weeks and additional 2 weeks is moved to project's total buffer (TB) at end of the project.

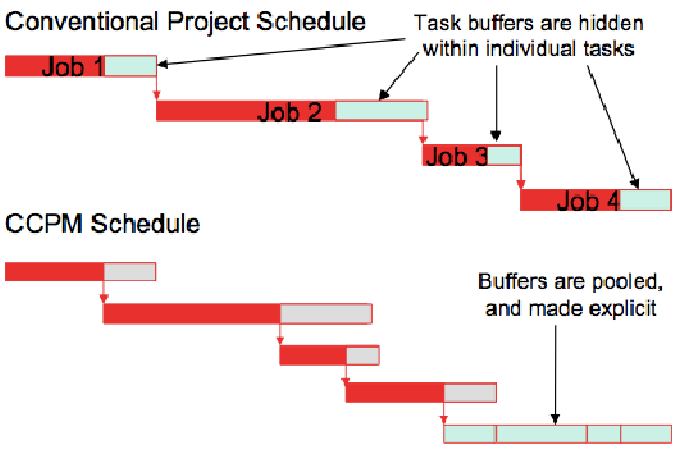

Figure 21. CCPM project scheduling (Raz, et.al. 2001: 3).

All critical tasks are scheduled the same way and in the end, the project backbone and project buffer are established. The buffer usage is monitored continuously and it works as an indicator for delays and helps the management to allocate more resources to tasks that lag behind. The project delay tracking is conducted from the used buffer perspective and not from the individual task point of view. This gives space for maneuvers and some tasks in the chain may take longer without immediate actions if the task does not consume too much of the remaining buffer.

Project work includes different tasks that can be divided into critical and non-critical activities. Both activities must be implemented before the project is finished, but non-critical tasks may have looser scheduling and they can be run simultaneously with critical chain tasks. For example ABB Marine's basic project task list contains about 1000 activities divided into different units (Blomqvist, 2006). The project managers should investigate which actions have the most important task dependencies in order to get things done from the project point of view. After that one needs to compile project activities and define the ones that have no critical task demands. Non-critical chains have feeding buffers (FB) that are linked to critical chain and these non-critical chains are task sequences inside the project plan.

All in all, the project schedule consists of one critical chain (backbone of the project) and many non-critical chains. The entire planning should start from the activity that has the highest risk to fail or its resources are most likely to be unavailable. Figure 22 illustrates a simplified picture about critical and non-critical chains.

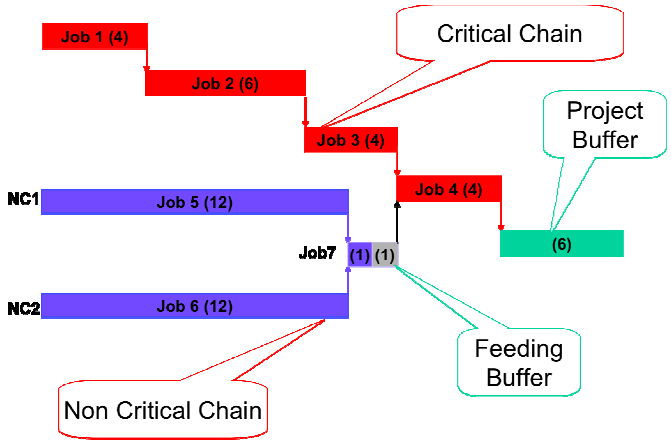

Figure 22. Feeding buffer in non-critical chain (Raz, et.al. 2001: 4).

In addition, CCPM also needs resource buffers (RB) in order to make sure that all the needed resources are available when the task is ready to start. If some task will finish earlier as planned, some kind of warning system to the next task executor should be established in order to be able to start the next task immediately. This prevents delay in the chain.

The CCPM has some constraints that need to be secured for it to work effectively. First, the employees in a critical task should manage only that task from the beginning to the end. They should not have any parallel tasks at the same time. This removes problems connected with multitasking and setup time needs discussed in section two. Second, a task should be finished as soon as possible despite its duration estimation. Third, as soon as a task is completed it should be handed over to next phase without any delays. (Raz, et.al. 2001: 5).

As a conclusion, if the organization suffers from poor project planning and process control, projects are mainly similar using matrix types of organization and organization's main concern is to meet deadlines, the CCPM could bring some advantages (Raz, et.al. 2001: 16). However, CCPM requires that all the project tasks are known before it can be established properly. In addition, it will also require some kind of software tool in order to control tasks and resource activities that may need some additional investments and training.

4. METHOD AND MATERIAL

This Thesis is based on qualitative research method. In addition, some elements of quantitative methodology were partly used for evaluating data from past projects. In this Thesis, the quantitative part has a minor role and it is intended to support the findings from the project manager (PM) data and the expert workshop session. The data for this Thesis has been gathered by using a questionnaire, expert workshop session and data analysis. Findings from the literature are based on books, academic journals and Internet materials and are intended to give a more holistic view of TTM interval mechanisms.

4.1 Quantitative Analyses Method for Project Performances

Data analysis from the past projects was based on the case company's internal databases and included all ongoing or finalized projects from 2009–2010. The Author has had access to all internal material in databases and this information has been utilized to provide a holistic view of the delayed projects. The time to market performances are scrutinized from the NPD project point of view, while small improvement projects are only listed because the available data covering project delays or durations was incomplete.

4.2 Elements of Qualitative Analyses Method for Project Performances

The second part of the data collection consists of the questionnaire that was sent to all project managers in the case department. These project managers were located in Finland, Germany, Czech Republic and France. The aim of the enquiry was to collect feedback from the project managers (PM) on various organizational and project managerial issues that reflect to TTM delays. In total, 11 questionnaires were sent out and 11 were received back on time. The response rate was 100 % and therefore the data reflects well to the current situation with the projects.

The last data collection method summarizes the project managers' and employees' opinions from the expert workshop session that was held in Czech Republic in February 2011. The discussion topics in this session were based on general issues that are explained thoroughly in Chapter 5. The total of 23 people participated in the expert workshop session. The groups were mixed in order to conduct the best possible overview of the issues in the case department. Due to limited time (1 hour), the session included only two main questions that are explained later on in section 5.3.

4.3. Reliability and Validity Considerations

Figure 1 illustrated how the foundation of this Thesis is build. The data collection methods such as PM-data, expert workshop and data mining were recorded and all the data from different sources was collected and held in possession of the Thesis Author. The data collection methods were planned attentively beforehand and the goals were defined before any actions were launched. The company name and all the project details are removed for confidential reasons and the PM-data from the project managers was treated anonymously during the research process. This gave an opportunity for the project managers to freely express their feelings about the current situation without any tracking possibility to individual level later on. Due to high workload of the project managers during the research process open questions in the PM-data section may be biased a bit.

The Thesis Author has worked in the case company for several years and that has given the Author some level of pre-understanding about the current problems concerning time to market issues. As a consequence, a purely objective study was impossible to conduct and this may lead to somewhat biased outlook of the issues. The Author has kept a distance to the research problems and has not steered for example the project managers to any certain conclusions. The position of the Author in the case company has allowed access to internal data relatively easily and the management has supported the Author's research work collectively. Personal observations made during the last two years reinforced time to market delay findings from the project managers.

5. CURRENT STATE ANALYSIS

This section discusses the current state analysis (CSA). In order to give a holistic view of the issues, CSA scrutinizes the project performances from years 2009–2010 as well as the project managers' outlook on the organizational and the project managerial issues dated December 2010. This section is divided into three sub-categories. First, the project statistics were analyzed to find out the TTM delay durations and the number of projects carried out during these years. Second, the project managers' opinions are analyzed. For this purpose, all the case department project managers (11 people) filled the questionnaire anonymously to express their opinions about the current situation inside the department. Third, the expert workshop session was held. In the workshop the project managers and the department employees discussed freely the project problems and considered possible improvements for the future. Finally, all observations were summarized in the end of this section.

5.1 Insight to Case Department Project Performances 2009 – 2010

The case company uses a stage gate project model for NPD management. This project management model includes seven phase gates from Open- to Close-gate as illustrated in Figure 23. A time period between Open and Do can be seen as a "front end development" phase in projects. If the project passes the Do-gate it is normally implemented to production. The launch of the new offer is carried out in Sell-gate and it is the actual date when the products are usually ready for sales.

In general, all the projects were divided into two different categories depending on size, expenses and complexity in the case department. The first project category included the new NPD and major adaptation projects. The second project category contained small improvement or the productivity actions to existing offers.

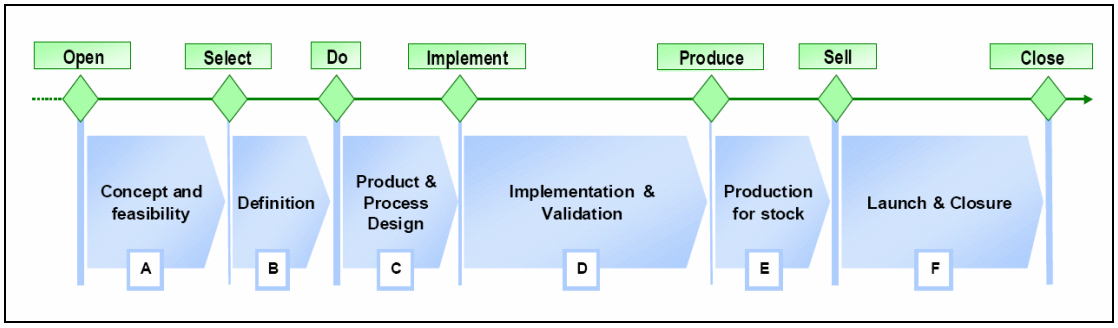

Figure 23. Case organization NPD project model.

The main project performance database included data from category one projects (NPD) and category two projects were saved in a different database. These two databases were not linked to each other.

Number of Active Projects

The case department had around 70 active projects per year during 2009 and 2010 and some of these projects still continue in 2011. Figure 24 illustrates the deviation between category one and category two projects combined from different databases. The case department had 27 NPD projects and 44 improvement projects in 2009. In 2010, the organization worked with 25 NPD projects (some continued from 2009) and with 41 smaller projects.

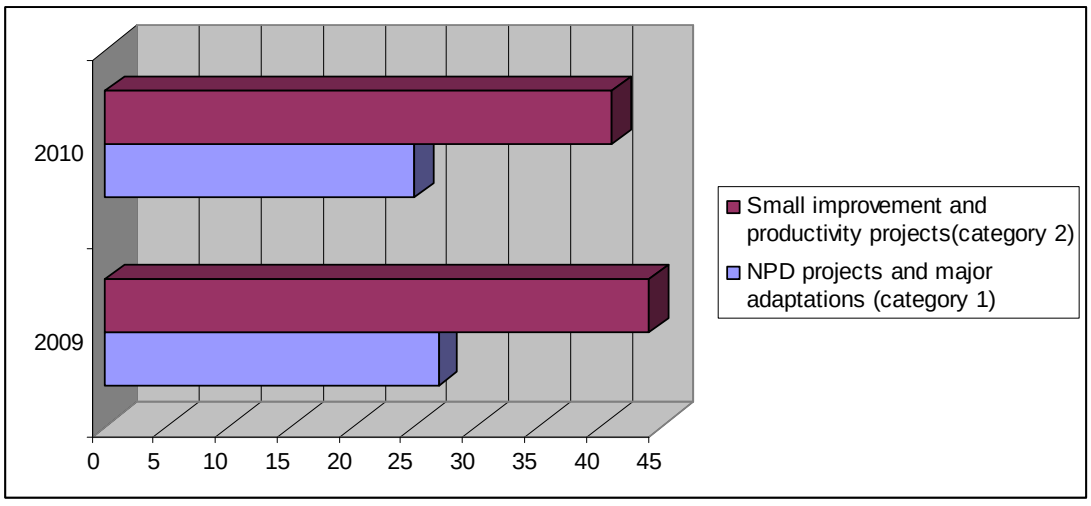

Figure 24. Number of projects in 2009 and 2010 in the case department.

All together, the deviation between the NPD projects and small improvement projects was about 40/60. This means that 60 % of the case department projects were small improvement projects or quality actions and 40 % of the projects concerned new product development. Finally, the number of projects between 2009 and 2010 remained almost the same. Slight decrease in the number of projects in 2010 can be seen from Figure 24.

Project Durations

The average project duration from Open-gate to Sell-gate in the NPD-projects was about 26 months. As a consequence, the organization in general needs more than two years starting from the Open-gate to introduce new products to the market.

The time period from Open-gate to Do-gate in the projects was around 8 months on average. This time is usually defined as a front end development time in projects. From Do-gate to Sell-gate the average project duration was 18 months.

The project duration between Do and Sell gates was longer because this period contains the major effort concerning the project execution. In addition, it also includes more gates. The final design of the product(s) and the industrialization is implemented between Do and Sell and therefore it requires more time than concept design and definition phase. Figure 25 illustrates time to market deviation from 20 NPD projects that were listed in the database and had information available.

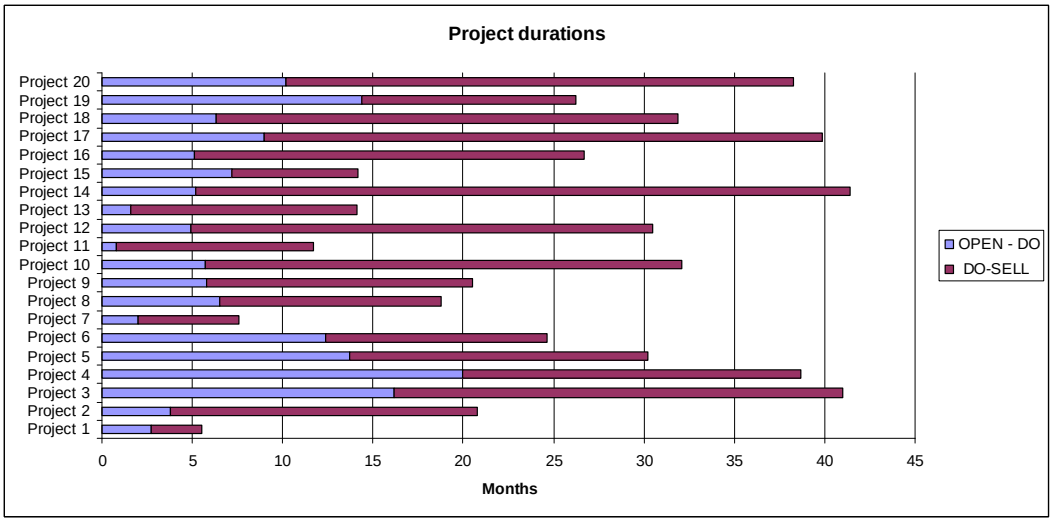

Figure 25. Project durations from Open-gate to Sell-gate.

As a conclusion, the case organization had new NPD projects of different magnitude as illustrated in Figure 25. Some scrutinized projects lasted more than 40 months. In the case department, the new product development project can include only one new product or it can include ten new products with several hundred new commercial references. This explains the great deviation between project durations.

TTM Delays

The TTM delay information in both databases was in most cases incomplete or it did not exist. As a result, TTM analysis is made only of the projects where the TTM data was available. From TTM metrics point of view, the due date for Sell-gate is set in Do-gate and the possible TTM delays compare to the date which was agreed in Do-gate. As a result, TTM delays cannot be evaluated from the point that was the initial plan of the product launch in Open-gate. This information is not usually recorded in the project performance database.

The TTM delays in the database were recorded only of nine projects so they do not represent all project performances. On average, the TTM delay has been 3,6 months also including projects which had future Sell-gate slippage already identified. The more complex the project was (e.g. number of new references) the more it was late. The greatest delay occurred in a project that lasted about 40 months and the TTM delay was more than 10 months. As a consequence, it can be stated that TTM delay problem was linked to large

mega projects. The general, smaller projects were executed on time or even before due date.

The company management insists that future projects are executed on time and 3-10 months delays will not be acceptable in the future projects. The most important from the company's point of view is data that compares delays to the initial time schedule from the Open-gate. This would measure best the department's capability to perform on time. At the moment, the TTM metrics concentrate to the due date agreed in the Do-gate although the original timetable from the Open-gate has been adjusted several times before the Do-gate.

As a consequence, this gives a bit distorted impression about the actual TTM performance. On the other hand, it also gives space to plan the remaining project timetable more precisely. The remaining workload is usually better identified at a later phase of the project. In the case department, the time from Open- to Do-gate can be described as front end development and after Do-gate the project is really up and running and well structured. It is not certain why all the projects are not under TTM delay tracking system although infrastructure for data collection exists and is available for every project. Two different databases also hide the total effort given to projects. The slight improvement projects constituted around 60 % of the total number of projects and yet these projects are not clearly visible in the main project tracking system.

5.2 Project Manager Data

This section analyses the questionnaire answers given by the project managers. In order to provide a clear view of the answers, the questions and answers are illustrated with figures. This section provides a qualitative perspective for the possible challenges in project work today. The aim of the questionnaire in Appendix 1 was to explore the current situation from various aspects from the project managers' perspective and to compare the results considering of the specific issues as they saw it.

The questionnaire had two answering fields; present situation and importance. The present situation reflected the challenges today inside the organization and in project work. The importance field reflected a "targeted situation" for these issues. The scale for answers was a five-point scale where number one in present situation means "strongly disagree" and in the importance section number one stands for "unnecessary". Number five

stands for “strongly agree” in present situation and “absolutely necessary” in the importance field.

In the figures, the project managers’ answers are combined and the results reflect the average value of the answers. Answers to some questions had great deviation between the importance and present situation and this has been mentioned separately in the analysis. That may reflect that there is something to improve from the project manager’s opinion. Table 3 illustrates the links between key questions and TTM delay symptoms from the current literature.

The questionnaire for project managers included also five open questions. These questions aimed to explore the challenges in the organization and to give an overview about other topics related to organizational issues. All answers and questions can be found in Appendix 1.

The answering rate for the enquiry was 100 % and all (11) answers were received on time. Some of the findings especially in the open questions may be biased due to managers’ high workload during the time when the questionnaire was filled. However, a holistic view about current issues can be conducted. The improvement actions and recommendations for the future use are analyzed thoroughly in Section 6.

Implications for TTM interval	Key Questions
Lessons Learned	9. In our department, we deal with mistakes positively and see them as opportunities for learning. 13. Employees are encouraged to provide ideas and suggestions for improvement. 21. We recognize best practices and distribute them in our department. 22.We spend time for reflecting our work. 23. We spend time for evaluating our success and failures. 32. We have a clear feedback system, which tells us how the targets have been achieved.
Student Syndrome	54. Project members manage tasks fast and deliver output to next person before due date.
Multitasking	50. Project employees remain the same during the whole project. 53. My project resources have not parallel tasks during the project.
Customer voice/inputs	18. I know our internal and /or external clients and I understand the needs/demands of the clients. 19. We regularly discuss feedback and ideas from clients.
Decision making process	34. In my opinion our company/department/unit is a "*let's get to it*" organization. Actions are taken immediately, plans are just not left on the table. 44. Our organization structure is clear and efficient. 46. Decisions are made quickly.
Communication and information	7. We openly discuss problems and other issues. 12. I participate in multi-functional and cross-departmental teams. 14. I can anytime ask for help from my peers and colleagues in the company. 15.I can freely network and collaborate with people from other departments in the company. 30. We use mentoring, coaching and/or tutoring for sharing knowledge. 33. I have a good enough access to information relevant to my work. 40. Project dead lines are clearly defined and distributed to project team.

Table 3. Links between questions and literature findings

The questionnaire consist altogether of 54 questions and the remaining questions that are not listed in Table 3 were related to learning organization. The aim of the questions was to analyze the issues linked to learning and organizational topics which also reflect TTM interval indirectly. All the answers and questions are illustrated in figures.

Objectives Related to Work

Based on the results, it seems that project managers have good understanding about the company targets and values and the top management messages have reached this organizational level comprehensively. In general, project managers do not discover any major problems with different opinions in the organization, and issues and problems are discussed freely.

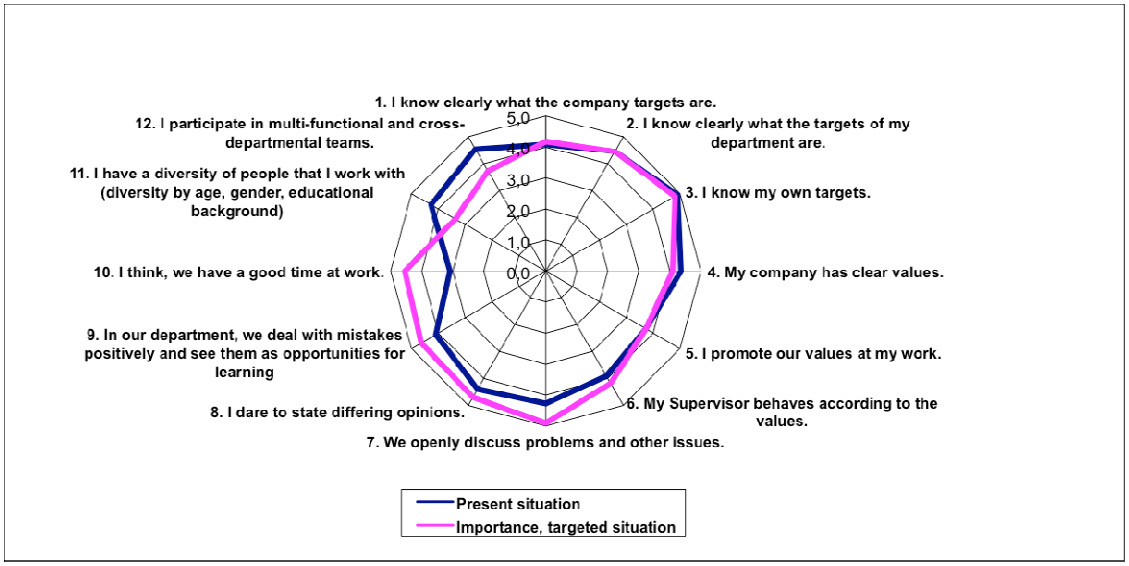

Figure 26. Objectives related to work (n=11).

The project managers (PMs) work in a diverse work environment as seen from “present situation” (Questions 11 and 12). However, the conclusion from the “importance” answers somewhat reflects that this kind of environment is not desired or it does not provide the needed benefits from the project managers’ point of view. Question 11 had significant variation. The “Importance” answers from two to five may imply that some of the project managers emphasize diversity in the organization (6 answers with scale 4-5) and the rest of the project managers argue that diversity is not so important (5 answers with scale 2-3). Because the organization operates in four different countries and the project managers anonymously completed all the answers, the reason for this deviation is complicated to examine.

In the case organization, most of the project managers have engineering background and they work mainly with technical projects. According to question number 11 the project managers did not see any special benefit for example in different educational background.

In the objectives related to work in Figure 26 the most notable deviation between present situation and importance was seen in question 10, *"I think we have a good time at work".* Majority of the project managers pointed out that this was important to them (average 4,5) but the present situation seems to be quite poor in the organization at the moment (average 3,1).

Finally, collaboration with different teams and the collective problem solving capability is important for every organization and these seem to work well in the case department based on questions 14-17. In general, the project managers get help from their peers and colleagues when needed and creativity and problem solving are promoted in the organization.

Peer Collaboration Questions

Promoting feedback after the project same as evaluating success and failures were ranked to work poorly in present situation. A reason for this may be that lessons learned are not utilized well in the case department or this kind of activity is not promoted at all. Sharing best practices (Question 21) had a bit smaller deviation, but it refers to the same phenomenon that the organization does not use enough time for analyzing positive and negative experiences from projects.

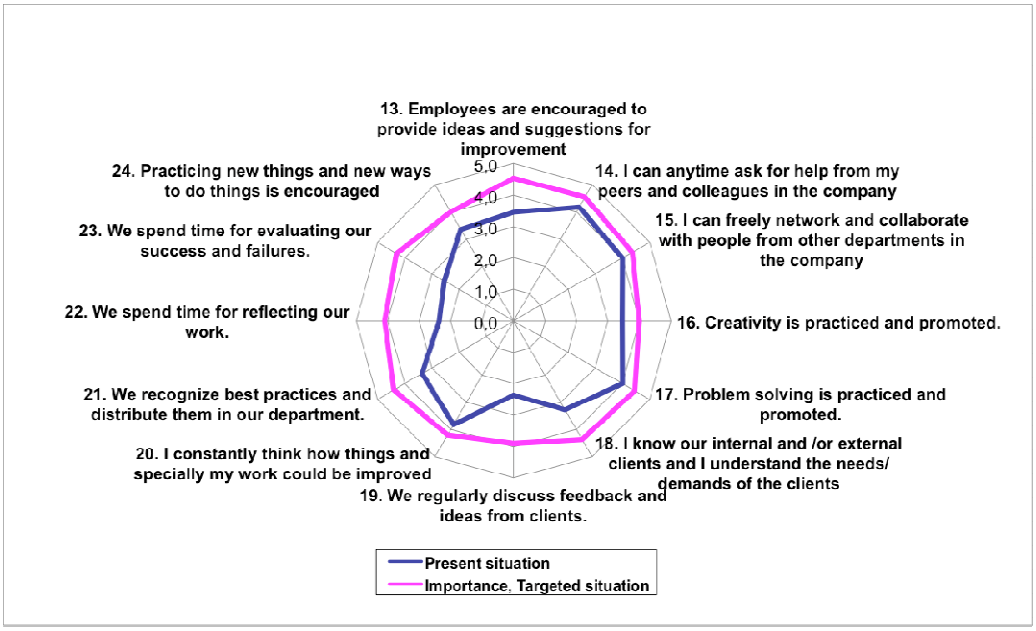

Figure 27. Peer collaboration questions (n=11).

The customer voice is important for all companies in order for them to be able to execute the right projects and avoid false starts. Based on Browns efficiency/effective matrix in Figure 13 the most important matter for the company is to have the right goals even if they may not be reached in efficient way.

Finally, the project managers argued that they did not discuss regularly with customers and did not get feedback from them, even if that could be important and bring additional value to projects from their perspective (Question 19).

Support to Personal Development and Learning

In general, the organization has a learning culture and the company also promotes it. The project managers have access to relevant information and data to facilitate their work and a personal development plan exists. The leader of the project management (Project Manager Officer) seems to actively control the company's processes and boost the processes usage to PM's. The project managers argued that they cannot take part to job rotation but in the end they did not prioritize it very high either (Question 28 in Figure 28).

The case organization lacks “let’s get to it” attitude although its importance was ranked quite high by the project managers. The reasons for this might be for example in bureaucracy or poor decision making process that deteriorate this kind of atmosphere in the organization.

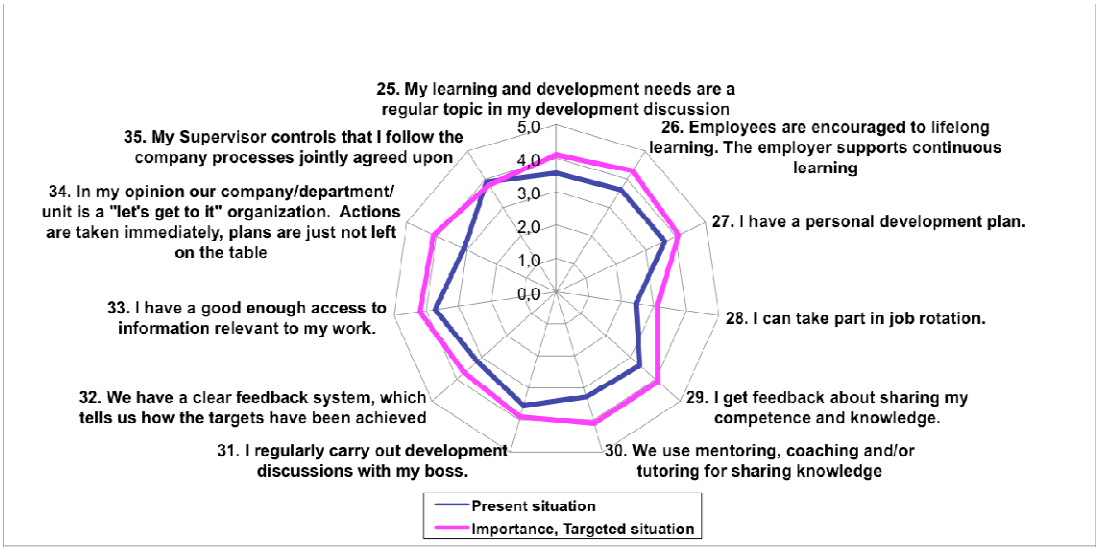

Figure 28. Support to personal development and learning (n=11).

Project Managerial Questions

The second highest differences regarding the importance and present situation in the questionnaire appear in the question *“I have enough time to relax between projects”.* Only a few project managers ranked the present situation to number four and the rest of the managers ranked this to three or lower.

The present situation got 2.3 points on average and its importance was ranked up to 4,2. These answers can be interpreted so that time to recover from previous projects is important in order to minimize the stress or conflicts due to heavy work load. Otherwise these may lead to brain leakage due to the reason that unhappy project managers seek new challenges outside the company. Answers to Question 10 (“*I think we have a good time at work”)* reflect that the work atmosphere in the case department could be better.

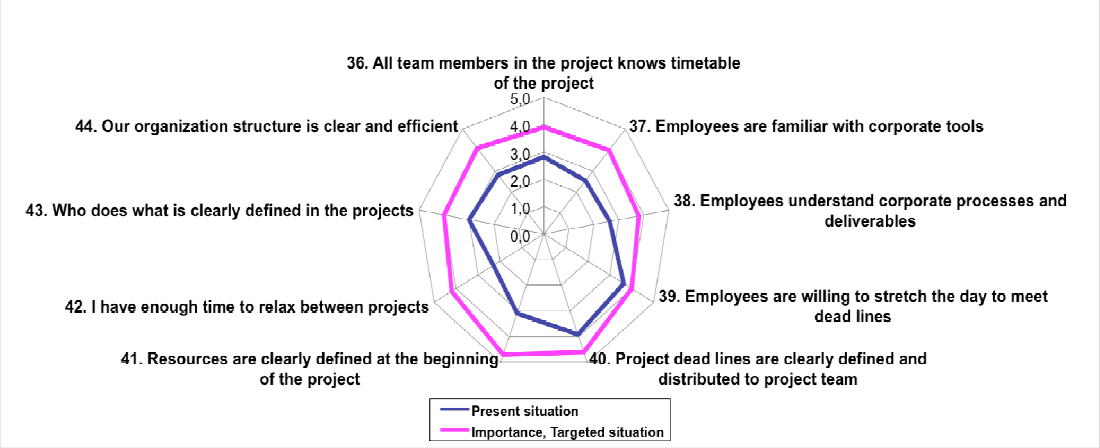

Figure 29. Project managerial questions (n=11).

The project managers considered a problem that the team members were not familiar with corporate tools and processes (Questions 37 and 38). The current resource allocation methods or resource availability for the projects was ranked quite low but its importance was high according to the answers. The employees were committed to project work and they increased working hours if needed to meet due dates (Question 39). Some questions also indicated that there may be some communication problems (Questions 36, 43, and 44)

Project Work and Decision Making Process

First, according to Questions 53 and 54 the case department projects suffered from some level of student syndrome and poor multitasking. The employees had parallel tasks during projects and the tasks were not managed quickly before due dates. Second, the project managers pointed out that the volume of work and the number of employees were not in balance (Question 49). These answers got the highest variation between present situation and importance scales in the questionnaire.

All in all, the project managers recognize the employees' knowledge level and skills although the teams are geographically distributed in four different countries (Question 51). The multinational teams were considered a neutral asset for the case department (Answers 48) without too much benefit.

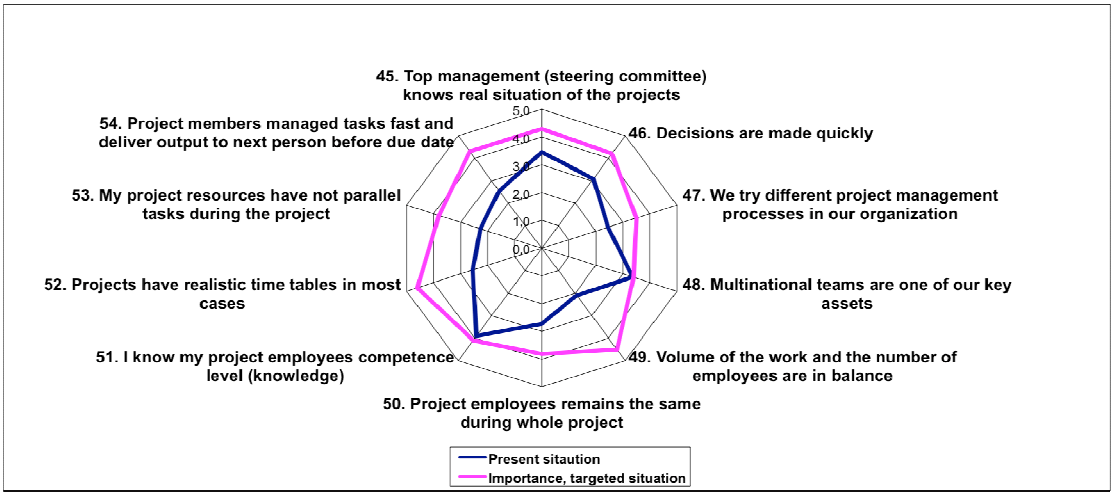

Figure 30. Project work and decision-making process (n=11).

Open Questions

The questionnaire also included five open questions. Answers for the question one *"How many projects do you run in parallel (PMP, BOC, Others)?"* pointed out that the eleven project managers managed over 39 projects concurrently (end of December 2010).

Figure 31 illustrates the deviation between the project managers. On average, one project manager deals with 3,5 projects simultaneously. However, project management tasks are not divided equally. A number of active projects are based on project managers' inputs and there is a great difference compared to data analysis in section 5.1. This appearance is scrutinized in the end of this section.

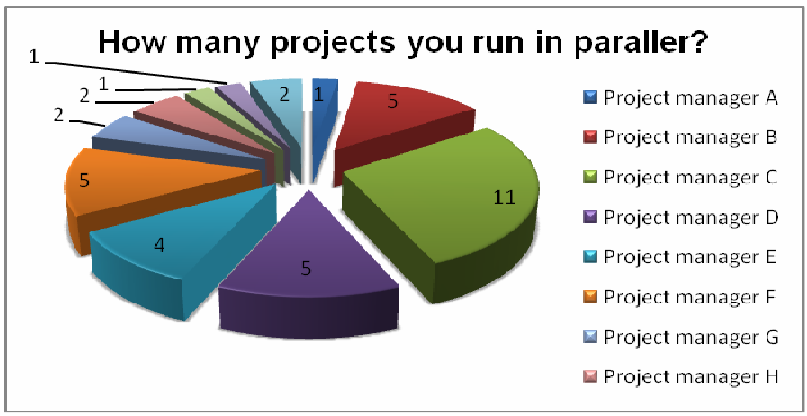

Figure 31. Number of the project per project manager.

As a result, about half of the project managers had more than four projects to govern and the other half had two or less. One project manager had as much as eleven projects concurrently. The number of projects included category one and category two projects and those were not differentiated in the questionnaire.

The majority of the project managers argued that *"Higher quality product needs longer R&D time".* Seven project managers notified that longer R&D time secures the product quality in the end. Three project managers argued that this was not the case and one answer was left empty (Figure 32).

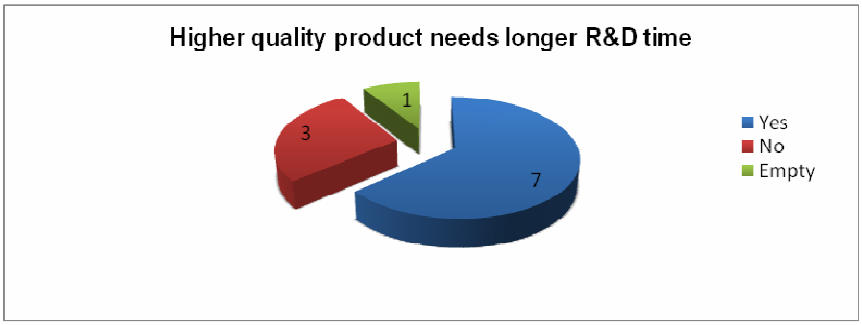

Figure 32. Higher quality product needs longer R&D time?

"In house development has better quality than outside made?" got similar deviation as the previous question. Seven project managers argued that in-house development has better quality than when exploiting external suppliers and companies. Two project managers were against the argument and two answers were left empty. Figure 33 demonstrates this deviation.

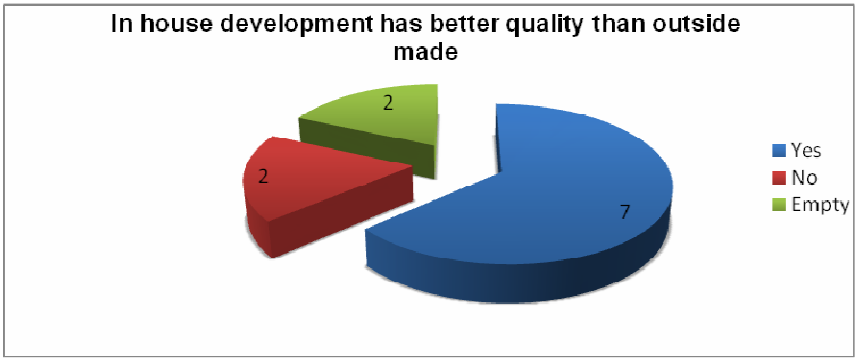

Figure 33. In house development has better quality than outside made?

Question four *"In our organization the biggest bottleneck at the moment is"* received quite similar comments from all the project managers. Majority of the project managers argued that in general the lack of resources in several project activities creates bottlenecks in the case organization. Such are for instance industrialization, ERP system team, documentation and testing. The project managers also saw problems with high workloads and the continuous changes in sites and project resources.

A few project managers commented also that company processes are not familiar to project members and the same problem was also discovered in Questions 37 and 38. All answers for open question answers can be found in Appendix 1. Below are some comments from the list concerning the most common problems:

Availability of resources when needed

High work pressure. Employees working over the limits

Unclear processes in the different departments (in house)

Last point in open question section inquired the project managers' opinions about issues when working with external suppliers. Only a few project managers gave input to this question and the main concerns were associated with quality and communication. Due to few comments received, this information cannot be used to conduct any proposal for future use.

5.3 Expert Workshop Session with Employees and Project Managers

This section presents the findings from the expert workshop session that also pursued employees' view of the project challenges today. At first, question one is analyzed and key findings summarized in Table 4. After that, the second question is analyzed and key findings recorded in Table 5. Finally, in end of this section a summary is presented of all the challenges observed in the current state analysis.

The expert workshop was held in February 2011 in Czech Republic. Overall 23 employees and project managers participated in the workshop session. The main goal was to discover the organizational challenges today and to find out improvement ideas collectively for the project issues. The whole group was divided into smaller groups of around four people and one of the members in each group was chosen to act as a secretary and to write down the group findings. There were altogether five groups and each of them got about 10 minutes to discuss about each question and to compress their findings to one word. Finally, each group presented their findings to all participants and shared their opinions about the issues from group perspective. The first question was as follows:

What are the main issues in the project work today?

The majority of the groups explored two main issues which were unclear requirements and communication in projects today. First, the unclear specifications and requirements about the customer needs from the marketing side were pointed out as a one main problem by almost all the groups. This influences especially the design process later on if the concept design and definitions are not fully clear and the requirements have to be modified again during the design phase. This may lead to false starts which cause re-work later on and have an impact on time to market interval as well.

Second, all groups pointed out that communication in the case organization is an issue because of the lack of knowledge and the fact that technical language skills of employees may vary depending on the speaker. A lack of knowledge about the corporate process was also considered one problematic point and the same phenomenon was also highlighted in the project manager questionnaire. Lack of process knowledge for example in new product development complicates communication between people and may lead to misunderstandings.

The organization develops and maintains complex products that need specific know-how and skills. One group discovered that sometimes the complexity of the products is underestimated which can be seen for example in excessively tight project timetables. Related to this, one group emphasized that all the issues during the design process can not be predicted beforehand and timetables are made based on “best case scenario”. However, there is normally no space for errors or re-work.

All the key words invented by the groups were in some ways linked to communication or information sharing topics. These topics were denoted to cause problems with project execution and these problems are encountered quite often today. None of the groups pointed out that capital or the company process itself has anything to do with the project performance. Therefore, one of the possible reasons behind the problems may be the fragmented organizational structure that creates communication- and information problems for the case organization.

One reason for this may be the organization being divided into four different countries with different demographic and cultural backgrounds. Also, most of the employees have not worked in the case company for more than five years. The organization is going through a transition period where structures are simplified. As a result, some of the responsibilities are unclear to employees which was also pointed out in the workshop session by a few groups. Table 4 presents all the notes written by the groups concerning the first question.

Group 1. • Missing Specification / Requirements from Offer Management • Inefficient communication interfaces between departments • Lack of resources • Poor process knowledge • Product complexity is underestimated • Key word: **Knowledge**
Group 2. • Target changes during the process • Globalization (Common understanding) • Tough timetables • Price pressure • Specifications unclear • Offer management requirements (Un-clear or not complete) • Key word : **Change**
Group 3. • Information problems, misunderstanding • Technical knowledge • No or bad communication • Key word: **Information problems**
Group 4. • To collect all proper request • Prioritazion and fixing the requirements • Established the time frame • Key word: **Communication**
Group 5. • Definition of roles, terms and responsibilities • Unclear requirements • Interfaces, timing issues • Industrialization • Key word: **Communication**

Table 4. Answers for question one in the expert workshop session

After the results and common discussion the groups were given another ten minutes to contemplate how the problems they found could be improved in the future. The second question was as follows:

How can we improve those in the future?

The majority of the groups pointed out that actions in *front end development* should have more time and the output from that phase should be frozen when it is moved to real execution. In the case organization this stands for a time period from Open-gate to Do-gate in Figure 22. One group pointed out that specifications should not contain any TBD points (To Be Decided) when the development starts and the select gate importance should be emphasized more than today.

Almost all the groups also defined that communication and efficiency should be better than today. Even if the organization has multiple IT- tools for project communication one group emphasized that the information sharing and tracking needs a functional tool. Based on these opinions it may be that the current project management tools are not as efficient as they should be or they are too complex to utilize well.

Learning from others' mistakes is one of the key procedures in a high performing organization and this was seen as a problem both in the workshop session and the project manager questionnaire. Lesson learned facilitates and accelerates the coming projects if the knowledge is utilized well. As a result, it also increases efficiency later on and helps people to avoid re-work which causes TTM delays.

One group discovered that projects need dedicated people. Poor multitasking and similar symptoms were also mentioned in the questionnaire. In general, the project members have several parallel tasks at the same time. This disturbs the task execution because the prioritization of the projects is not always clear. As discovered in last section the organization had 66 projects simultaneously to cope with in 2010.

The project with fewer resources and shared staff may cause problems for project execution later on. Industrialization team was highlighted as a team that suffers from the lack of resources at the moment. Initiativeness and removing the silos was also emphasized by one group as the future challenges for the organization. Table 5 summarizes the notes concerning question two.

Group 1. • More time at the beginning of the project • More initiative • Effective meetings and communication • Look beyond your own responsibilities
Group 2. • Frozen specification • Improve communication • Realistic timetables and price calculations
Group 3. • Project information sharing and tracking needs good tool • Increase understanding of the topics in shorter time • Increase efficiency
Group 4. • Increase importance of select phase • Proper definition for Do-gate • No TBD (to be decided) in specifications • Increase efficiency
Group 5. • Use the same language • Simplify processes • Motivation • Execute process in reality • Learning from others mistake • Project needs dedicated people

Table 5. Improvement ideas for question two in expert workshop session

Summary

Resulting from CSA, the case organization suffers from well known symptoms described in literature and communication seems to be the biggest bottleneck in the projects. Improving communication and information sharing automatically removes some symptoms and helps the employees to learn from others' mistakes.

The case organization seems to have many parallel projects with long lead times. The number of active projects in 2010 and the number of organization's employees are not in balance. Project managers stated that they handled together overall 39 projects in 2010. However, data analysis shows that the number of active projects in 2010 was 66. Reason for this difference may be explained with some of the projects being finished by the end of 2010. Second, smaller projects (category 2 projects) do not necessary need a official

project manager for their execution and the leader can be anyone in the organization. Because the questionnaire was sent only to project managers it may be that the leaders of smaller projects were not included. This also highlights the problem that visibility of the active projects is difficult to conduct in the case department.

The feedback of project success or failures and regular discussions with the customers were also seen as problematic issues according to questionnaire and expert workshop session. The unhappiness of the project managers was clearly a problem according to questionnaire results. Therefore it is important in the future to balance their work loads. “Unhappiness” will reflect also to lower organizational levels and it may create general resistance against the company.

One observation from open questions was also that majority of the project managers stated that “in house development has better quality than outside made”. In general, this is positive feedback that project managers trust the employees and the common processes that enable the company to produce high quality products. However, there is a slight risk that some kind of protectionism may prevent from detecting opportunities and benefits in working with external suppliers. Sometimes collaboration with other companies may facilitate NPD and innovations due to their different competencies and skills.

Summarizing findings from CSA in order to establish an action plan for the future, the main issues to improve TTM interval in the case department are:

1. Resources in critical activities such as testing, industrialization and documentation
2. Information sharing and communication between employees
3. Feedback from projects’ success or failure.
4. Lack of knowledge concerning corporate processes and tools

Table 6. The main issues in CSA

6. Proposals and Conclusions

The last section of this Thesis introduces improvement ideas in order to be more efficient and improve communication between different sites and people. This section answers the research question “How to improve the time to market interval of projects”. It has been scrutinized from a perspective that fits to the case department. These recommendations may give insights in how the case department could improve its project efficiency and effectiveness and exploit the findings from project managers. The recommendations are divided into two categories that introduce improvement ideas from the general and project point of view.

6.1 General Proposals

The majority of the project managers argued that the organization has not enough resources available to execute all the projects on time and in an efficient way. This was discovered during the expert workshop session and from the project manager questionnaire. Therefore it may be advisable for the organization to secure the resources for critical activities in the projects. *Testing, documentation* and *industrialization* activities are the most disordered areas. If the organization cannot increase the numbers of employees, prioritizing the projects should have a more important role and the prioritization of projects should be visible for all the employees.

Prioritization

The majority of the case department employees are knowledge workers. It means that in the case of poor multitasking, the employees may be left to decide which project task to execute first without a manager constantly supervising them. The case department has plenty of projects simultaneously to work on. If all the projects are prioritized for instance on a 1-3 scale, it may help that the employees realize how the top management rank the projects based on the company strategy and growth expectations. As an effective measure, we can suggest that a list of all active projects with clear prioritization should be distributed to each organization level. It will lower the risk of the employees prioritizing projects by themselves without any comprehension of the company goals. In geographically remote teams that use shared resources from the other departments it is important that the goals are made explicit.

Reducing Number of Projects

Reducing the number of active projects facilitates the department to maintain shorter TTM interval and to secure the project resources more reliably. The data analysis from past projects discovered that the case department has parallel mega projects and limiting the size of the projects in the future may help the organization to gain shorter TTM interval. All in all, the planned mega projects could be divided into smaller manifolds or establish common timetable templates for all projects thus forcing the projects to stay small. Defining the absolute maximum project duration to two years or less in the case department facilitates avoiding mega projects although this also means that new product development projects have less new references or that complex projects are divided into smaller subprojects. Reducing the project lead times and maintaining the project size small enables the response to customer needs more rapidly via second or third generation product from the initial offer as discovered in the literature review.

Training

The case department employees lack knowledge about the corporate processes and tools which causes problems to the project lead time as discovered in the project manager questionnaire. Staff should be trained continuously and the possible gaps in knowledge should be discovered. Training for necessary topics should be arranged as soon as possible. The department is part of the multinational corporation and it collaborates with other departments. Therefore, is important that the department's own employees communicate with the same terms than the other corporate employees. This facilitates cooperation in the future and helps the case department to avoid conflicts about project tools and arguments about common processes. Figure 34 illustrates how knowledge should be developed inside the case department.

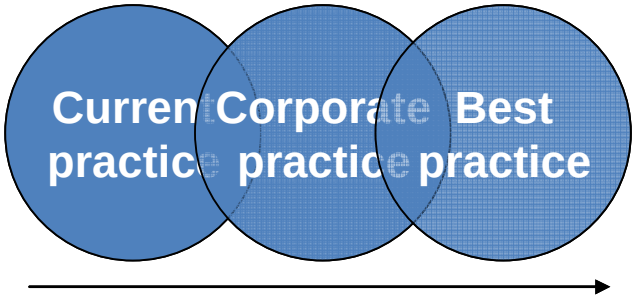

Figure 34. Towards the best practices

The case department position from practice point of view is somewhere between corporate and current practice as presented in Figure 35. The corporation has training programs for different tools and processes and the case department should take advantage of this possibility. Trainings can be managed in small entities so that they do not disturb ongoing project activities.

Training the staff keeps their motivation high. Furthermore, the managers could also provide some cross-functional training for the employees who are interested in this. This would increase the individual's knowledge of different functions in project work and diminish the information gaps between departments. One objective for the case organization is adjusting the corporate processes so that they match the case department's needs and apply the best practices in the future projects. However, this requires that the employees are first familiarized with the existing corporate processes and tools. This has to be obtained before best practices can be discovered because the department collaborates with other units and all parties should understand the basic framework to be able to develop it further on.

TTM Metrics

The existing time to market (TTM) metrics should be part of every project and not only of few pre-selected projects as discovered in this study. TTM metrics should be made apparent to all the project managers and they should be recorded more precisely. There is also a need to record the delays between stage gates because this could give the possibility for management to monitor the disorder areas in the development process. Finally, TTM metrics should be measured from the Open-gate because that reflects best how well the department is able to introduce new products to the market and how accurately the employees can estimate complex project durations.

Common Workshop

The last recommendation for the whole organization is a common workshop for all employees organized every second year. In this kind of networking session the employees could familiarize themselves with each other, discuss issues and find the best practices collectively for projects and organizational issues. The case department is geographically distributed and the possibility to face-to-face meetings is limited since the project team members meet only occasionally. Common workshop that covers the issues and informs about future strategies and challenges from management side could be seen as an opportunity to integrate the organization together and focus on the staff working towards a common goal.

6.2 Proposals for Project Work

The results from the project manager enquiry and from the workshop session discover that the current methods to utilize the lessons learned experiences are not powerful enough or their implementation is left to halfway.

Increasing the knowledge of unsatisfactory project experiences between the employees prevents repeating the same mistakes in the next projects. However, this requires good documentation and identifying the improvement points and topics that could be improved in the future projects. The case company's NPD framework includes one Close-gate document the purpose of which is to collect this information. However, it seems that the lessons learned document is not used properly or it is not distributed to all employees afterwards. As a result, it can be observed that seeking these kind of documents from the corporate databases is demanding.

Knowledge Broker

As a recommendation for the future, a project manager should nominate one employee in a project to act as a *knowledge broker* recording findings about desirable and unsatisfactory practices discovered during the project execution. In addition, the knowledge broker organizes a lessons learned meeting after the project and presents the findings for all project members. This enables collecting the whole team feedback verbally and discussing the improvement points for the next projects.

As soon as the new project team has been established, the knowledge broker from the previous project could present the findings to the new team. This enables face to face questions and the information sharing does not rely only on documents and databases. Although the findings from the lessons learned would be well documented inside a team, the knowledge broker ensures that the information is also shared with the next project group without them having to read the actual documents. This also reduces the hidden effort in project tasks as the project team members may ask for help from the knowledge broker in case of problems in future project execution.

In any case, a common database should be established for this kind of information to guarantee a relatively easy access to the data for employees. Sharing the lessons learned experiences helps the organization to learn from mistakes and it also has a positive influence to TTM interval and project lead times. The lessons learned database allows to filter the best practices from the previous projects and it can be used as a resource in developing best practices for the organization in the future.

CCPM and Timetable Template

The case department suffers from poor multitasking and student syndrome and the project timetables are often delayed a bit. As an experiment, the project managers could run one pilot project using Critical Chain Project Management (CCPM) model and establish a critical chain for the project activities in order to explore the benefits of this project model. The CCPM model may relieve some of these symptoms and it could offer some improvements that could be utilized in the current project management model of the department.

In addition to the CCPM experiment, the department needs common project timetable templates that should contain a list of actions in a project from its beginning to the end. The timetable template gives a better conception to project managers about the tasks and their dependencies thus allowing the project managers to plan projects more accurately. The common timetable template tailored for each project would decrease the need for hidden effort and re-planning during the project.

Project Blog

Social media has been used for information sharing by several companies already for years and in general it has had a positive impact on communication between employees. Although the case company has different databases and tools for information sharing it seems that a good solution for free communication does not exist at the moment.

In the workshop session, one group emphasized that projects need good project tracking and information sharing tools. One approach to develop this further on could be some kind of social media solution for projects such as a project blog. In the blog, each project could have its own workspace where the employees can write comments concerning project progress, distribute the files and follow the timetable. In the best case, this kind of database could replace all e-mail communication concerning the project and the project information would be shared via project blog only. The documentation of tacit knowledge also increases if the discussions between employees are saved for future use. The whole blog may function as project history storage. Sharing the best practices and lessons learned database could be integrated to the same site. Enabling free communication between the employees improves the department problem solving capability further on.

6.3 Cost Considerations

Accelerating TTM interval generates costs one way or another (Figure 6) as argued in previous sections. The proposed improvement actions are in general low cost actions without the need for large additional investments. Table 7 illustrates cost estimations for each recommendation and the actions are divided into green, yellow and red categories.

The green category includes recommendations that do not require special investments and can be implemented with easy measures for the case organization. The green costs mainly consist of working hours and internal coordination. The yellow activities require some capital; the needed amount depends on how much knowledge can be found internally and how much external consulting is needed. The yellow actions require some dedicated people to manage the tasks and quite likely some external competencies are also needed. The red action investment depends on the number of personnel and on which location these actions are implemented.

CSA findings (Table 6)	Recommendations	Cost estimation
1. Resources in critical activities such as testing, industrialization and documentation.	1. Hiring more personnel	
	2. Reducing the number of projects	
	3. Project prioritazion	
	4. CCPM	
2. Information sharing and communication	5. Knowledge broker	
	6. Project blogs	
	7. Timetable template	
	8. Common workshop session	
3. Feedback from project success or failures	9. Knowledge broker	
	10. Project blogs	
	11. Common workshop session once in two years	
4. Lack of knowledge concerning corporate processes and tools	12. Training	

Table 7. CSA findings, recommendations and cost estimation for activities

In addition, some of these actions may also have an indirect impact on costs although the direct costs are minimal. For example reducing the number of active projects has no costs in general but the costs may be seen later on in lower product profitability or quality problems. Reducing the number of small improvement projects for example may affect the product return rates or bring unsatisfied customers. Due to this, a more detailed analysis of the indirect costs is needed when the recommendations are implemented.

6.4 Summary

During this research it has become obvious that the case department has many areas of improvement within TTM management. The project time to market interval has an important role in keeping the company in the edge of competitiveness. However, the issue in question is not easy to improve due to the several different variables. All the project members, managers and external partners should have a clear vision about the project goals and possible disorder areas should be communicated immediately to higher organizational level. Securing the resources for critical activities during the project facilitates the project to stay on time. Reducing the number of active projects assists the organization to cope with high work load.

In general, all mentioned recommendations improve TTM interval and project lead times in the long run. A short term action plan for the case department would be to emphasize *lessons learned* sharing and *common timetable* creation. These two slight improvements have an immediate effect and implementing them does not require much effort or investments. During the work shop session employees also expressed their interest in this kind of common forums for problem solving. It was considered important and promoting similar activities in the future helps the management to deliver their message to lower organizational levels and gain feedback from employees.

This Thesis also suggests several opportunities for future research topics. First, Critical Chain Project Management model should be investigated more deeply. It may be worth analyzing for its suitability for the case department projects. Second, the project blog and social media usage in project work should be analyzed. Benchmarking the competitors' corresponding solutions for these may assist in building up the department's own solution. All of these topics require a large collection of data, hence the employees' inputs should be taken into consideration. This may help to provide the company with new insights into different problems and solutions.

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Questionnaire for Project Managers — Dec 2010
Case Company

The next questionnaire has statements concerning various aspects.
Answer the following questions by "marking" the number which best reflects your insight/feelings.
First evaluate how much you agree with each of the following statements at the moment in your department/unit.
Next estimate how well you think the claims correspond to the importance of your operation targets.

Scale (present situation)
1 = Strongly disagree
2 = Disagree
3 = neither agree or disagree
4 = Agree
5 = Strongly agree

Scale (importance)
1 = Unnecessary
2 = Not important, but pleasant, if this is the case
3 = Useful and desirable
4 = Necessary
5 = Absolutely necessary

	Questions	Present situation	Importance
1	I know clearly what the company targets are.		
2	I know clearly what the targets of my department are.		
3	I know my own targets.		
4	My company has clear values.		
5	I promote our values at my work.		
6	My Supervisor behaves according to the values.		
7	We openly discuss problems and other issues.		
8	I dare to state differing opinions.		
9	In our department, we deal with mistakes positively and see them as opportunities for learning		
10	I think, we have a good time at work.		
11	I have a diversity of people that I work with (diversity by age, gender, educational background)		
12	I participate in multi-functional and cross-departmental teams.		
13	Employees are encouraged to provide ideas and suggestions for improvement		
14	I can anytime ask for help from my peers and colleagues in the company		
15	I can freely network and collaborate with people from other departments in the company		
16	Creativity is practiced and promoted.		
17	Problem solving is practiced and promoted.		
18	I know our internal and /or external clients and I understand the needs/demands of the clients		
19	We regularly discuss feedback and ideas from clients.		
20	I constantly think how things and specially my work could be improved		
21	We recognize best practices and distribute them in our department.		
22	We spend time for reflecting our work.		
23	We spend time for evaluating our success and failures.		
24	Practicing new things and new ways to do things is encouraged		
25	My learning and development needs are a regular topic in my development discussion		
26	Employees are encouraged to lifelong learning. The employer supports continuous learning		
27	I have a personal development plan.		
28	I can take part in job rotation.		
29	I get feedback about sharing my competence and knowledge.		
30	We use mentoring, coaching and/or tutoring for sharing knowledge		
31	I regularly carry out development discussions with my boss.		
32	We have a clear feedback system, which tells us how the targets have been achieved		
33	I have a good enough access to information relevant to my work.		
34	In my opinion our company/department/unit is a "*let's get to it*" organization. Actions are taken immediately, plans are just not left on the table		
35	My Supervisor controls that I follow the company processes jointly agreed upon		
36	All team members in the project knows timetable of the project		
37	Employees are familiar with corporate tools (like Symphony)		
38	Employees understand corporate processes and deliverables		
39	Employees are willing to stretch the day to meet dead lines		
40	Project dead lines are clearly defined and distributed to project team		
41	Resources are clearly defined at the beginning of the project		
42	I have enough time to relax between projects		
43	Who does what is clearly defined in the projects		
44	Our organization structure is clear and efficient		
45	Top management (steering committee) knows real situation of the projects		
46	Decisions are made quickly		
47	We try different project management processes in our organization		
48	Multinational teams are one of our key assets		
49	Volume of the work and the number of employees are in balance		
50	Project employees remains the same during whole project		
51	I know my project employees competence level (knowledge)		
52	Projects have realistic time tables in most cases		
53	My project resources have not parallel tasks during the project		
54	Project members managed tasks fast and deliver output to next person before due date		

Open questions:

How many projects you manage parallel (PMP, BOC, Others)?

Higher quality product needs longer R&D time

In house development has better quality than outside made

In our organization the biggest bottleneck at the moment is:

		Present Situation												Importance										
	Questions	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	Average	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	Average
1	1. I know clearly what the company targets are.	3	5	4	4	5	4	4	3	4	5	4	4,1	4	4	5	4	4	4	5	4	3	4	5	4,2
2	2. I know clearly what the targets of my department are.	4	5	4	4	5	3	5	4	5	5	5	4,5	5	5	4	4	5	3	5	4	5	4	5	4,5
3	3. I know my own targets.	5	5	5	5	5	4	5	5	5	5	5	4,9	5	5	5	5	5	4	5	5	5	4	5	4,8
4	4. My company has clear values.	5	5	3	5	5	3	4	4	4	5	5	4,4	4	5	4	5	5	4	4	4	3	3	4	4,1
5	5. I promote our values at my work.	4	4	3	4	5	3	3	4	3	4	4	3,7	4	4	4	4	5	3	3	4	3	4	3	3,7
6	6. My Supervisor behaves according to the values.	4	4	3	4	5	3	4	4	4	4	4	3,9	4	5	5	4	5	3	4	4	4	4	4	4,2
7	7. We openly discuss problems and other issues.	4	5	4	5	4	4	5	3	4	4	5	4,3	5	5	5	5	5	4	5	5	5	5	5	4,9
8	8. I dare to state differing opinions.	5	5	4		4	4	5	4	5	4	4	4,4	5	5	5		5	4	5	4	5	4	5	4,7
9																									
	9. In our department, we deal with mistakes positively and see them as opportunities for learning	5	4	3	4	4	4	5	4	4	4	4	4,1	5	5	3	5	5	4	5	4	5	5	5	4,6
10	10. I think, we have a good time at work.	3	2	3	3	3	3	3	3	3	4	4	3,1	5	5	4	5	5	4	3	4	5	5	5	4,5
11	11. I have a diversity of people that I work with (diversity by age, gender, educational background)	5	5	4	4	3	4	5	4	5	4	4	4,3	5	4	3	2	4	2	3	4	4	4	2	3,4
12	12. I participate in multi-functional and cross-departmental teams.	5	5	4	5	5	4	5	4	5	4	4	4,5	5	3	4	3	5	3	3	4	4	4	3	3,7
13	13. Employees are encouraged to provide ideas and suggestions for improvement	4	3	4	3	5	3	4	3	3	4	2	3,5	4	5	5	4	5	4	4	4	5	5	5	4,5
14	14. I can anytime ask for help from my peers and colleagues in the company	4	5	4	4	5	3	5	4	4	4	4	4,2	5	5	4	4	5	3	5	5	4	5	5	4,5
15	15. I can freely network and collaborate with people from other departments in the company	5	5	3	4	3	4	5	3	4	4	4	4,0	5	3	4	4	5	4	5	4	4	5	5	4,4
16	16. Creativity is practiced and promoted.	4	3	4	4	3	3	4	3	3	4	3	3,5	5	3	4	4	5	3	3	4	5	4	4	4,0
17	17. Problem solving is practiced and promoted.	4	5	4	4	4	4	3	4	4	4	4	4,0	5	4	4	5	5	4	4	4	5	5	4	4,5
18	18. I know our internal and /or external clients and I understand the needs/demands of the clients	2	4	3	4	3	4	1	4	4	4	3	3,3	4	5	5	5	5	3	3	4	5	4	5	4,4
19	19. We regularly discuss feedback and ideas from clients.	2	2	2	3	2	3	1	3	4	2	2	2,4	4	3	4	5	4	3	3	4	5	4		3,9
20	20. I constantly think how things and specially my work could be improved	4	4	3	4	5	4	3	4	3	4	4	3,8	4	4	4	4	5	3	3	5	5	5		4,2
21	21. We recognize best practices and distribute them in our department.	3	3	4	3	4	4	3	4	4	2	3	3,4	4	4	4	4	5	4	4	5	5	5		4,4
22	22. We spend time for reflecting our work.	2	2	3	3	1	3	3	3	3	1	2	2,4	4	4	3	5	5	3	4	4	4	5		4,1
23	23. We spend time for evaluating our success and failures.	2	2	4	3	1	3	3	3	4	1	2	2,5	4	4	5	4	5	4	4	4	4	5		4,3
24	24. Practicing new things and new ways to do things is encouraged	2	3	3	4	4	4	4	3	3	4	3	3,4	4	4	4	4	5	4	3	4	4	4		4,0
25	25. My learning and development needs are a regular topic in my development discussion	2	5	2	4	4	3	3	4	4	4	4	3,5	4	5	4	4	5	3	3	4	5	4		4,1
26	26. Employees are encouraged to lifelong learning. The employer supports continuous learning	2	5	3	4	4	3	3	4	4	4	4	3,6	4	5	5	4	5	3	4	4	5	4		4,3
27	27. I have a personal development plan.	3	5	4	5	4	3	3	3	3	4	3	3,6	4	5	4	4	5	3	4	4	4	4		4,1
28	28. I can take part in job rotation.	2	2	1	3	4	3	1	3	3	3	2	2,5	4	2	3	3	4	3	3	3	3	3		3,1
29	29. I get feedback about sharing my competence and knowledge.	2	4	2	4	3	4	3	3	4	4	4	3,4	4	4	3	4	4	4	4	4	5	5		4,1
30	30. We use mentoring, coaching and/or tutoring for sharing knowledge	2	5	3	4	4	3	2	3	4	3	3	3,3	4	5	3	5	5	3	4	4	4	4		4,1
31	31. I regularly carry out development discussions with my boss.	4	4	4	3	4	2	5	3	4	3	3	3,5	4	4	4	4	5	2	5	4	4	3		3,9
32	32. We have a clear feedback system, which tells us how the targets have been achieved	3	3	4	4	4	2	3	3	4	2	3	3,2	3	3	4	4	4	2	4	4	5	4		3,7
33	33. I have a good enough access to information relevant to my work.	4	4	3	4	4	3	4	4	4	4	3	3,7	4	4	4	5	5	3	4	4	5	4		4,2
34	34. In my opinion our company/department/unit is a "let's get to it" organization. Actions are taken immediately, plans are just not left on the table	2	4	4	3	3	3	3	4	2	4	2	3,1	4	4	5	5	4	3	4	4	4	4		4,1
35	35. My Supervisor controls that I follow the company processes jointly agreed upon	3	5	4	4	4	3	4	4	4	4	4	3,9	3	5	4	4	4	2	4	4	4	4		3,8
36	36. All team members in the project knows timetable of the project	2	3	3	3	3	4	2	2	2	4	3	2,8	3	5	3	5	4	3	3	4	5	4		3,9
37	37. Employees are familiar with corporate tools (like Symphony)	3	2	2	3	2	2	2	3	2	4	3	2,5	3	5	4	4	4	3	5	4	4	4		4,0
38	38. Employees understand corporate processes and deliverables	3	2	2	3	2	3	2	3	3	4	2	2,6	3	5	3	4	4	3	4	4	4	4		3,8
39	39. Employees are willing to stretch the day to meet dead lines	4	5	3	4	3	3	4	3	4	4	3	3,6	4	5	4	4	4	3	4	4	4	4		4,0
40	40. Project dead lines are clearly defined and distributed to project team	3	4	4	4	4	4	5	3	4	4	4	3,9	4	5	5	5	5	3	5	4	5	5		4,6
41	41. Resources are clearly defined at the beginning of the project	3	3	3	4	3	2	4	3	2	4	3	3,1	4	5	3	5	5	5	5	5	5	5		4,7
42	42. I have enough time to relax between projects	1	1	3	4	1	3	4	3	1	2		2,3	4	5	4	3	4	4	4	4	5	5		4,2
43	43. Who does what is clearly defined in the projects	3	3		3	2	2	3	4		3	4	3,0	3	5		4	5	4	4	4		3		4,0
44	44. Our organization structure is clear and efficient	1	3	3	3	3	2	3	3	3	4	3	2,8	4	5	3	4	5	3	5	4	4	4		4,1
45	45. Top management (steering committee) knows real situation of the projects	2	4	3	4	4	3	2	4	4	4	4	3,5	3	5	4	4	4	4	5	4	5	5		4,3
46	46. Decisions are made quickly	2	3	3	3	4	3	3	4	2	4	3	3,1	4	5	4	4	4	4	4	4	4	5		4,2
47	47. We try different project management processes in our organization	2	1	2	4	3	4	2	4	2	2	1	2,5	3	5	3	3	3	3	3	5	4	3		3,5
48	48. Multinational teams are one of our key assets	2	2	4	3	3	4	5	3	3	4	4	3,4	2	2	4	3	4	4	4	3	4	4		3,4
49	49. Volume of the work and the number of employees are in balance	2	1	2	3	2	2	2	3	1	2	3	2,1	4	5	4	5	5	4	4	4	5	5		4,5
50	50. Project employees remains the same during whole project	2	2	2	4	2	3	4	4	1	3	3	2,7	3	5	3	4	4	4	4	4	4	3		3,8
51	51. I know my project employees competence level (knowledge)	4	4	4	5	3	4	4	4	4	4	3	3,9	4	4	4	5	4	4	4	4	4	4		4,1
52	52. Projects have realistic time tables in most cases	2	2	2	3	2	3	4	3	2	2	3	2,5	4	5	4	5	5	4	5	4	5	5		4,6
53	53. My project resources have not parallel tasks during the project	2	1	1	4	1	2	2	3	2	3	4	2,3	4	5	4	4	4	3	3	4	4	3		3,8
54	54. Project members managed tasks fast and deliver output to next person before due date	3	1	3	3	2	3	3	2	2	3	3	2,5	4	5	5	5	5	2	5	4	4	4		4,3

OPEN QUESTIONS

How many projects you manage parallel (PMP, BOC, Others)?	
Project manager A	1
Project manager B	5
Project manager C	11
Project manager D	5
Project manager E	4
Project manager F	5
Project manager G	2
Project manager H	2
Project manager I	1
Project manager J	1
Project manager K	2

Higher quality product needs longer R&D time	
Yes	7
No	3
Empty	1

In house development has better quality than outside made	
Yes	7
No	2
Empty	2

In our organization the biggest bottleneck at the moment is:

Industrialization, Tech.documentation
Industrialization
Test.lab
Master data, SAP team
Resources: IPL, R&D, PM, OM
Availability of resources when needed
Too less resources
Schedules compressed by top management
High work pressure. Employees working over the limits
Workload of all functions
Continous changes of resources and sites
Uncertainty of the future may demotivate the peple and it leads long TTM
Unclear processess in the different departments (in house)
Not well known company processes
Validation, testing
Documentation

Problems working with external suppliers are:

Quality
Time schedules
Co-operation willingness of supplier
Task definitions and clear specifications
Communication and commitment
Quality differencies. It takes lots of time to qualify a supplier