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LAPPEENRANTA UNIVERSITY OF TECHNOLOGY

LUT School of Engineering Science

Industrial Engineering and Management

Master's Thesis

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**Developing a performance management system to support supply chain management in an SME.**

27.8.2018

Examiner: Professor, D.Sc. (Tech.) Timo Pirttilä

Instructor: Procurement Mgr., M. Eng. Otto Tynys, case company

## ABSTRACT

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<b>Title of thesis:</b> Developing a performance management system to support supply chain management in an SME.	
<b>Year:</b> 2018	<b>Place:</b> Lahti
Master's thesis. Lappeenranta University of Technology, LUT School of Engineering science, Industrial Engineering and management. 123 pages, 26 figures, 12 tables and 5 appendices Examiners: Professor, D.Sc. (Tech.) Timo Pirttilä	
<b>Keywords:</b> Organizational culture, Management culture, Leadership, Performance management, Performance measurement, Performance management system, SME, Supply chain management, Project management and ERP	
<p>This is a constructive thesis aiming to implement a performance focused management culture to the case company, so that the case company can systematically assess its performance, develop processes based on knowledge and execute strategy in such way that it complies to ISO 9001 quality standard. To support performance management, this thesis defined a performance measurement dashboard, which was tested in teams involved in project division's supply chain. This thesis assesses managerial first impressions with a structured interview and uses this information to identify success factors for rolling the management practices to the rest of the organization.</p> <p>This thesis positions performance management to a much larger quality management context and treats performance measurement as one of the most significant tools of performance management. Literature review examines alternative ways to construct a performance measurement system, set goals and manage performance. Examples provided in this thesis are focused on supply chain aspects of the business, as the supporting tools of performance management were tested in supply chain teams.</p>	

## TIIVISTELMÄ

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<b>Työn nimi:</b> Suorituskyvyn johtamisjärjestelmän kehittäminen pk-yrityksen tilaus-toimitusketjulle.	
<b>Vuosi:</b> 2018	<b>Paikka:</b> Lahti
Diplomityö. Lappeenrannan teknillinen yliopisto, LUT School of Engineering Sciences, Tuotantotalouden koulutusohjelma. 123 sivua, 26 kuvaa, 12 taulukkoa ja 5 liitettä. Tarkastaja(t): Professori, TkT Timo Pirttilä	
<b>Hakusanat:</b> organisaatiokulttuuri, johtamiskulttuuri, johtaminen, suorituskyvyn johtaminen, suorituskyvyn johtamisjärjestelmät, pk-yritys, toimitusketjun johtaminen, projektijohtaminen, toiminnanohjausjärjestelmät	
<p>Työn tarkoituksena on jalkauttaa kohdeyritykseen suorituskyvyn systemaattiseen analysointiin ja johtamiseen painottuva kulttuuri, joka auttaa yritystä kehittämään liiketoimintaprosessejaan sekä toteuttamaan strategian mukaista toimintaa tavalla, joka tukee ISO 9001 laatustandardin käyttöönottoa. Työssä määritellään suorituskyvyn johtamisen tueksi suorituskykymittaristo, joka pilotoidaan projektiliiketoiminnan toimitusketjuun osallistuvissa tiimeissä. Työssä selvitetään strukturoiduin haastatteluin kokeiluun osallistuneiden johtajien ensivaikutelmia suorituskyvyn johtamisesta ja sen tueksi tarjotuista työkaluista. Näiden ensivaikutelmien perusteella pyritään tunnistamaan keskeisimpiä tekijöitä, jotka tulee ottaa huomioon jalkauttaessa suorituskyvyn johtamisjärjestelmä koko organisaatioon.</p> <p>Työ käsittelee suorituskyvyn johtamista osana laajempaa laatujohtamisen käsitettä ja asemoi suorituskyvyn mittaamisen yhdeksi suorituskyvyn johtamisen työvälineeksi. Teoriaosuus käsittelee vaihtoehtoisia tapoja suorituskykymittariston rakentamiseen, tavoitteiden asettamiseen ja suorituskyvyn johtamiseen. Työssä annetuissa esimerkeissä korostuu toimitusketjun näkökulma, sillä suorituskyvyn johtamisen työkaluja testattiin toimitusketjussa.</p>	

## **Acknowledgements**

I would like to thank everyone who has walked alongside with me during this a bit longer than a half year project. Firstly, I want to thank the case company, moreover former CEO Jussi Teijonsalo, who gave me this opportunity to research such an interesting topic. This master's thesis is done for a company where I have worked for more than a year and a half. It has been an amazing journey for a young professional like me to work in such an open environment where newcomers get a lot of responsibility and a chance to truly develop their skills.

Then I would like to express my special thanks to Otto Tynys for all the help and encouragement as my supervisor and as the instructor in my thesis. Otto has been a lot more than just an instructor in this thesis project, he has guided me and given me so many rewarding assignments, projects and career advises that have meant the world to me. Thanks to Otto, I am able at such young age to be absolutely sure in what direction I want to go in my career and I'm not afraid of the future. I would also like to thank all of my colleagues at the case company. The working community was one of the most valuable things to me in this project.

I want to also thank professor Timo Pirttilä for complete guidance in this project. His feedback was sometimes tough, but it challenged me to think differently and consider multiple aspects of performance management. I would also like to show my gratitude towards my family. My parents for being there for me and supporting my decisions. My fiancé for all the help and support through my entire studies in university and in this thesis work, especially for coping with my pessimism in finding the perfect way to write my thoughts down and waiting while I spend every minute before the deadlines to make my submissions as perfect as they can come in the remaining time.

Lahti, 27.8.2018

Sanna Vainikainen

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### List of Abbreviations

<b>BSC</b>	Balanced Scorecard
<b>ERP</b>	Enterprise Resource Planning
<b>FPM</b>	Flexible Performance Management System
<b>ISO</b>	International Organization for Standardization
<b>PM</b>	Performance Management
<b>PMS</b>	Performance Management System
<b>R&amp;D</b>	Research and Development
<b>SC</b>	Supply Chain
<b>SCM</b>	Supply Chain Management
<b>SME</b>	Small and Medium Sized Enterprises

## 1 INTRODUCTION

Performance has been measured in companies for a long time, even before performance measurement or management was a real topic to discuss. Business performance has been measured unconsciously by traditional financial measures, such as return on equity and profit margin. In the late 20<sup>th</sup> century, performance measurement became a topic to discuss among organizations, researchers and in academics. The concept of performance management (PM) was established. In the 1980s, performance measurement became a dominant term for using financial ratios as tools of monitoring and managing corporate performance. (Gautreau, et al. 2001, Neely 1999)

Soon, in the early 1980s, it was discovered that financial ratios represent a very narrow point of view when analyzing company's performance. Academic literature expressed criticism for the financial ratios on being short-term focused, ignoring customer and strategy perspectives and encouraging department optimization. (Neely 1999; Rantanen & Holtari 1999) Kaplan & Norton (2002) explain in their book *The Strategy-Focused Organization* that in the era of financial measures there was no need for any other measures. The tangible assets were the most significant factor in the business world that time, so financial indicators were comprehensive and sufficient enough to measure business performance. In 1990s, attitudes changed as people realized that businesses operate in more complicated and turbulent environment where intangible capital has become the most critical competition factor. In such an environment, companies must consider different perspectives – such as competitive position and success factors, in balanced performance measurement. (Laamanen, 2005; Lönnqvist et al., 2006)

The increasing complexity of the business environment creates more and more new challenges in decision-making to the top management of a company. The acceleration in business environment change is perhaps a worn out a statement in the academic literature as continuous change in business environment can be considered the new normal in all industries. (Järvinen 2016; Laamanen 2005; Nudurupati et al. 2011; Barrows & Neely 2011). As many basic assumptions of business activities are getting older and the importance of new approaches grow, such as customer orientation, networks, ability to reorganize, a new approach is needed to manage and organize operations. Today, many

executives expect their staff to be self-directed and to have decision-making ability that drives towards a common goal. In such changing and self-directed environment, the key to success is to invest and develop business performance. (Nudurapati et al. 2011, Järvinen 2016)

The information produced by measuring the business performance is one factor in which decision-making and developing of operations can be supported. Furthermore, measuring performance communicates the organization's strategy to staff, which supports the implementation of the strategy. (Lönqvist et al. 2016) One of the critical success factors in responding to changes of the business environment is the creation of a new strategy that is often the responsibility of top management. A new strategy and a functional performance measuring system alone do not guarantee successful implementation of the strategy, but the dedication of management and the entire staff are required to achieve these goals. This task emphasizes the importance of leadership, as resistance and fear are humane in a changing environment. (Järvinen 2016) In addition to the traditional financial indicators, which look to the past, other success factors that will mirror the future should also be considered. Measurement and management of performance are nowadays done in all types of organizations and it has become more common outside its original use in production and service organizations and expanded for example to expert organizations and government owned companies. (Lönqvist et al. 2006; Laamanen 2005)

## **1.1 Background of the study**

The case organization of the thesis is a SME company in greentech industry. The company has enjoyed rapid growth in recent years as greentech has become more affordable and serious alternative for conventional technologies. Strong growth has led to professionalization of business practices, and higher stake holders' expectations of quality. As the company is expecting to keep growing, it has started to develop new practices that can support larger scale of operations. As some examples of professionalization this far, the case company hired a new CEO in 2017 and moved the responsibility of operative and strategic decision-making from owner-manager to board of directors and the CEO.

The newly appointed CEO restructured organization to functional teams and begun rolling new management practices to the company.

The assignment given by the case company is based on a project initiated to achieve an ISO 9000 series compatible quality management system. Implementation of the quality management system involves many requirements by ISO 9000 series and many developmental aspects have been identified in the organization's culture and operations to meet the standard. This thesis is focused solely on the company's supply chain (SC) process. The purpose is to initiate a change in organizational culture to more customer centric, performance focused and process orientated atmosphere. Although SC is often associated with logistics and warehousing, in this thesis and in most companies, supply chain management (SCM) is seen as the core process of the company and comprehends all other supportive processes.

Performance has not been actively measured or assessed before in the organization, so the performance management system (PMS) will be created from scratch. The organization has monitored some financial figures, mostly derived from annual statements and changes in cash balance. Description of the current state is similar to Rantanen & Holtari (1999), who say that medium-sized companies utilize financial figures and financial statements derived from profit and loss accounts, in contrast to small businesses where management is often based on the owner's personal experience of his or her own business. Unfortunately, the mere financial information represents a very narrow view of the company's past success, which can, in the long run, lead to fatal mistakes. This is an extremely important factor when considering the adoption of a PMS. The need for a performance management system is also supported by the top management to shift away from founders and by the organization's strong growth over the last few years.

This graduate thesis is written as a final proof of qualification for the master's degree in Industrial Engineering and Management at Lappeenranta University of Technology, and it relates strongly to performance measurement. Performance management has become a part of the everyday life in SMEs due to constantly evolving, turbulent and global operating environment which requires adaptation to changes to satisfy the needs of stakeholders and the markets. (Pekkola et al. 2016).

## 1.2 Research problem, boundaries and supportive questions

This is a constructive thesis with no definitive answers to research questions. The goal of this thesis is to define a PMS suitable to the case company and initiate the creation of constructive, performance focused management culture in said company. Defined PMS must be implementable and utilize an existing ERP system. This thesis is written as part of a project aiming to adopt an ISO 9001 compatible quality management system. Therefore, the outcome of this project must comply to the rules defined in ISO 9001 and support managerial decision-making, successful management of operations and continuous improvement. The dashboard-to-be-created should include sections that would be provided to the entire staff to motivate, guide, and communicate about the company's performance.

This study identifies suitable implementation templates for the design and implementation of the PMS. The main focus of this research lies in understanding the overall management system and how performance measurement can be leveraged to improved managerial decision-making. The PMS is the most tangible result of this thesis, but it can also be considered as a by-product of research in implementing a performance focused management culture. In addition to that, this thesis examines the evaluation of user experiences as part of the process of changing the methods of operation.

The Main Objective:

*Defining and implementing a performance management system suitable to the case company's supply chain and initiate the creation of performance focused, constructive management culture.*

Supportive Questions:

*How do performance management systems support leadership, decision-making, and what kind of change in management culture is required to reach this?*

*How can performance metrics be built and what are performance management systems?*

### **1.3 Research methodology and theoretical framework**

This study is composed of theoretical and empirical sections. Theoretical research will carry out a literature review in this work, which will familiarize readers with previous studies and the literature of the discipline. The empirical part of the thesis covers examination and analysis of the case company, resulting in concrete observations from the research topic. Empirical research is carried out by interviewing organizational representatives who are the main users of the performance metrics and organizational decision makers in the SC processes. The interviewees are procurement manager, a project team leader and the CEO. Discussions will be held with other team members involved in SC processes and their feelings about performance management will be addressed. Additionally, the performance meter metrics are selected together with the main users.

The study complies with the case study strategy, as it combines both quantitative and qualitative research in one business case. The case study method does not aim to make a general description of the phenomenon, but it is more important to have a profound understanding of the subject in question in its own environment. (Saunders et al. 2015 p.184-185) It is an important feature of this thesis to generate value for the case company by solving some of the current problems in their organization. Also, a small survey is conducted to determine the state of management and performance before and after the introduction of a performance metric. This is part of the overall assessment of user experiences and leadership development.

A draft of PMS was defined together with top management and team managers in a workshop. Based on the outcome of this workshop, the CEO was interviewed several times to iteratively construct a company specific, strategic measurement system to aid managerial decision-making based on this draft. Of these metrics, SC measurement system was implemented as a pilot during the process of writing this thesis. As a part of this pilot, SC related operative measurement systems were also defined together with team managers and introduced to some teams. Because most employees have no previous experience on performance management, only top management and team managers were interviewed

for this pilot. After the organizational culture adopts the concepts of continuous measurement and improvement, workers at all organizational levels will be heard to improve existing and implemented new performance metrics.

#### **1.4 Research material**

I have familiarized myself with the current organizational culture and key processes while working there as an ERP system administrator for a year and a half before starting in this project. Previously I have written a bachelor's thesis for the same case company. I am a full-time employee there and I have a good understanding of business processes and operating principles in the case company. A lot of my research material is a product of participant observation as an active participant in the community. Acknowledging the risks of 'going native', objective view is maintained by member checking where portions of this thesis are sent to participants for validation and feedback. Asking participants about their intended actions helps to confirm that valid conclusions are drawn from their observed behavior. Many of the conclusions regarding the shift in organizational culture are drawn from my experience as a member of the target company, as well as my coffee-table discussions with team members and warehouse workers.

At Lappeenranta University of Technology, I had a SC development course, during which students solve real life issues in SCs. Outcome of this course was a written, thesis type paper a bit more demanding than bachelor's thesis but less than master's thesis. I wrote my paper to the case organization of this graduate thesis, relating to the same quality management system adoption program. In that paper, I defined ISO-9001 compatible process models and introduced process management and continuous improvement concepts to the case organization. This graduate thesis is an extension to the paper written on that course.

Besides formal interviews and the survey, information was also gathered through regular discussions with managers and the CEO regarding the themes presented in chapters 6.1 and 6.2. Chapter 5 is based on team manager workshops and my private discussions with the CEO. A lot of material presented in chapter 4 has come from discussions between me, quality manager and the head of logistics and procurement. Quality manager was involved

in those discussions to ensure that the proposed PMS meets the requirements of ISO-9001 quality management standard. The unofficial discussions span over six months' time. Discussions began, and the first workshops were organized during the SC development course. I used them as part of my coursework, which is why those are not discussed in detail in this graduate thesis.

In total, this has been an 8-months journey, beginning with the supply chain development project during which I outlined my thesis topic and decided what to include in that course project and what to discuss in my thesis. By March 2018 I had completed the literature review and held the first workshops. I held several training sessions discussing the importance of business process management and corporate performance. Performance metrics were implemented to the ERP system in April, and in May I held more training sessions about how to use the system. Empirical part of this thesis was written mostly during the summer 2018. I decided to keep this a bit longer than usual master's thesis project to let the case organization use performance management tools for few months and get feedback on first impressions.

### **1.5 Delimitations of the study**

This master's thesis is limited to looking at PM in the SC context, to which the company's core business processes are related. The order-delivery process includes two sales channels – project deliveries, and retail sales. In recent years, the company has been focusing more on project deliveries and co-operated with 3<sup>rd</sup> party distributors regarding the retail business. Therefore, this master's thesis focuses on project deliveries. Performance metrics were defined for entire organization, but trial was limited to supply chain teams and findings of this trial will later be leveraged to implement the system in other teams as well. Consequently, measurement of the sales, financial management or R&D processes will not be examined in the context of the research. This thesis briefly introduces the complete planned PMS but discusses in detail only those SC related measures that will be implemented.

Both the financial and the non-financial indicators will be taken into account in the performance measurement system. The PMS should be balanced and hence the importance

of operational meters is important. The aim of this research is to consider the perspective of the SME, but the literature is not limited to this perspective, as the company's growth prospects support the PM for wider performance measurement. In addition, the PMS supporting tools are implemented to the ERP system, so maintaining the performance measurement system will not create additional maintenance costs.

## **1.6 Structure of the study**

This thesis consists of introduction, five main chapters, conclusions and a summary. Chapters two and three form the theoretical part of this thesis while chapters four, five and six are a product of author's empirical research. Structure of the thesis is illustrated in figure 1. Chapter two discusses what performance is and how it can be managed, how target setting influences performance and what are the most likely challenges relating to PM. This chapter seeks theoretical answers to supporting question number one.

Chapter three focuses on measuring performance. It presents some theoretical constraints required to ensure the quality of measured information and presents some frameworks for defining overall performance measurement system. At the end of this chapter, the focus shifts to SC aspect, the context in which the performance management system will be piloted. Chapter explains what to consider when measuring SCs by presenting traditional SC measures and alternative ways to measure SC. Chapter tries to answer supporting question number two.

Chapter four introduces the case company and its SC processes discusses the boundaries set for PM in case company. These boundaries are quality management system and ERP system. This chapter is based on empirical observations regarding the case company.

Chapter five explains how the performance measurement system was designed and implemented. A new framework for performance measurement system was created for the case company's needs and it is presented in this chapter. In addition to that, this chapter discusses metrics selection and performance measurement system implementation to ERP system in practice. This chapter also discusses the limitations that ERP sets to performance measurement.

Chapter six describes the organization's management practices, in particular, how management and decision-making have changed since the introduction of the PMS. It begins by taking a view into the steps that have taken the case company to the point that they have realized the need for measurement system, and how the company has thought to be using the measures. In this context, the results of the questionnaire on user experience is also discussed, as well as the way in which leadership has developed in the organization. The summary and the conclusions summarize the outcome of this study and elaborate on further research and development targets.

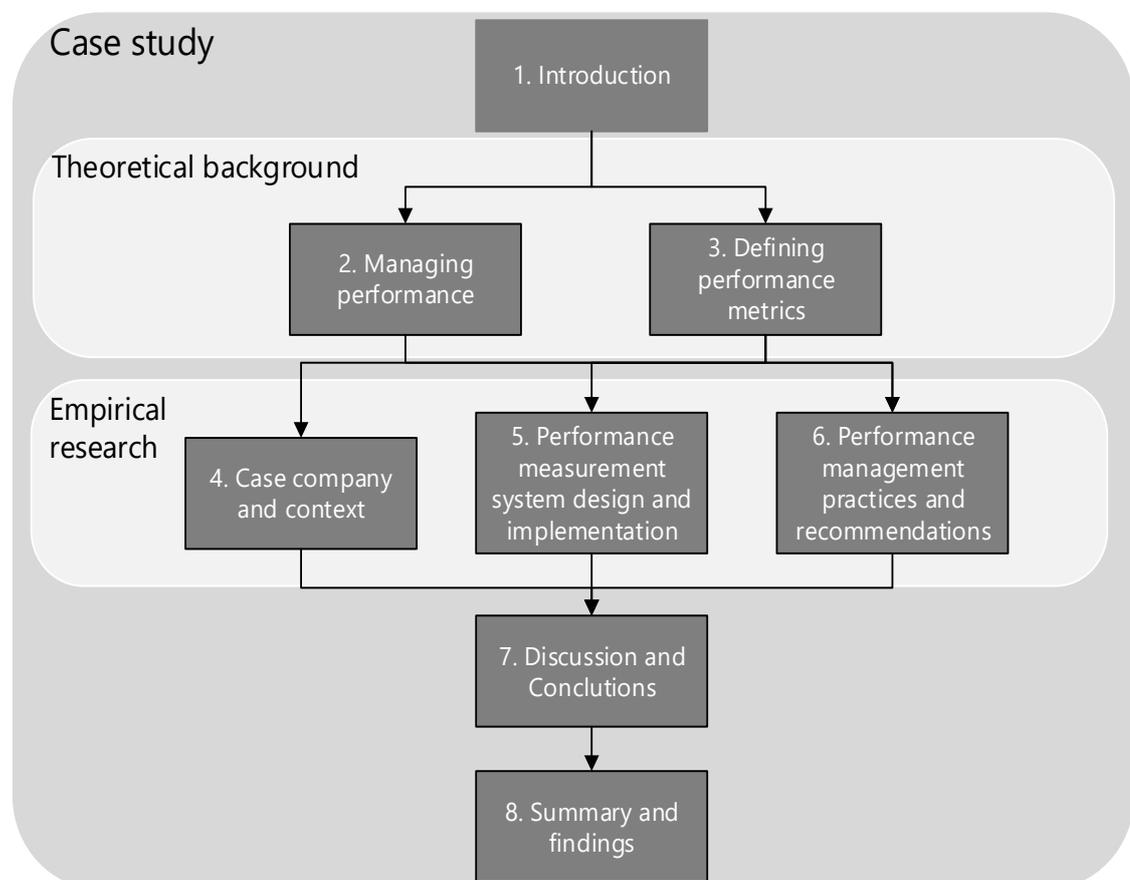


Figure 1. Structure of thesis

## 2 MANAGING PERFORMANCE

This chapter focuses on managerial implications of adopting a performance measurement system. It seeks for theoretical answers to supporting question 1:

*How do performance analysis systems support leadership, decision-making, and what kind of change in management culture is this?*

The chapter begins by defining performance in business context, and then discusses how organizational culture could be tuned for performance through good managerial practices. Goal setting theory describes how business targets could be converted to performance goals and how these goals influence short-term and long-term organizational performance. At the end of this chapter, some performance related managerial challenges are presented.

### 2.1 Elements of performance

PM refers to a process which's purpose is to use indicators to determine the status of a business entity. The performance management system is based on the identification of the success factors that are important to achieve goals set to the business, measure them and use the measured information to develop organization. It is one of the most conventional tool for management and instructing. The performance management system is a tangible tool that is crucial when coordinating operations and it can be used to communicate key factors to the personnel. (Lönqvist et al. 2006)

Several definitions have been proposed to performance management and analysis. According to Rantanen & Holtari (1999) the company's performance can be defined as its ability to produce outputs with set dimensions in relation to the set goals. Many other very similar definitions arise from literature. At the most basic level, performance can be understood as Lönqvist et al. (2006) states it to be performers ability to reach set goals.

Rantanen & Holtari (1999) represent in their report seven components of performance.

They are:

- Effectiveness, that is the degree to which the system accomplishes what is set out to accomplish.
- Efficiency can be described as the relationship between the planned run-in and the actual run-in, i.e. the fact that the system has used the right things.
- Quality is the system's ability to fulfil users (customers) needs and expectations.
- Profitability represent how effectively financial resources have been used.
- Productivity tells how the output is proportional to the amount of inputs used. It describes the performance of a company's real process in converting inputs into production outputs.
- Quality of work life is the way participants in a system respond to sociotechnical aspects of that system.
- Innovation describes the ability of the company to create reforms.

Ability to perform can be understood as information gained by measuring the output of an organization, a process or an employee. This information is interesting and useful for corporate management if, and only if, it can be taken advantage of to improve decision-making, gain a larger market share, or improve processes, products or human knowledge. PM is also about taking responsibility. Without responsibility and control, no decision, action or learning can be achieved through this information. (Laamanen 2005)

Both Rantanen & Holtari (1999) and Laamanen (2005) point out the basic breakdown of performance into two main areas. These areas are external and internal performance. They describe that external performance focuses on external accounting and is based on looking at the company and its performance. External performance evaluation and measurement can be performed by an external party or by the company itself.

One challenge of external performance analysis may be that an external party may not have all the information and data needed for calculations. That's why external performance analysis is often based solely on publicly available information. Measurable items may be, for example, financial performance, which makes it more difficult for an outsider

to obtain the same high-quality information as if it were the company itself. An external analyst can, for example, act as a stakeholder group, such as financiers. Analyzing external performance is the most commonly seen as company's financial statements analysis. (Laamanen 2005, Rantanen & Holtari 1999)

Internal performance refers to the performance within the company. In this case, the analysis is often carried out by the company itself. Usually, the company also has clearly better and more accurate information than an external reviewer in external accounting. When external accounting looks at the company, internal accounting divides the company into parts to evaluate and measure the performance of individual departments or functions. Some stakeholders in the company can also analyze their internal performance. For example, the financier may have sufficient information to analyze the internal performance when making the funding decision. Generally, representatives of the company are required to provide this information to the sponsor upon request. (Rantanen & Holtari 1999)

The most important components of internal performance are productivity, efficiency and economy. Analyzing quality, delivery time, lead time, and capacity are also important areas for internal performance analysis. The internal performance analysis therefore focuses on looking at the parts of the business and analyzing the performance or the result of a single machine or person at its most detailed. Internal performance analysis often utilizes information produced by internal accounting, especially cost accounting. There are no similarly established accounting methods or guidelines for cost accounting or more widely available accounting policies for management accounting purposes than those used for external accounting analysis. Every company can use the meter that they want and the best fit in the different metering situations. (Rantanen & Holtari 1999)

Performance can be analyzed at several different levels. A kind of base division may be a structure in which the analysis is divided into two levels which are society and organizations. (Neilimo & Uus-Rauva 2009; Rantanen & Holtari 1999) Society can be analyzed at economies, sectors and at the corporate level. Those levels are high above corporate level and they very seldom used in corporations.

According to Neilimo & Uus-Rauva (2009), organization level can be divided into more detailed examination levels such as:

- Profit centers
- Departments and Functions
- Processes and Occasions
- Groups
- Individuals

Different parties may emphasize only a certain level of performance in their performance measuring. To be able to develop productivity broadly, society and its organizations must focus on the performance of all levels affecting the outcome. Generally, performance is created at lower levels, while the upper levels influences the prerequisites for productive business. The performance is closely related to the concepts of productivity, efficiency and profitability. Improving the productivity of a company usually means, directly or indirectly, that the company's cost development slows down, price competitiveness improves, ability to pay improves and structural changes take place. The decline in productivity, on the other hand, has the opposite effect. The rise in productivity may also mean a decline in jobs, particularly in industries where there is no growth. In these situations, productivity can be increased, for example, by automation. Just like performance, productivity can be defined as the relationship between the outputs of a viewed subject, i.e. the systems throughput, and the inputs placed to the system, i.e. input per output (figure 2). (Neilimo & Uus-Rauva 2005)

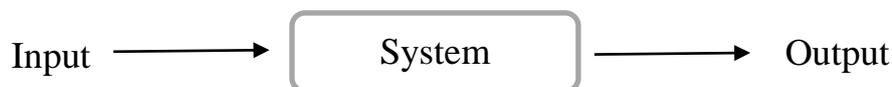


Figure 2 Components of productivity (Neilimo & Uus-Rauva 2005)

The size of an organization has a great impact on the need to measure business performance and to the challenge of measuring performance. In small organizations that are usually led by the founder, entrepreneur's responsibility is clear, and decisions are fast made by the entrepreneur because he or her is very aware about what's happening in the business environment and business. In medium sized organizations activity is based on functions and sharing responsibilities. In a mid-sized organization, managing various

tasks requires different know-how. Important tasks are hired to be taken care of by professionals instead of enthusiasts. As the size of the organization grows, more and more information produced by measurement is needed to measure different functions and company when management is increasingly excluded from the operative action. In large companies' performance measurement is a vital operation for decision-making and management. Also finding the information needed for management in large organizations is much more difficult than in smaller organizations. (Laamanen 2005)

Performance is often seen as a very multi-dimensional issue influenced by many factors (Pekkola 2006). One key factor is to identify the most important stakeholders and their needs. Usually, a shareholder is of great worth if they get a share of the process results, or they play an active role in the activities development. Developing performance management information based on stakeholders' interests enables evaluating whether tactical plans are being met and it provides a means of testing the presumed cause and effect relationships between the measures and strategies. (Franceschini et al. 2007) A company can be seen as a system of collaboration, that strives to meet the objectives set for it. The objectives of different stakeholders can be very different, e.g. owners emphasize return on equity and employees value regular pay and stability in working environment, so the performance can be understood differently. Likewise, different parts of an organization may have contradictory goals. For all stakeholders, the common goal generally appears to be the ability of the company to efficiently generate revenue, i.e. profitability through cash flow. (Lönqvist et al. 2006; Pekkola 2006; Rantanen & Holtari 1999)

The company must be able to cover the income of all key stakeholders with reasonable requirements. The most traditional stakeholders are owners, managers, employees, customers, suppliers, financiers and public power. At least in the long run, failure to meet the requirements of a key stakeholder may lead to a stakeholder withdrawal from the company, and hence, disruption of the business. Excessive emphasis on an individual stakeholder or dimension may be a dangerous approach. In short term, it can maximize success with respect to that dimension, or in the eyes of that stakeholder, but in the long term, the whole suffers. For example, short-term maximization of the profit announced in the interim reports and the increase in the value of the share can haunt the company in the future through neglected investments and research and product development. However,

many of the most successful companies struggle to consider their stakeholders interests balanced. (Laamanen 2005; Rantanen & Holtari 1999)

Performance measurement is one of one of the most common management processes used to evaluate, analyze, control and manage business. (Rantanen & Holtari 1999) It is an important part of instructing and controlling activities, as it systematically quantifies information so that more informed, rational decision-making can take place. In addition to that, performance measurement can be used to communicate the important matters to the employees. Managerial reasons for performance measurement may be summarized as follows: (Karhu 2005).

- Guidance
- Planning
- Monitoring
- Alerting
- Diagnosis
- Learning
- Informing
- Recompensing

PM is about the information gathered through measurement. It tells how an organization, its process, its products or individuals performs. This information is then used to decision-making to make the organization create new, develop employee know-how, intensify processes and grow market share. The prerequisite of PM is responsibility. Organizational performance that is nobody's responsibility is not useful because decisions, action or learning does not happen without ownership, commitment and responsibility. (Laamanen 2005)

## **2.2 Management culture**

Managing the company is often described as a cycle of planning, implementing the plans, monitoring the implementation and, if necessary, correcting the direction of the business. The definition is derived directly from Deming's PDCA cycle, which can be used to look at the management process. Depending on the views of the author, management can be

defined in very different ways. Traditionally, PM and measurement are about strategies, processes, and critical success factors. (Laamanen 2005, Ukko et al. 2005)

Measuring performance is about measuring performance, where performance is the result of human activity. Therefore, while designing, implementing and using the performance management system it should be inevitable to consider the personnel using it. Some authors refer this with *leadership* to make distinction between managing people and managing issues, to which they refer to with *management*. Leadership can be understood as a process or action that effects a group of people while they strive towards their goals. A visionary leadership can be described like a process illustrated in figure 3. In leadership it is indispensable to motivate, commit and to involve employees. Performance management system is a way to communicate company's vision to its employees and whole organization. (Ukko et al. 2005)

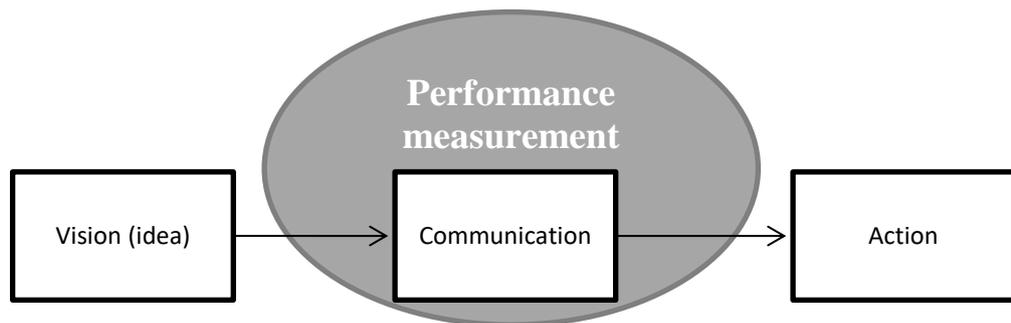


Figure 3 Leadership process

Bititci et al. (2004) found out that organizational culture, leadership style, and performance measurement have a strong influence on each other. Successfully implemented PMS leads to more participative and consultative management style. Use of performance management system leads to better corporate performance and refines organization towards the culture of achievement. They also discovered that performance measured should be seen as a cross-functional issue. It requires joined-up thinking at all levels of organization.

When designing a PMS, it must be pondered at which organizational level measurement is to be performed and at which organizational level the objectives are set. The top management is responsible for deciding which decisions can be carried at which organizational level. These decisions must be made carefully because they affect PM. The top management makes decisions about strategy and lower management sets operational

measures, but the role of employees in objective setting must also be considered. This is important since participating employees in setting objectives related to their own work makes it easier to commit them to these objectives. (Ukko et al. 2005)

Kaplan & Norton (2002) highlight their book that performance measurement is essential when communicating company's vision. And therefore, it is not possible to communicate vision if measures are displayed only to the top management. According to Kaplan & Norton (2002), companies should see the implementation of a strategy the same way as they understand launch of a new product. Companies should use the same effort to communicate new vision to their employees as they do in marketing to the customers. The first step is to educate employees, then testing the stage of understanding the strategy and lastly to evaluate how employees obey new strategy and even teach it to everybody else in the organization. The whole process should accordingly be resourced and budgeted. The idea is to understand that it is the point to command from the top to bottom. The question is about communication from top to bottom. In the latter case it is possible for employees to find innovative to help the organization to achieve its strategic goals. As researches show, communication has a significant impact in organizations success. If employees do not understand strategy, they are not able to execute it in their everyday work. To create a high-performance environment in a company through performance management, PMS must create relevant and visualized information. Generally, graphs and gauges are better visualization tools than tables. Successful visualization enables the dissemination of measurement results. (Robson 2005)

Motivation stands for a state of mind caused by motives. Other definitions state that motivation is state of an individual that defines the stage of activity and diligence in completing tasks or that motivation is employees' consciousness about set objectives and has enthusiasm completing the set objectives by using own resources in an appropriate way. High motivation is often derived from a job that suits the employee and corresponds to personal interests. Motivation is traditionally divided into two aspects: internal and external motivation. Internal motivation is usually high if work is done because of its property of being challenging. External motivation is usually created via financial incentives that can affect working positively. Still incentives only remove dissatisfaction and seldom creates complacency or high motivation. Also, the use of incentives must be balanced.

Too much of incentives creates a negative effect on efficiency. That is why balancing internal and external motivation is essential in leadership. Research has proven that work motivation is related to performance and quality of work done. That is because motivation creates more effort and dedication into tasks. Other aspects that affect working motivation positively are: (Pekkola 2006)

- Clear objectives that are measured and possible to achieve
- Evaluation of results that is done regularly
- Feedback that concentrates on actions and results
- Positive guidance
- Actuate salary
- Varying work that is challenging and self-driven
- A suitable amount of work over time

The development of a PMS requires the continuous involvement and commitment of the top management to the process. Business goals are derived from the company's strategy and one purpose of performance measurement is to follow the implementation of the strategy. This strategic vision can only be developed by the top management of the company. The development of PMS is a task that cannot be assigned to a lower management or consultants alone. When company's top management is involved in presenting a PMS to lower levels of hierarchy, it is easier for employees to accept change. The role of the management is especially emphasized when a company is starting a systematic PM through an organized measurement system. In this case, the top management should clearly express their support for the change process. The introduction of a PMS in an organization where performance has not been measured before is a major change in the work environment. It requires a whole new way of thinking, especially when there is no previous PM experience. Creating this new way of thinking is at the forefront of the top management, as lower levels or an outside consultant may not be strong enough as authority to assure the importance of the matter. Especially in SMEs the activity of the top management, CEO or owners rises into even more high importance. (Tenhunen 2001)

Tenhunen (2001) also explains the importance of committing the employees to the PMS. Again, if PM is a new concept to the organization, it is justified to deal with the role of

the staff from the point of view of the change process. In this case it is essential to commit the key persons to the change and to get the employees prepared to the change coming. A team leader should discuss with his or her team's key persons about their team's working culture and its influence in hands-on working. Discussions should strive into a mutual understanding of team's key values and a vision how their working culture can be improved to respond to the changes in business environment. After this the conversation can be moved to lower levels of hierarchy, where should be discussed the pressure that influences working and what actions that causes.

According to Järvinen (2016), performance is determined as a product of dedication, action, know-how and potential. First two of these are strongly related to motivation, and the latter two to training. Dedication and willingness to act separate the good from the excellent, but neither of those two factors affecting performance can be improved through training. Potential refers to the capability of learning new skills or improving existing ones, and skills and capabilities set the upper boundary to current maximum performance. They describe know-how as a collection of skills and capabilities combined with ability to target them into something useful. In modern environment, especially following skill-set should be trained to achieve higher performance.

1. Relaxedness - the ability to perform without over-stressing
2. Optimism - right type of discernment in tough times
3. Multitasking - concurrent, parallel execution of multiple tasks
4. Ability to stay focused - understanding what is relevant and what is not
5. Impressiveness - ability to influence other people
6. Dedication - ability and desire to do productive work as a part of a work community
7. Giving up - ability to let go at the right time when change is required to survive

People tend to say that you get what you measure or measure what you want to lead and encourage. However, leadership is always done through people. Leadership is influencing, pursuing and achieving excitement and interaction with people. It must remain inspired and encouraged. In the best case, PM and measurement create positive effects in the work community.

According to Neilimo & Uus-Rauva (2005), they

- Motivate
- Emphasize the value of the matter that is measured
- Guide to do the right things
- Clarify the objectives
- Create healthy competition
- Improve communication
- Create a prerequisite for incentive schemes

At worst, measurement can cause the reverse effects of the positive listed above. In this case, measurement will cause organizational personnel to become annoyed, enable part-optimization, stiffen the organization, and create bureaucracy. (Neilimo & Uus-Rauva 2005)

Quality focused companies are more likely to encourage the use of PMSs, and without clear strategy, it is hard to find the right things to measure. Organizational culture partially determines the effectiveness of performance management systems, yet it is unclear what type of culture is the most beneficial and how this culture can be created. Environment and industry characteristics likely affect the use of PMSs, but most authors have relied on vague assumptions with no further research on how contextual factors should, by common sense, affect the way organizations deal with these systems. (Franco-Santos & Bourne, 2005).

Effective implementation of processes ensures better understanding of causal relations in business operations – to improve performance, it is essential to be able to separate the vital key processes from the trivial. When managers understand the need for change, the next step is execution. The challenge in execution is that performance usually drops momentarily. If managers give up on change initiatives now, change process will stop and employees fall back into old habits. (Laamanen, 2005).

### 2.3 Management practices

Management trends come and go, like fashion. Usually these trends are characterized by a guru, an external consultant popularizing the trend. These fashions are experienced as rapid, bell curves in the popularity of management techniques. Some may even call them fads, as they gain popularity by offering quick solutions to complex problems and after wide adoption problems emerge, after which quick decline in adoption rates begins. Yet these trends enrich management culture as companies retain the positive factors from these trends. In 1980s, Quality Circles was one of these trends, as around 90% of Fortune 500 companies adopted this method. By 1987, 80 percent of these companies had abandoned the method. However, several timeless key concepts remain at the core of business management. (Abrahamson, 1996).

- Understand your core business
- Measure strategically important things
- Improve performance by optimizing your processes

Bourne et al. (2005) studied the performance impact of managing through measures by comparing the operating principles of several similar business units. Balanced Scorecard (BSC) was used not so much to maximize performance but rather to ensure meeting established standards and alert when actions must be taken (a traffic light in IT system). Active communication between managers and workers as well as collaborative planning in continuous development was identified as the most significant success factor separating the good from the average. Profound understanding of business operations and the connections between people, processes and performance helped exceptional team managers reach higher performance compared to the average managers.

Anitha (2014) surveyed factors of employee engagement and their influence on employees' performance. His findings suggest that team and co-worker relationship together with working environment are the most significant factors of employee engagement. Less important factors include leadership and workplace wellbeing. He found positive correlation between employee engagement and their measured performance. Although somewhat difficult to objectively and accurately measure, these soft factors should also be considered

in PM. Similar findings have been made by Gruman & Saks (2011). Harel & Tzafrir (1999) noted that training was the most important success factor determining the market performance of large Israeli companies.

As Kaplan & Norton (2002) appointed the importance of communicating the company's strategy, they also provide in their book few examples how effective communication can be carried out in the organization. They propose:

- Quarterly meetings
- Brochures
- Monthly handouts
- Teaching routines
- Intranet

Richards (2014) lists some best practices for efficient communications when introducing performance metrics to employees:

- Use terminology that your staff can understand and that is meaningful to them
- Understand what your staff needs to do to improve service or reduce costs
- Use common industry KPIs to enable benchmarking
- Review the data regularly and look for trends
- Not overreact to a particular data point
- Only introduce cost-effective metrics
- Not measure what you cannot change

Neely (1998) talks in his book about aligning measures and strategy. In his opinion for most organizations it is the most difficult part in measurement that their measures are not aligned to the business's strategy. The linkage between measures and strategy is discreet but important. If measures are linked to strategy they provide information whether the implementation of the strategy is successful or not. It also helps to encourage behavior that is consistent to strategy. Both Lönnqvist et al. (2006) and Kaplan & Norton (1996) encourage companies to create a strategy map for both general management and performance management reasons. Strategy maps are important when implementing a strategy-based measurement system such as BSC. Strategy map is a visualization of organization's

strategy through the causal relationships between measurable success factors (Figure 4). The strategy map works as a graphical model of the organization's strategic goals and their connections. In practice, the map should help to identify the event path followed by achieving strategic goals. Strategy map is considered as a tool to manage the overall strategy and an example use case may be the executive board discussions of the success of the strategy. Strategic mapping can also be considered useful in the construction of a PMS as identifying relationships between success factors is essential when constructing business performance management system.

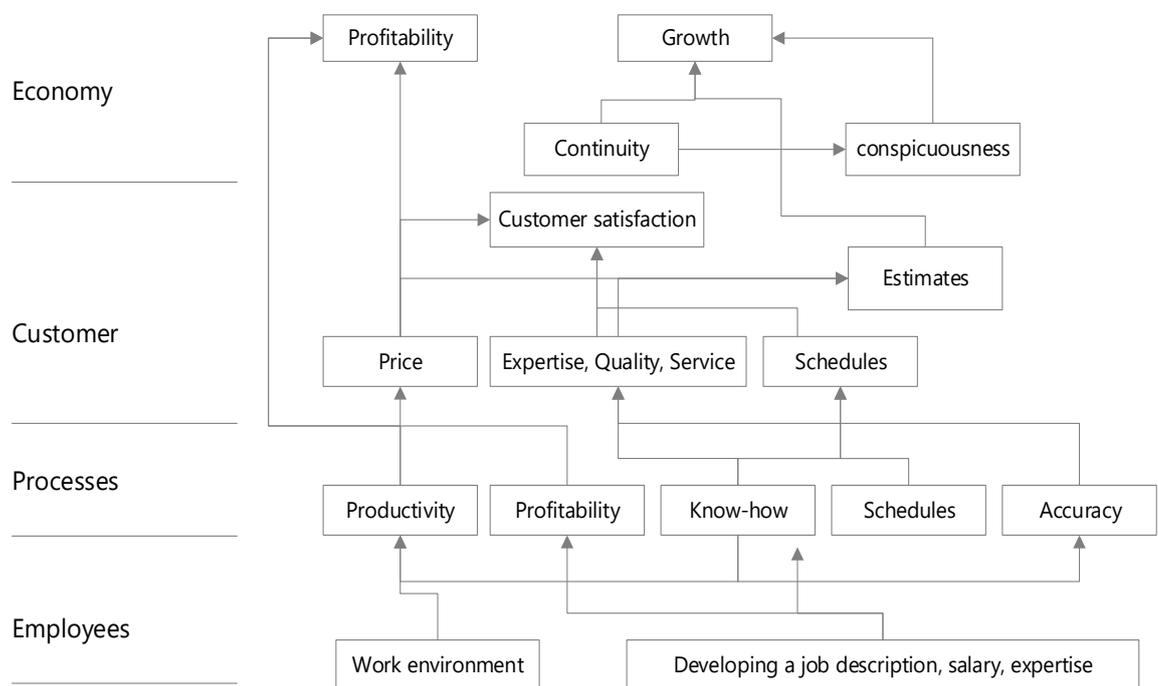


Figure 4 Strategy map (Lönqvist et al. 2006)

## 2.4 Goal setting theory

Traditionally, goals have been grouped into four classic categories in goal setting theory. These levels are do-your-best, easy, difficult and impossible. Rewarding employees for achieving goals has been proven to increase individual work performance by Locke & Latham (2002), who define four distinct mechanisms through which goals affect performance. These mechanisms are directing attention, energizing and improving effort, affecting persistence and discovery, and use of task-relevant knowledge. Generally speaking, harder goals make people work harder and longer, as well as find new ways of doing

things more efficiently. Similar effects can be achieved by gamification. Landers, Bauer and Callan (2017) illustrate the use of leaderboards as a means of improving performance. First, they demonstrated the performance increasing effect of those four classical levels of goal-setting, by showing that impossible goals yielded the highest performance in given tasks. However, when public leaderboards were introduced, and the performance ratings of others revealed, all participants aimed for the top positions in the leaderboard even though they were not asked to do so. Even the ones with the lowest initial targets aimed to the top spot previously occupied by some of those who were given the impossible targets.

Although setting higher targets definitely has performance increasing effects, Welsh & Ordóñez (2014) argue that consecutive high-performance goals also have a dark side of increasing depletion and unethical behavior in employees and managers. They also note that decreasing goals have the exact same effect on unethical behavior, but a dwindling effect on depletion rating. Setting consecutively increasing goals or “do your best” goals have much more modest impact on the amount of unethical behavior and the number of burnouts.

For overachievers, individual performance assessment is like throwing gasoline into a fire. While it improves organizational performance in short-term, it is exhausting and will likely burn out these talents in longer term. In sales division, it also prevents teamwork as individuals are only concerned about their own sales figures. In some cases, salespeople may try to steal leads from other people to increase their own performance ratings. Measuring in too much detail may lead to micromanaging, where managers begin to look excuses for random changes and try to solve issues that do not exist.

When used for planning purposes, targets should be set as realistic as possible, indicating the best guess with equal probability of over and under estimation. This gives managers best baseline for planning the operations, as they do not need to compensate with excessive hoarding of resources to meet objectives set at the most optimistic level. At worst, impacts are similar to bullwhip effect in poorly managed supply chains. For motivational purposes, targets should be communicated to be at a higher than actual level. This pushes employees to try harder to meet the target, especially if there’s an external reward for

reaching the target. However, impossible targets decrease motivation as there is no point on trying if the employees are sure they will fail to meet the target. (Merchant & van der Stede, 2016 pp 309-318).

Measuring individual performance may limit the performance if targets are set based on previous performance. Workers quickly learn to protect against poor performance ratings by settling to meet the target or slightly exceed it, as this makes the target more reachable next year. In case of poor performance, verbally gifted, selfish and bogus employees may try to find excuses for it. This prevents from tackling the real issues behind poor performance.

The performance measurement gives a good base for fair and evenhanded rewarding system. As discussed in the motivation section, incentives tend to effect on motivation and it further affects quality and efficiency work is performed. As it is well known in organizations nowadays, employees are one of the most important competitive factor in companies. Scholars emphasize the importance of employee resources. Employee strategy is the only real way for companies to create competitive advantage as resource perspective. Other, more traditional competitive advantage factors e.g. production technology and economies of scale are relatively easily copied, so competitive advantage can be reached only by factors that are more difficult for competitors to get. (Karhu 2005)

Cascio (1986 pp. 360-370) discussed linking compensation strategies to business strategies. He identified three distinct strategies companies go through during their life cycle. In *invest to growth* strategy, individual talent is vital in determining the future of the company. Usually the number of employees is rather low in this stage, and performance of few key employees or business units dictates the overall performance of the business. In this phase, entrepreneurialism should be stimulated with above-average incentives for individual performance. As the business exits rapid growth phase and reaches maturity, it often enters *manage earnings, protect the markets* strategy where management skills should be rewarded. Individuals are not as centric to business performance anymore, and moderate incentives should be set for individual, unit or corporate performance. As the market eventually declines, companies enter *harvest earnings, reinvest elsewhere* strategy. Cost control is key here to postpone the eventual closure of declining operations.

Employees should be given below-average cash compensation with small incentives tied to cost control.

Setting the performance targets explicitly enables efficient and transparent communication as well as rightful and inspiring compensation schemes. Managers have clear responsibilities and can influence their own compensation by their actions. It is easier to detect issues and react accordingly when development of performance is constantly monitored. With the generated information, organizations can learn and improve. By constantly monitoring customer satisfaction, company cannot get too detached from its customers. With concrete information to present about corporate performance, shareholders are more likely convinced about the company's ability to generate value.

## **2.5 Challenges and different approaches to performance management**

According to Ukko et al. (2005) decision-making is essential part of managing. Managing can be seen consisting of three sections that are detecting the decision-making situation, identifying the operating model and deciding the operating model. PM especially helps to the first section, detecting the decision-making situation. These situations can emerge when certain measured matter does not meet desired position/rank. Even though performance management systems give information needed to detect objects that require improvement, it doesn't tell directly what to do or what the options are in that situation. The success of management depends on how the information got from measurement system is used to make decisions and if the decisions made are right, management can be considered successful.

Choo (1996) divides the use of information into three distinct categories. Companies can use information to support decision-making, sense operating environment and to support organizational learning e.g. creating new ways of doing things or inventing new business opportunities. In theory, all decisions should be made based on all available information and careful evaluation of potential implications of these decisions. In practice, decision-making involves balancing between interests of organizational stakeholders and making decisions under uncertainty or imperfect information, jumbling rational decision-making processes.

In addition to Choo's article, Laamanen (2005) identifies few more information needs for companies' top management.

1. Needs of stakeholders and competition
2. Resource allocation
3. Process efficiency
4. Achieving change

Information according to stakeholders and competition is one of the most important because all the stakeholders expect to benefit from the company. Each stakeholder group's objectives and needs may vary, e.g. shareholders and customers have very different interests. Giving benefits to stakeholders may happen all naturally in companies because companies tend to strive into profitable business by giving customer the product or service they are willing to pay for. Still varying need of stakeholders may cause situations where it is difficult to balance between the interests of stakeholders. Resource allocation is one of the most traditional balancing problems among managers. (Laamanen 2005)

Franceschini et al. (2007) note that care should be taken in interpreting the measures. As stated in agent theory, agents i.e. *actors*, will interpret the definitions of indicators in a way that is the most favorable and aligned with their self-interests. That is, if the definition leaves some room for interpretation, numbers will be biased towards better than actual performance. Detailed, process level indicators are likely to yield cost shifting rather than actual cost savings, when costs are rolled to other processes and business units to make the own unit look more favorable.

Misinterpretations of performance indicators are common, especially when indices are used. If multiple measurements are combined into a single number, the meaning of this number can easily become blurry. Aggregating data from several sources is an effective method of compressing complex information to a more easily understandable format, but it may bias the results if the original data is not properly standardized. Numbers are easily manipulated, and the risk of manipulation increases when compensations are tied to a performance index. People are more easily convinced, if numbers are used as a basis of an argument. However, numeric measures should not be trusted too much without understanding the source, potential limitations and possible biases. (Laamanen 2005)

When compensation schemes are built, special care should be given to ensure objectivity of the performance ratings. It was demonstrated by Scullen, Goff & Mount (2000) that when bosses and co-workers were asked to rate their bosses, subordinates and peers, raters' perception of world influences the ratings more than ratees' abilities and actual performance.

Analytical approaches supporting PM are always based on information systems. A well-functioning ERP system is a requirement for an efficient PMS because it serves as the main source of data. Besides enabling IT-based applications, efficient PM support systems require the intersection of strategic management accounting applications and analytical methods (see Figure 5). Finding causal relationships between different indicators should be the main driver of business analytics in PM. (Schl afke, Silvi & M oller, 2012)

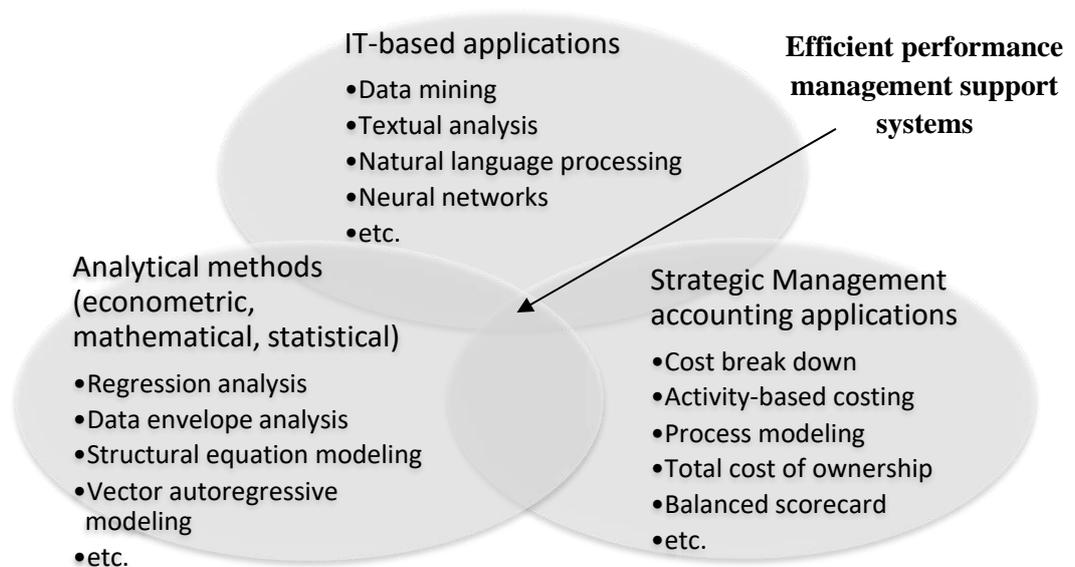


Figure 5. Performance management support systems according to Schl afke et al. (2012)

Fukushima & Peirce (2011) propose a hierarchical analytical framework for improving performance through decision-making and performance measurement. They highlight the importance of knowing past performance and the causal relations between business performance and performance metrics. Strategy maps, like those that were discussed previously in chapter 2.2 of this thesis, can be generalized to tree structures (Figure 6) that break down the composition of factors affecting a financial performance measure.

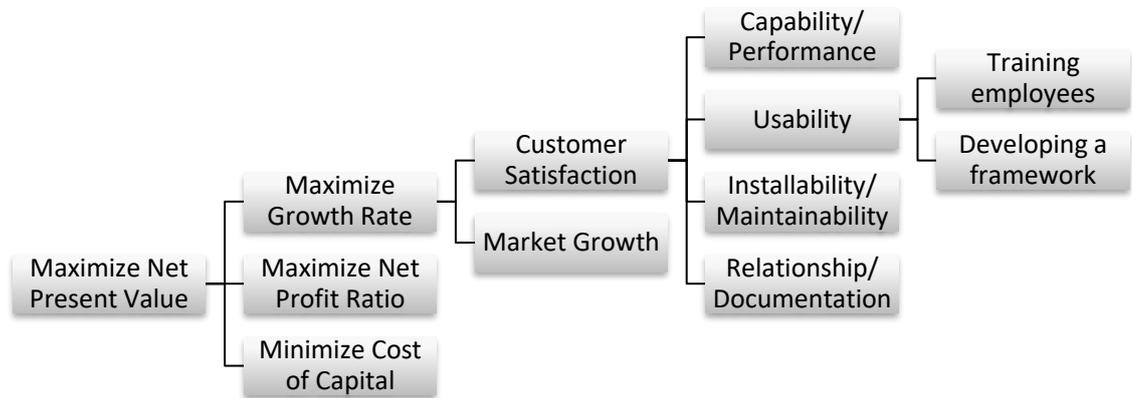


Figure 6. Abbreviated hierarchy of objectives for a generalized computer manufacturing company like presented in Fukushima & Peirce (2011)

Furthermore, this tree structure can be used to construct an analytical model of business performance. A simple multiple linear regression model or artificial neural network classifier could be applied to determine the weight of each node in this hierarchical tree structure, and that would enable focusing on the most important determinants of performance. Let's say that the customer satisfaction in Figure 6 is determined by following multiple linear regression model.

#### *Customer Satisfaction*

$$\begin{aligned}
 &= 0.26 * Reliability + 0.91 * Capability + 0.5 * Usability \\
 &+ 0.022 * Installability + 0.16 * Maintainability + 0.33 \\
 &* Performance + 0.079 * Documentation + intercept \alpha \\
 &+ error term \varepsilon
 \end{aligned}$$

In that case, we would know that a one-unit increase in capabilities offered by the product have more significant effect on customer satisfaction than a similar increase in maintainability of the product. We would also know that improvements in usability and performance are way more important than improvements in documentation or installability of the product, provided that all improvements vary in a similar range. Combined with cost information of possible improvements, we could determine the most cost-efficient way of improving customer satisfaction. The importance of similar analytical models is highlighted in Rompho (2012), who claims that strategy maps alone do not provide deep

enough information to improve decision-making. He argues that any manager could point out that higher customer satisfaction yields higher customer retention and that higher market share can cause higher revenue. The more relevant question is by how much these improvements improve some aspect of performance.

Laamanen (2005) lists some challenges and risks associated with monitoring corporate performance. These challenges are:

- Measuring guides decision-making towards disadvantageous decisions.
- Allocating resources to measure something that is not strategically relevant.
- Measuring individual performance might undermine human relations and cause burnouts.
- Deciding between quantity and quality.
- Measuring quantity in organizations that have high standards regarding quality undermines motivation.
- Measuring things that cannot be influenced or acted upon.
- Monitoring too carefully and acting too rapidly.
- Wrong interpretation of performance index.
- Finding excuses for poor performance.
- Goals are dragging down the performance.
- Putting too much emphasis on poor data in decision-making.

Of these challenges, the first two are likely the most significant. Without balanced and robust measurement systems, companies are likely to put too much emphasis on single indicators that guide decision-making towards undesired outcomes. For example, based on the price criterion procurement unit may buy large amounts of cheap components, which may cause issues later if they turn out to be of poor quality. Measuring something that is not strategically relevant may guide the organization to a sidetrack and take attention out of strategically important things.

### 3 DEFINING PERFORMANCE METRICS

This chapter introduces to the key concepts of performance measurement, digging deep into individual metrics and how to select and combine these metrics to a measurement system. This chapter looks for theoretical answers to the supportive question 2:

*How can performance metrics be built and what are performance management systems?*

At the end of this chapter, several alternative frameworks of performance measurement are discussed. These frameworks elaborate on the content presented during the first half of this chapter, discussing how performance measurement systems could be constructed. Finally, these frameworks are compared, and a summary of findings is provided.

#### 3.1 Elements of measurement

Rantanen & Holtari 1999 note that if one wants to know about a phenomenon, the properties of that phenomenon should be measured. In other fields than businesses, measured properties are e.g. size, color, shape, temperature, weight, space or quality. If you are less interested in the phenomenon, you will not spend much time, efforts or resources on the measurement. However, if the phenomenon is very essential, then the aim of the measurement is to be accurate and avoid mistakes. Measuring can therefore happen randomly, instinctively or predetermined, guided and systematically. The other way is not necessarily the better one, but accurate measurement is seen essential for good decision-making. The ultimate purpose of measuring performance is to support decision-making by producing useful information from the desired assessment and measurement sites, because successful decision-making requires good and reliable information.

Laamanen (2005) identifies 11 key reasons for measuring performance. These reasons are:

1. Identifying change in time.
2. Balanced planning of operations.
3. Analyzing efficiency for decision-making.
4. Efficient communication of made decisions.
5. Delegation, oversight and allocation of responsibility.
6. Monitoring performance and adjusting accordingly.
7. Inspiring and righteous compensation.
8. Efficient execution of development projects.
9. Provoking change.
10. Organizational learning.
11. Convincing the customers and the owners.

Karhu (2005) also summarizes some surveys by Finnish scholars. These surveys investigated the use of performance measurement in Finnish companies. The main purposes for organizations to use performance measurement were:

- Development of activities
- Instructing activities and employees
- Evaluating the performance of operations
- Motivating of employees
- Communicating of the business strategy and objectives
- Detecting problems
- Producing information supporting decision-making
- Enables incentive schemes
- A general interest in the company

In both surveys, the personnel related matters were among the most important use cases for performance measurement. It was also discovered that employees and managers use performance measures in different ways and for different reasons. Personnel are therefore an important factor in companies and performance measurement is significant, especially in guiding and motivating employees. (Karhu 2005).

Rapid changes are easily observed even without monitoring performance. It is the slow development of operating environment that creates a nearly invisible threat to business operations. Without constant observation, slow decline of customers trusts or falling behind competitors in technological development is usually noticed only when it is too late to react to. Those organizations that monitor their operating environment actively can anticipate future developments and react accordingly. By balancing the interests of stakeholders, such as customers, owners and personnel in decision-making the company can sustain its market position in long-term. Analyzing the efficiency enables enlightened decisions. Too often companies monitor only their own performance. While this provides a good understanding of historical development, benchmarking is important to keep track on performance development compared to the other companies in the markets. (Karhu 2005).

Performance measures can be classified by many ways. One widely used way is to divide them into financial and non-financial. Traditionally, the performance areas have been seen by merely financial dimensions. However, the need for non-financial dimensions has been identified as early as in the 1980s, when growing global competition made it essential to use non-financial indicators to improve business performance. (Lönqvist et al. 2006; Laamanen 2005; Neely 1998) Action taken to develop performance is most often carried out in the hierarchy at the lowest levels. At these lowest levels, performance measurement is largely done by non-financial dimensions. Though the significance of these physical indicators decision-making is now known, their usability is not always self-evident. The problem with physical meters is that they do not necessarily reflect on financial indicators. (Rantanen & Holtari 1999)

Financial indicators are based on money-measured data. They help organization to steer towards its business goals and to control the realization of financial targets. Financial indicators are generally accepted, and their measurement is relatively easy, as most of the measurements can be calculated from the financial statements. Examples of financial indicators are the profit margin and return on investment. However, traditional financial indicators have received much criticism from their too short-term and narrow perspective, which does not guide long-term success. Financial indicators are often considered too difficult to understand from staff perspective, as they do not report operational errors in

the work. Although financial indicators have been criticized, they are still the most used tools for measuring performance. This is because the use of financial indicators has become established in organizations and their use is the easiest approach to measurement, as the billing rules have stabilized. (Lönqvist et al. 2006; Laamanen 2005; Neely 1998)

While the need for non-financial indicators has long been known, their adoption in companies has been very sluggish. Non-financial indicators allow for a more inclusive measurement of the organization. Comprehensive measurements make it possible to take better account of the different areas that are not based on monetary information. The benefit of non-financial indicators is their easy adoption and thus facilitates the communication of real things. Such indicators include, for example, delivery time and cycle time. Non-financial indicators have common weaknesses with financial indicators, as both can cause departmental optimization. On the other hand, weaknesses in non-financial indicators are identified by the non-standardization of counting policies, which makes them not comparable between organizations. (Lönqvist et al. 2006)

The significance of performance aspects and the indicators that describe them varies from one organization to another and by the examiner. It is obvious that a financial specialist has different opinion than an engineer. Performance measurement systems are based on dividing performance into smaller parts, so measuring and finding cause and effect relationships are easier to detect and better results can be achieved. Whether the measurement of a performance component is necessary or important depends on the nature of the organization or the organizational level of the unit being analyzed. Obviously, measuring profitability is more reasonable at higher levels than individual person or a machine. Similarly, measuring quality is important at individual performance levels, but at the level of an organization it is not as meaningful as it is. Marketing also focuses on different performance areas compared to the production line. However, the breakdown shown here does not fall within the scope of the reviewer. For example, the company itself can analyze both its external and internal performance. The performance indicators used can also have the same internal and external performance. In this case, the item to be measured changes the point of view - for example, the percentage of return on capital in a particular department depicts internal performance and describes the overall performance of the entire enterprise. (Rantanen & Holtari 1999; Laamanen 2005)

Other classifications have been proposed in literature. For example, Lönnqvist et al. (2006) have divided performance measures to objective and subjective measures. Objective indicators are based on quantitative information on the organization's performance or its results, while subjective indicators are based on the estimate of the measure of success. Most often, financial indicators are objective indicators and subjective are non-financial measures. Objective meters usually do not give enough extensive measurement information for decision-making, while subjective ones do not always give enough accurate picture of success factors. Other divisions are splitting measures into hard and soft measures or into direct and indirect measures. Hard meters are based on unambiguous values, such as business transactions, execution or performance. Soft indicators are based on people's attitudes, views and feelings. Indirect measures are used to help measure the performance of actor that cannot be directly measured, but something that is known to be closely related to the subject of the measurement can be measured. Productivity is an example of indirect measure that is illustrated in figure 7.

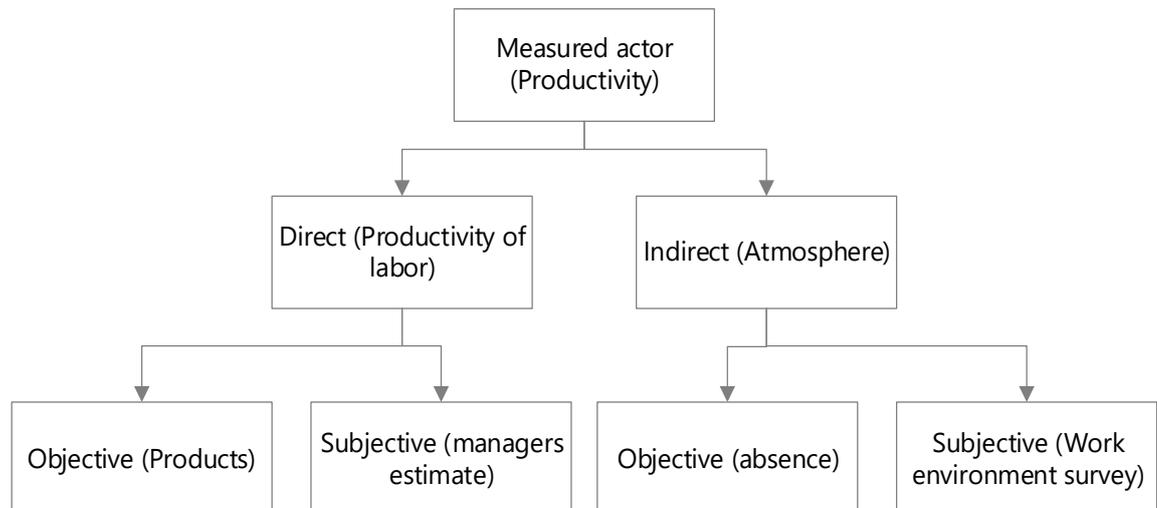


Figure 7 Different approaches to measure productivity. (Lönnqvist et al. 2006)

Some of the features of the metrics selected to improve performance can be very self-evident. However, it is important to consciously identify different aspects that effect measuring, and measures when selecting meters. Organizations use too often obscene and inaccurate gauges, which are used to spend a lot of time and effort. On the other hand, the meters may have been introduced at some point and have remained in use even though

they no longer need them. Due to the functionality of the performance measurement system, it should be constantly updated and monitored. The usability and need of the indicators must be constantly questioned. (Rantanen & Holtari 1999)

### 3.2 Premises for measurement and system design

Measuring requires data collection. Information about a phenomenon or system can be collected by at least three basic ways, which are surveys, observation, and gathering pre-collected secondary information from existing sources such as information systems. The measurement can therefore be based, for example, on a questionnaire, cost, time, customer estimates, checklists or photography. The results of measuring are generally a ratio or a qualitative comparison. Often, the results are more useful to handle and present, for example, as an image in the form of a trend graph, scatter diagram or parcel diagram. The goal or benchmarks shown in the images make it easier to interpret the results. The measurement process can be phased in as shown in Figure 8. (Rantanen & Holtari 1999)

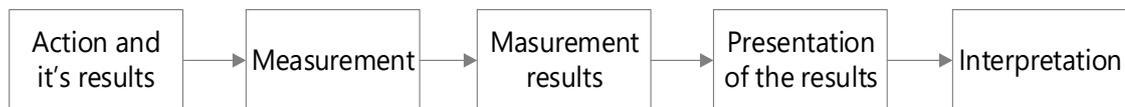


Figure 8 Measurement process (Rantanen & Holtari 1999)

Things to measure in performance management are often referred to as a success factors. In this case, the company's performance is examined at the level of success factors. Success factors are those issues relevant to business strategy and can be identified in every organization. Success factors can be further divided into critical success factors that are the key business areas for a company to gain high performance in order to achieve success. All success factors create together a cause-and-effect relationship and they can be divided into causal factors and effect factors. It is important that the causality is seen as the main reason for consequence effects, even if they are supposed to act only after a long period of time. The effects are usually seen as the actual business objectives and results. For example, customer loyalty can be a cause for sales volume and employee skills can be a cause of effective action. Sometimes a single success factor can be both cause and

effect factor. Profitability is one example of this kind of success factor. However, recognizing success factors properly is far more important than classification of these success factors. (Lönqvist et al. 2006)

When designing a business performance measurement system, few aspects are essential to be considered. There are some basic criteria for the meters to be met to guarantee the quality of performance measurement system. According to Lönqvist et al. 2006 and Huuhka 2016, these factors are:



Validity as a design criterion of performance indicators stands for describing the ability of the indicator to measure the success factor that it is pointed out to measure. If the meter's validity is poor, the meter may have an incorrect assumption. Behind this is the idea that the measure has a feature that the factor of success and the measuring system are different things since one success factor can be measured by more than one meter. When validity reflects to a systematic error associated with the value of the meter, reliability describes the random defect of the indicators value. The results of the reliable indicator are consistent and do not vary randomly. This means that the results must be consistent when measuring is repeated. Reliability and validity are strongly related, since if the meter has poor reliability, its validity will not be met either. Similarly, if the meter's validity is weak then the reliability is not of great importance. (Lönqvist et al. 2006)

The design criteria that differ from the validity and reliability are relevance and practicality. The meter's relevance describes whether the meter is essential to the user's needs. Strategic measurement, for example, should only select success factors that are important to the strategy and to be measured. Relevance can be defined more broadly, for example, so that the user feels it is important. In both cases, irrelevant meters do not produce value for the user of performance measurement system. Relevance is also influenced by the situation and purpose, as in some situations it is more important to get certain information than some other than in any other situation. The organization must select indicators that are relevant to use for its performance measurement system. The practicality criteria mean how easy or difficult measures are to use. In practice, the meter must be useful in the

decision-making situation and thus necessary to measure. Also, if the meter is not relevant it is also not practical. On the other hand, even if the meter is deemed necessary, it is always necessary to reflect on the cost of collecting the data. If the measurement of the meter's data and the calculation of the value causes a greater burden than the probable benefit, the meter can be considered unnecessary. Defining cost-effectiveness is always case-specific and its cost-effectiveness must be determined by the person responsible for the measurement. (Lönqvist et al. 2006; Huuhka 2016)

Neilimo & Uus-Rauva (2005) supplement the characteristics above by describing what kind of criteria must be met for information to be useful and efficient for decision-making. They have some criterion to be added – timeliness, accuracy and visualization. For decision-making it is essential to get information on three levels:

- Information about the situation e.g. the business environment and the business itself
- Information on quantitative and qualitative objectives
- Information about methods and technique to achieve objectives

### **3.3 Designing a performance measurement system and operating principles**

Designing a performance measurement system can be very challenging regarding all the dimensions and breakdowns discussed above. When designing a performance measurement system, it is crucial to make the measuring system balanced. Balancing means that different dimensions, such as time, financial and non-financial and cause-effect relations have been noticed and taken into account. (Neely 1998; Rantanen & Holtari 1999) Another challenge is to choose measures right so all the needed criterion for measuring have been fulfilled so the output of measuring process can be useful for managerial needs. To develop a functional performance measurement system, it is important to understand in addition to the elements of measures and performance how the measurement system must be developed and to maintained.

Academic literature has proposed a wide range of different implementation processes for performance measurement systems. The traditional performance measurement implementation processes are very multi staged especially in BSC implementation process.

This kind of multi staged processes have been proposed in research papers of Neely et al. 1995 and 2000. Neeley's original process description consists of nine phases, listed below.

1. Define company's mission.
2. Identify company's strategic objectives by using the mission.
3. Developing an understanding of functional area's roles in achieving those identified objectives in the company.
4. Developing performance measures that are capable to identify company's competitive position by measuring
5. Communication of objectives and performance measures to lower levels of organization.
6. Assuring the consistency with strategic objectives among the performance criteria used at each level.
7. Checking the compatibility of performance measures to functional areas.
8. Using the performance measurement system to identify the level of businesses performance and problem areas.
9. Developing performance measuring system by re-evaluating measurement system.

The length and many multiple stages of the traditional performance measurement implementation processes make them too harsh to use in SMEs that operate in a rapidly changing environment. These kind of implementation processes take too much time and other resources such as personnel that is problem in SMEs that usually lacks resources. That is why in SMEs it could be better to use project models that are less staged and gives more flexibility to design project. (Pekkola et al. 2016) This kind of shorter projects have been proposed in the literature by Bourne et al. (2000) and Laamanen (2005) have proposed more compact implementation project model that consist of three main phases that contain phases of other performance measurement project models but is still more flexible to use.

Project model by Bourne et al. (2000):

1. Designing performance measures
2. Implementing the performance measures
3. Using the performance measures

Project model by Laamanen (2005):

1. Data collecting and warehousing about circumstances, processes and stakeholders.
2. Data preparation and analyzing, making choices and identifying measures.
3. Representing measures and testing them.
4. Agreeing on goals, working in processes and making changes.
5. Monitoring, reviewing, evaluating and improving.

When designing a performance measurement system, it is crucial to document the operating principles of the measures and the performance measurement system. It is a prerequisite for key figures to be used effectively in management. According to Neilimo & Uus-Rauva (2005) This includes at least the definition of:

- Who is responsible of the composed result and where is the value managed (e.g. management group)?
- What is the target value, the critical limit value and the rules for estimating the outcome?
- Where is the data collected from and how the results are visualized?
- To whom and how often will the results be reported?
- What are the calculating principles for the measures and who is responsible of counting?
- What are the risks of partial optimization?
- What are the means to achieve the goals?

Neely (1998) discusses in his book *Measuring Business Performance* about questions to ask when designing a performance measurement system. His approach toward designing is quite similar to Neilimo and Uus-Rauva (2005) as they highlight defining the operating principles when designing a performance measurement system. Neely divides the questions into five categories that are measure, purpose, target, formula and frequency. Measure includes the questions of what the measure should be called, is the name easy to understand and does it explain what the measure is and why it is important. Questions that define the purpose are defining the aim of the measure, why it is chosen and what kind of behavior does it encourage. The category target defines the eligible level of performance, desired time to achieve eligible level and how the level of performance compare to the

competition. The formula includes questions of how the measures are counted, how data to be collected and by whom. Also, this category includes aspects of how accurate the data should be. The last category is frequency and it includes questions about how often should measuring be repeated and reported.

Same approaches can be found by Huuhka in her book from 2016. She states that performance management system should be based on strategy and after deciding performance areas and objectives it is essential to decide how it is going to be measured, where the measuring information will be gathered, how information will be reported and how often, how the measures are used, who is responsible and is benchmarking needed.

Performance measurement can be seen as four main stages that repeat themselves. These stages are illustrated in figure 9. The first stage is designing the performance measurement system. The designing phase is about deciding what to measure and how. Next phase is about taking the measurement system into use that consists of training within organization and employees. Third stage is the utilization itself and it means that organization will use the measured information in decision-making processes. Last phase is the maintaining and it consists of decisions about updating the measurement system e.g. deciding new more relevant measures and removing old ones. When measuring performance, things illustrated in the middle of figure 9. must be considered in every phase. Those things are people that are measured (also stakeholders), processes that are measured, the needed infrastructure and the organizational culture that effect measurement. (Neely et al. 2000)

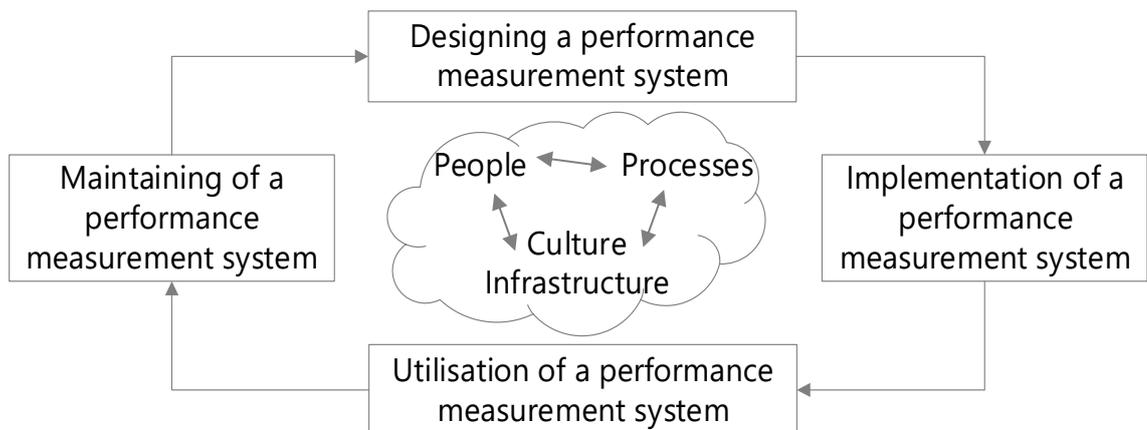


Figure 9 Four stages of performance measurement (Neely et al. 2000)

### 3.4 Performance management systems

When talking about measuring performance, this term means anything from a single measure to a comprehensive measurement of the whole organization. Rantanen & Holtari (1999) report in their report that individual indicators or indicators give a picture only of a part of a business and is thus always deficient. Individual gauges always reflect a certain perspective and a set of individually-selected indicators form an unbalanced image of the company's performance. To obtain a holistic image of the company's performance, more than one measure should be used in a way that the whole scorecard is balanced and considers the company's stakeholders and dimensions. Only by taking all the relevant dimensions into account it is possible to make the decision-making effective. Complete performance measurement system may not have overlaps. Even though single indicators would seem to be useful at their own, a combination of them may not be sufficient. Theorists have developed a number of ready-made model models and methods for this purpose. These ready-made metrics are often referred to as PMSs, most notably the BSC, Lynch and Cross's performance pyramid and performance matrix. (Rantanen & Holtari 1999) Here is a brief summary of these and a few other performance analysis systems that also take into account the Finnish perspective and SMEs.

BSC is a performance analysis system developed by Kaplan and Norton in the early 1990's (Figure 10.). With Kaplan and Norton being the most prominent strategy experts in their time, they developed a BSC management strategy that helps the company achieve strategic goals with a metrics that consider the different performance areas. (Rantanen, Holtari, 1999, Kaplan, Norton, 1996) The toolkit consists of four perspectives: the perspective of innovation, learning, and financial, customer, internal processes and enterprise. The financial aspect describes how well the strategy has been financially realized, i.e. whether it has succeeded in creating value for the owners. The financial aspect represents the financial indicators of the old school, such as ROI, growth in operating profit and equity ratio. Customer's point of view is customer satisfaction, for example, the quality of the product or service experienced by a customer. In terms of internal processes, it means how processes succeed in satisfying customer needs. This measure can be, for

example, the process lead time. The latest point of view, that is, the perspective of innovation and learning, describes the organizational capacity of the organization to meet the changing needs of the customer. (Kaplan & Norton 1996)

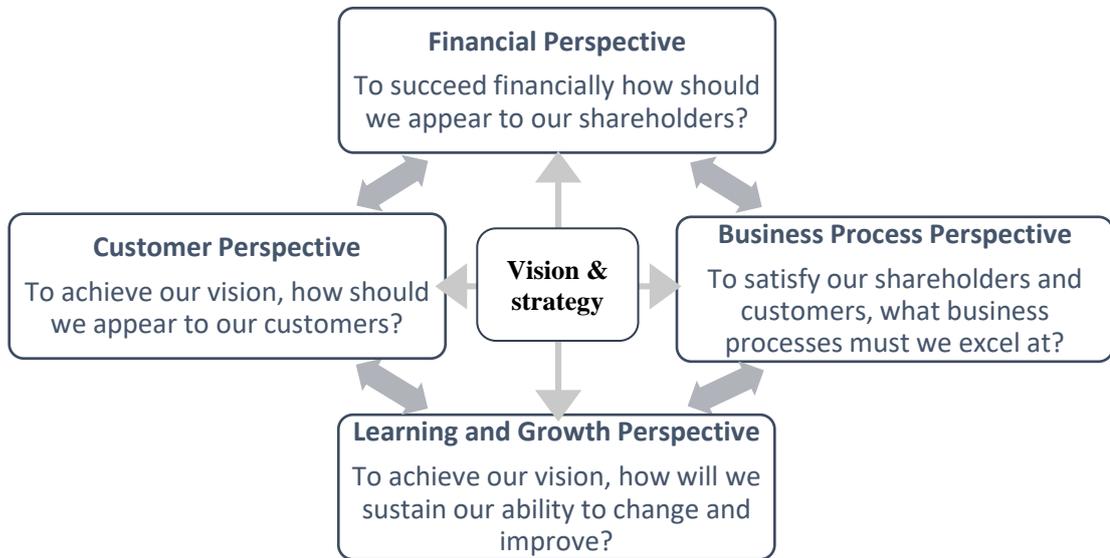


Figure 10 Balanced scorecard according to Kaplan & Norton (1996)

Behind the name of the BSC is the idea that the instrument takes a broad and balanced view of many perspectives. Controlling short-term financial results and simultaneously controlling processes will create the competence to achieve financial performance in the future. In practice, learning and innovative staff enables short lead times and high-quality processes. High quality processes continue to enable timely deliveries that increase customer loyalty. Customer loyalty, in turn, creates financial performance. Thus, the metrics creates the cause-and-effect relationship between the perspectives of the chain of relationships described in Figure 11 The BSC is designed to support strategy work and decision-making, and to communicate strategy to staff. Currently, the PMS gives feedback and teaches the success of the strategy, which is what the inventors think is the most important feature of scorecards. (Kaplan & Norton, 1996)

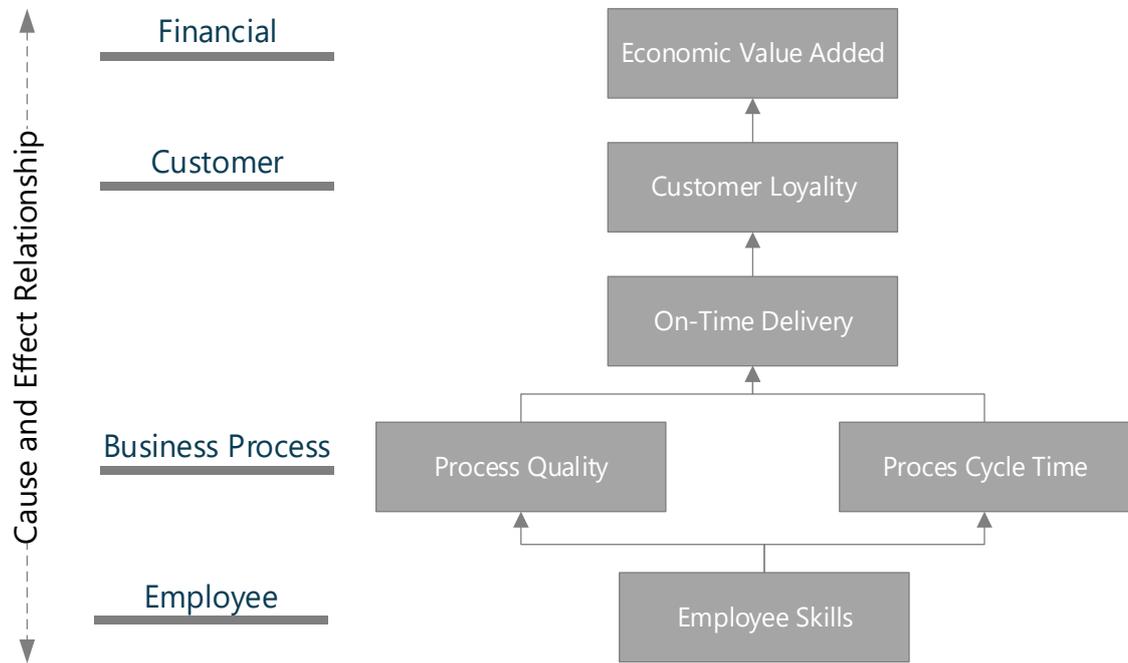


Figure 11 Cause-and-Effect relationship in BSC

The performance pyramid (see Figure 12.) was developed on early 1990s and later improved to its current appearance by Lynch and Cross in 1995. The performance pyramid combines strategy and activities by converting customers objectives hierarchically from top to bottom and performance indicators, respectively from down to up. The performance pyramid contains both perspectives of internal and external effectiveness and four levels of an organizational hierarchy that are business units, core business, groups and individuals. Each hierarchy level has its own performance indicators that cover both of internal and external effectiveness. The complete pyramid is based on by defining the company's vision when developing the measurement system. Then company's vision can be divided into business units' market and financial goals that represent business unit's hierarchy level. The strategy is defined to achieve this goals and other way around the indicator for the market and the economy helps to track how company's vision will be realized. The same way on the level below the market and financial goals can be achieved by implementing. And so on, each level of the hierarchy consists of fulfilling the objectives of the previous level as shown in Figure 12.

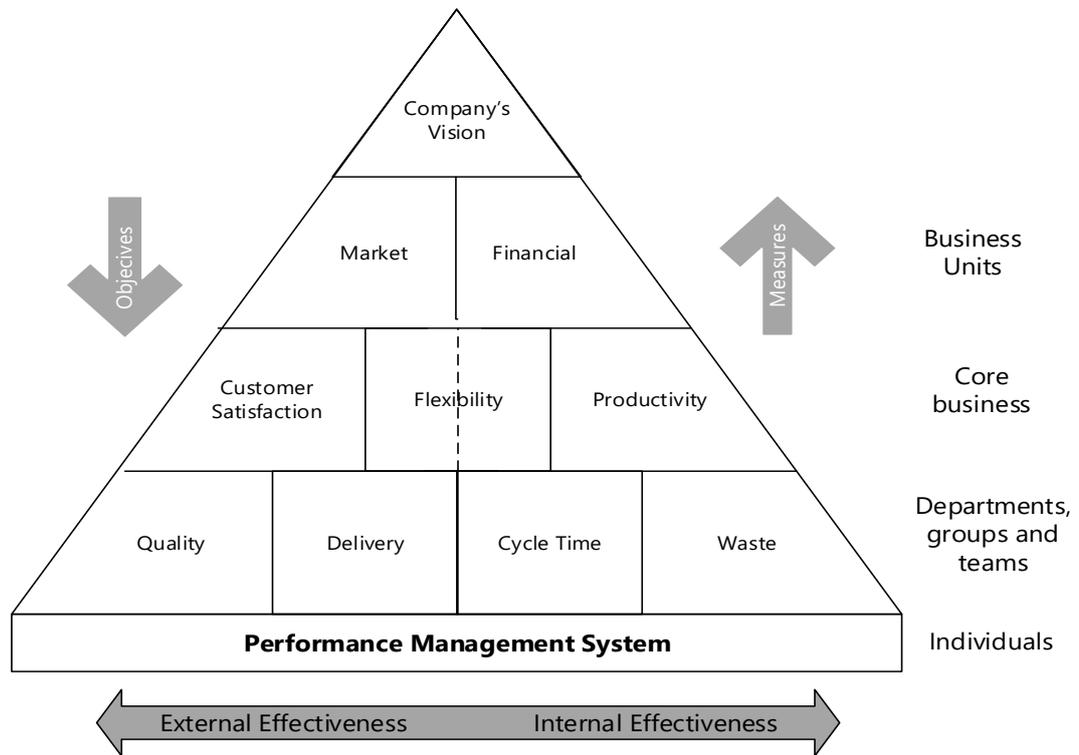


Figure 12 The performance pyramid

The performance matrix usually consists of three to seven critical productivity factors, i.e. performance section, and their indicators. The figure 13. illustrates the logic of the measurement system. For each indicator there must be defined a scale for giving points from 0 to 10 to each of the performance metrics. Each performance metric is given a weight to count its total score. The sum of weight values must be 100. The individual points are then multiplied by weights and their sum is the total performance index. This value is compared to past development or target values. The performance matrix is tailored to fit each situation. Matrix results are not comparable between companies, but comparison can only be made internally. (Rantanen 1999)

Measures	Measure 1	Measure 2	Measure 3	Measure 4	Points
	Seasons results	635.16	84.5%	45	
Reference value	800	100	60	100	10
	765	95	55	90	9
	730	90	50	80	8
	695	85	45	70	7
	660	80	40	60	6
	625	75	35	50	5
	590	70	30	40	4
	555	65	25	30	3
	520	60	20	20	2
	485	55	15	10	1
	450	50	10	0	0
	X	5	6	7	3
=	30	35	15	20	Weight
	150	210	105	60	Weighed total
	Performance index				<b>525</b>

Figure 13 The performance matrix

Operating a small and medium sized company can be very challenging. Continuously changing need of customers and tightening competition between companies create very turbulent environment to operate in. Growing instability sets new challenges to management and especially performance measurement and management. The traditional BSC has been seen in small and medium sized companies very rigid for changes and unsuitable as growing instability in SMEs that has created need for more flexible PMS. Also, traditional eleven step implementing processes are too heavy for SME because it is very resource intensive system. That can cause that designed PMS is already old when completely implemented. An SME as an organization sets its own challenges to implementation. SMEs employees and management are extremely hard to get on board with implementation of a new measurement system and usually there is a high risk of using measurement information or scorecard wrong. Other challenges are that PMS is used correctly but it doesn't suit the situation or changes are done to the PMS that are not thoughtful decisions. Flexible performance measurement system was created by operating experience of BSC in one SME company. The case company was designed a seven-dimensioned scorecard that included internal and external measures and it considered the reason-cause

effects. A rapidly changing environment and tightening competition led the company to use three main meters and some support meters. This resulted in the FPM (figure 14.), which takes better than the BSC into account owners, flexibility, changes and operational operations. The main idea of the PMS is that it consists of a few of the financial metrics that do not change as the strategy or the situation changes and the support meters that are redesigned in a changing situation or strategy. The purpose of the key financial meters is to secure the profitability of the company in the long run, while the support meters ensure the implementation of the strategy. (Pekkola et al. 2016)

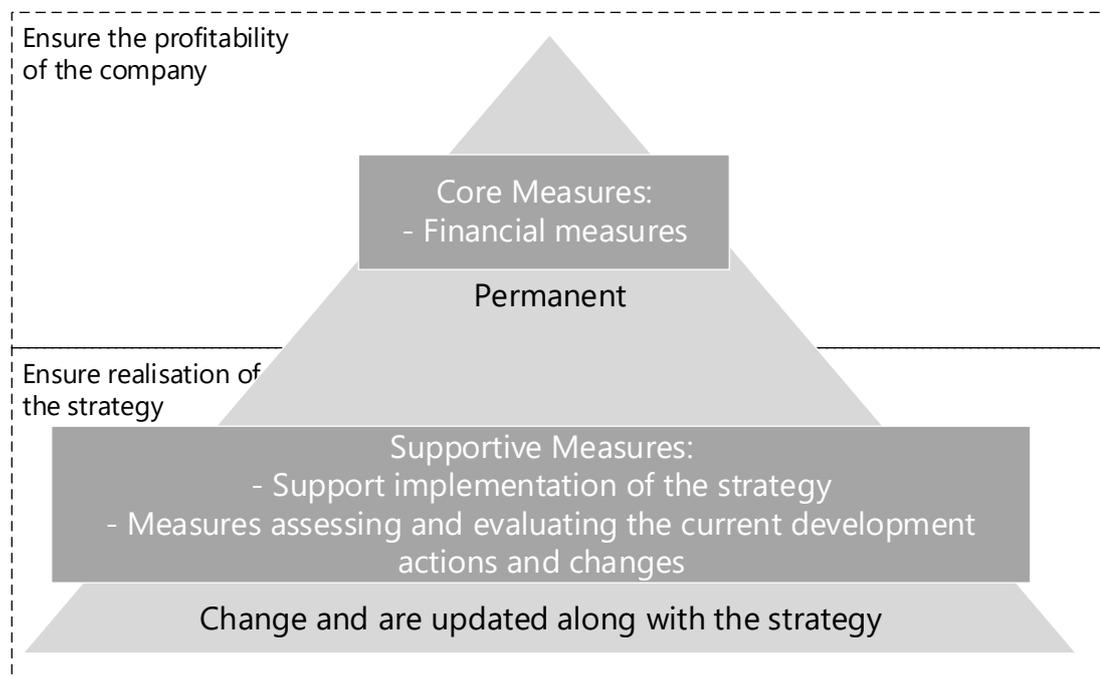


Figure 14 Visualization of flexible performance management

Dynamic performance measurement system is another PMS designed for small and medium sized companies though it is suitable for organizations of all sizes. The system was designed in Finland by Erkki Laitinen. This measurement system considers the internal and external factors and it strives to monitor the dynamics of the company by following the resource flow in the company from the cost of production factors to competitiveness and financial performance (figure 15) The process is formed so that the steps follow each other causally. The chain reaction illustrated in the model describes how internal performance affects external performance, the process returns from an external dimension to the first internal dimension, cost structure. The dynamic performance measurement system is based on the logic of resource utilization. It includes two external and five internal

performance sub-areas. External are financial performance and competitiveness. Internal are cost, production factors, products, functions and revenues. The principle of the model is to track the flow of resources within the company and to study their change during processes. According to Laitinen, the measurement must be dynamic for the management to learn to identify the causal relationships in which successive strands affect each other's performance. The advantage of the model is its easy modification, for example by considering environmental impacts as an external component. The template is easy to modify and further develop. For example, a dimension could be added to the model, considering environmental impacts. (Laitinen 2002)

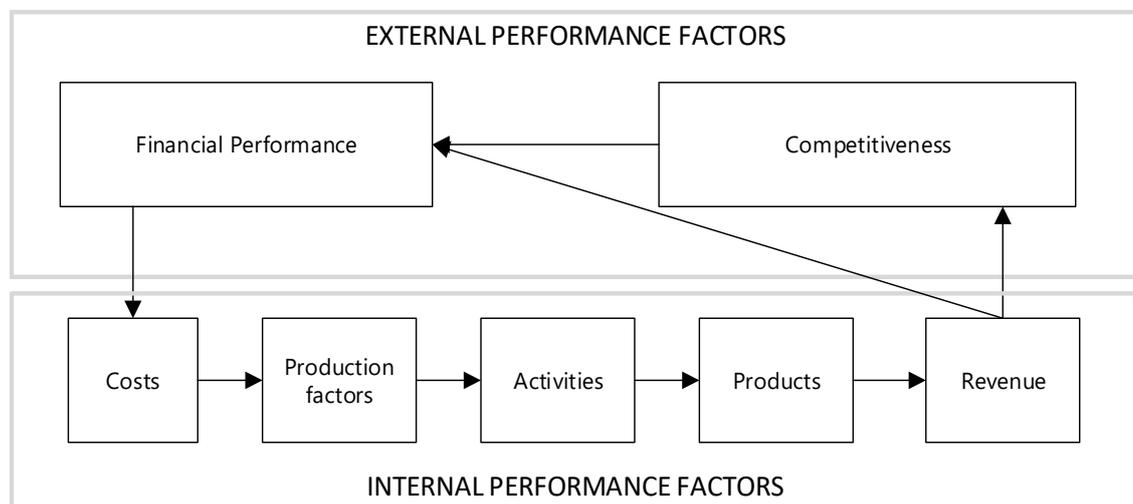


Figure 15 Dynamic performance management system (Laitinen 2002)

Performance measurement systems help to understand the concept of performance measurement. They show the importance and meaning of dimensions and cause-effect relationships. Especially if someone is not familiarized with the PM concept, measurement systems are the best way to explain what performance measurement means. Performance measurement systems also visualize the set dimensions for company's PM that may be the only use for them at this century. As different software designed for measuring company's performance evolve, need to use these before the 2000s developed measurement systems decreases. These frameworks might be the most useful at the designing phase of an implementation. Without a performance measurement framework, there is a risk to choose measures poorly, that can make harm in decision-making when using them. Use of performance measurement frameworks can be also used for visualizing the structure of performance measurement system. A well-done visualization may help when training

the organization. The decision to make between different frameworks must be done so, that the result would suit best in the measured organization. this choice is influenced by industry, company size, and resources available. In table 1 it is summarized the features of presented frameworks.

Table 1 Performance management system features

<i>PMS/ Criteria</i>	<i>Dimensions</i>	<i>Pros</i>	<i>Cons</i>
<i>BSC</i>	Time, Financial, non-financial aspects, cause-effect, 4 perspectives	Widely used framework for PM, considers cause-effect relations	Implementation projects usually too long and heavy for SMEs.
<i>Performance Pyramid</i>	10 perspectives, internal and external effectiveness, 4 levels	Considers multiple dimensions.	Many perspectives that may not be essential for every business.
<i>Performance Matrix</i>	Objectives, critical success factors	Gives a concrete value to the overall result of organizations performance, which can be compared seasonally	Seems to be very heavy to implement and to use.
<i>FPM</i>	Financial and non-financial measures	Ideal to implement in SMEs.	Being simple, allows to ignore cause-effect relations
<i>Dynamic PM</i>	7 perspectives, internal and external effectiveness	Simple way to balance a scorecard.	May be hard to understand among employees.

### 3.5 Supply chain performance management

According to Richards (2014), performance of supply chain should be measured to

- ensure customer satisfaction
- cultivate a culture of continuous improvement
- discover potential issues before they become major problems
- identify the right areas in which to train staff
- reward staff for good performance

He also notes that it costs six to seven times as much to get a new customer than it does to retain an existing one. Reliability, including on-time delivery, fill rates and accuracy, is vital to a good customer experience and thus customer retention. In a modern world, customers expect rapid and flexible deliveries. Therefore, SCM is a key competition factor separating the successful from the unreliable. Customers also talk to each other through internet looking for reference. One bad experience may outweigh multiple good ones when customer decides between providers. Conventional performance metrics listed by Richards (2014) are:

- Labor hours utilization
- Warehouse area utilization
- Material-Handling Equipment (MHE) utilization
- Units picked per hour
- Dock-to-stock time
- Order accuracy
- On-time shipments
- Order fill rate (orders filled completely on first shipment)

Based on these conventional metrics, new KPIs have been developed by aggregating them. Commonly used metrics include On-time and In-full (OTIF) and perfect order metric. OTIF is calculated as a multiplication of fill rate and on time shipment percentages. Perfect order metric is calculated as a product of on-time delivery (%), in full delivery (%), damage free (%) and accurate documentation, labelling and invoicing (%). Richards (2014).

Dweekat, Hwang & Park (2017) list common problems in supply chain performance measurement:

- Lack of connection with strategy and a clear distinction between metrics at the strategic, tactical and operational level
- Lack of a balanced approach to integrating financial and non-financial metrics
- Focus on the local optimization instead of a comprehensive SC context
- Incompleteness, inconsistencies and absence of relational structures in performance measurements and metrics
- A large number of metrics, which makes it hard to distinguish the critical from the trivial
- Too inward-looking and focusing insufficiently on external parts (customers, suppliers, competitors)
- Being static, too short term and profit oriented

Before introducing their conceptual, fuzzy SC performance measurement method, Chan et al. (2003) list some commonly used quantitative and qualitative metrics of SC performance. Of these, flexibility, i.e. the degree to which the SC can respond to sudden changes in demand, and integration of information and material flow are the most interesting ones. Qualitative in nature, these are hard to quantify and measure numerically but should be considered when thinking about the overall quality of SC. Of quantitative measures, most can be generalized to min/max optimization problems. For example, cost minimization, profit maximization, product lateness minimization and capacity utilization maximization are some aspects SC managers should focus on when designing metrics for SC performance evaluation.

Elrod (2013) divides traditional measures of SC performance to cost, quality, time and flexibility measures (Table 2). Each measure is introduced with definition, benefits, limitations and managerial implications. For example, tracking shipment errors identifies when and where these errors occur and may help to reduce them, but the root cause of the error is often difficult to isolate. These are satisfaction decreasing events and should be eliminated.

Table 2 Traditional supply chain measures by Elrod (2013)

MEASURE NAME	BENEFIT	LIMITATION	MANAGERIAL IMPLICATION
<b>COST MEASURES</b>			
INVENTORY COST	Bring low inventory levels to avoid warehousing and inventory costs	Often cannot be zero but can be used to minimize safety stock levels	Accurate forecasting and decreasing inventory reduces inventory costs
RETURN ON INVESTMENT (ROI)	Higher ROI implies profits on the investment, encouraging new investors	Difficult to measure	ROI is often used to make go/no go decisions, should be evaluated closely
<b>QUALITY MEASURES</b>			
SHIPMENT ERRORS	Identifies the errors and assists in reducing them	The root cause of the error is often difficult to isolate	These are not value-adding events and should be eliminated
ACCURACY	Helps in identifying the accuracy of producing the new product with minimal waste	Internal measure only and difficult to isolate the cause(s) of inaccuracies	Inaccuracy is a source of costs requiring management action to correct
<b>TIME MEASURES</b>			
ORDER LEAD TIME	Helpful to know so the company can give the customer an idea of wait time	The measure can be misleading because other factors must be considered	This is key in scheduling and in the SC's agility
AVERAGE LATENESS TIME	Identifies the average time for late deliveries which can be used for scheduling decisions	Does not assist in identifying errors	Good overall measure

**FLEXIBILITY MEASURES**

RANGE OF PRODUCTS AND SERVICES	A company with less products in the market may be able to react to demand shifts more quickly	A company with many products in the market may be less likely to be flexible to meet shifts in demand	The range itself is not crucial; the decisions made and reactions to market will affect the range
VOLUME FLEXIBILITY	Identifies response rate to changing demand or product requirements	Can be difficult to calculate until after events	This is less crucial when producing commodities

Theeranuphattana & Tang (2007) extend Chan’s fuzzy model by combining it with SCOR model. SCOR is a framework for supply chain PM, introduced by the Supply-Chain Council in 1996. It is developed jointly by companies and individuals interested in SC and has gained some popularity among researchers (Li et al. 2011; Huan et al. 2004; Persson 2011; Persson & Araldi 2009). The model is built on five core processes – plan, source, make, deliver and return. These five key processes are addressed on three complexity levels, each aiming for more detailed description of the process. Performance in in these core processes is evaluated on five attributes – reliability, responsiveness, flexibility, costs and asset management. These five attributes are also evaluated on three different levels. Level 1 and 2 metrics are more general, describing the overall state of operations. Level 3 metrics are used to detect variations in performance against normal values. Figure 16 illustrates hierarchical aggregation of SCOR level 1 metrics.

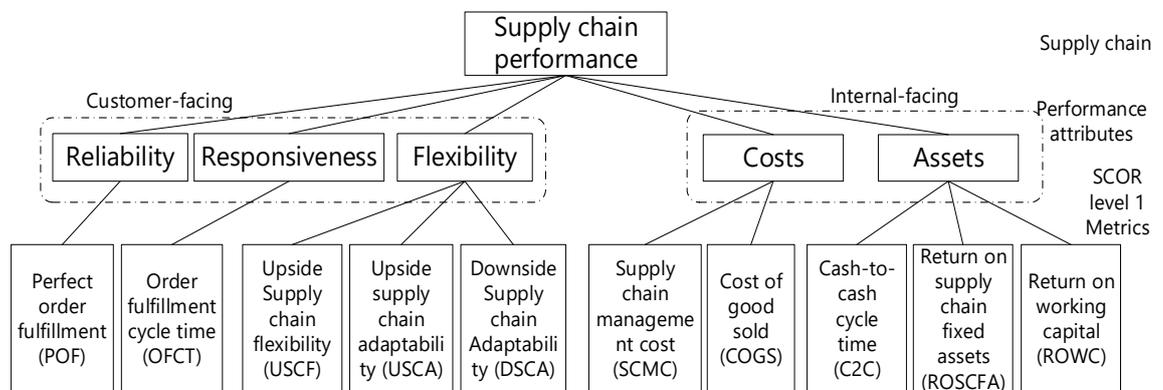


Figure 16 SCOR model

A BSC approach was presented by Brewer & Speh (2000). They divide SCM to four categories – end customer benefits, financial benefits, SCM goals and SCM improvement. Each of these categories is then mapped to a corresponding BSC field. When goals are defined for each of these categories, suitable metrics can be determined based on these goals.

SCM framework		BSC field
SCM goals	→	Business process perspective
Customer benefits	→	Customer perspective
Financial benefits	→	Financial perspective
SCM improvement	→	Innovation and learning perspective

SCM goals refers to waste reduction, time compression, flexible response and unit cost reduction, which form the basic objectives of SCM. The customer benefits perspective refers to the tangible output of the SC, as seen by the customer. This includes product/service quality, timeliness, flexibility of delivery and value added to the customer. Financial benefits perspective discusses the financial implications of SC actions, as seen by the management and shareholders. SCM improvement adds a dynamic layer to the SC framework. It evaluates the learning ability of the organization, and includes product/process innovation, partnership management, information flows and potential threats and substitutes. This SC aptitude is evaluated relative to the competition, as innovations in the market determine the goodness of current methods.

## **4 CASE COMPANY AND CONTEXT**

This chapter introduces the case company, its SC processes, quality management context, ISO 9001 standard and the implemented quality management system where performance measurement system will be developed. This chapter contains more detailed descriptions for the boundaries set on introduction. Chapter aims to explain the starting point for performance measurement and analyze the factors that affect performance measurement in case company.

This chapter begins by introducing the ISO 9001 quality management system, to which this implementation project is strongly related. Then it discusses the case company and its SC processes, which are also illustrated as diagrams in appendix to help reader understand the case company's SC structure. Chapter continues with presenting case company's strategy since chosen performance measures are based on strategy.

### **4.1 Quality management and ISO 9001**

Quality management can be referred to a philosophy that is about identifying and applying best management practices and operating models to develop operations and achieve competitiveness. (Laamanen, 1995) The basic principle of quality management is to emphasize the understanding of customer needs and the continuous improvement of products, services and operations based on customer needs. (Laamanen & Tinnilä 2009)

In academic literature and ISO 9001:2015 standard there is a consensus on the guiding principles of quality management (TQM) – customer orientation, process orientation and continuous improvement. (van der Wielen et al., 1997; Jayawarna & Pearson, 2001; Asarlind & Gremyr, 2016; ISO 9001: 2015) ISO 9001 refers to a standard for a quality management system and is maintained by an international standardization organization. The implantation of ISO 9001 standard can implicate to the stakeholders that company works according to the standard. The ISO 9001 standard includes the requirements on which the organization must act to meet the criteria of the standard and to qualify for auditing. ISO 9001 standard helps organizations improve efficiency and customer satisfaction. (ISO 9001: 2015)

The ISO 9000 quality standard has greatly contributed to quality thinking and quality management in Europe. The purpose of this standard is to systematically work towards higher internal efficiency, and higher customer satisfaction with continuous improvement. The foundation of ISO 9000 is to guarantee the organization's ability to deliver customized products. The ISO 9000 series of quality standards aims to harmonize quality assurance internationally. (Laamanen 1995) The Quality Management standard is based on the principle of continuous improvement and its revised version 9001: 2015 focuses more on risk management. Standard is suitable for all types of organizations regardless of size. Benefits and Prerequisites of the Quality Management System are (ISO 2015):

- Overall evaluation and management
- Setting targets and detecting new business opportunities
- Producing products and services that meet customer requirements
- Increased customer satisfaction
- Guiding to identify and prepare for the risks
- Compliance with statutory and regulatory requirements
- Enhancing SC thinking
- Engagement of management

According to the International Standardization Organization, it is important to consider three issues in the quality management project:

1. Setting Goals: Why is the standard being implemented?
2. Management commitment
3. Identifying the core processes of an organization: seek to understand each process's customer requirements and seek to ensure that they are guaranteed. (ISO 2015b)

Standardized and modelled processes form the core of this ISO standard. To achieve constant improvement, organization must understand what it does and how it delivers value. Comprehensive process models help understand the hidden linkages between different processes and help to identify bottlenecks in operations. This leads to a PDCA cycle – plan, do, check, act, and plan again (Figure 17). Basically, this means finding and implementing new ways of doing things to improve efficiency or quality. To detect the improvement, measuring is required. Without accurate measures, it is hard to say whether

actions taken have actually improved performance of not. Per ISO 9001, company must determine key factors contributing to the quality of their offering. These key factors must be measured regularly, and results analyzed following a predetermined schedule. It must evaluate the performance of quality management system and retain documented results as a proof of compliance. (ISO 2015)

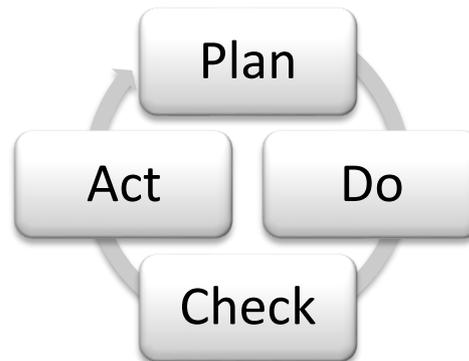


Figure 17 The PDCA -cycle

The company must evaluate the quality of information gathered through measurement. Based on the information gathered, the company must assess how well their offering meets set requirements, how satisfied its customers are and how well the quality management system works. It must also evaluate potential risks and change requirements in quality management practices.

#### **4.2 Supply chain process**

The case company operates in green technology industry and was founded in 2010. At the first quarter of 2018, the company had 42 employees, which is twice as much as two years ago in 2016. The company has enjoyed a high growth rate for several years. The company's strengths in technological know-how and customized solutions has been a major contributor to the growth. The company operates mainly in B-to-B sector, serving customers on a project basis, like construction industry. Consumers can also buy their products and services, but this is mainly done through resellers. The company also seeks growth from the international market. The company has outsourced production and relies heavily on imports.

The case company's delivery processes begin with a purchase order from customer. When a binding order has been established, the project department of the case organization takes over the order and start planning the project delivery. The project department staff will make the necessary calculations for the practical implementation of the project and a project manager will be assigned to the project to represent the organization. The project manager's tasks include planning work and objectives, risk and quality management, resource management, tracking and management of project progress, communicating with people and organizing work. The project manager may need support from other teams, such as the engineering team, to complete the necessary calculations and technical drawings. Based on their calculations, the project manager makes a sales order for needed components of the delivery. The project manager may decide to order components directly from supplier or company's warehouse, depending on the stock levels. If a direct delivery is generated from the importer to the customer's site, a purchase order will be generated based on the sales order for the required components. Every purchase order is then checked by the procurement manager who sends the final purchase order to the supplier. Functions and responsibilities of these two key managers are presented in Table 3.

In practice, the company orders components to their own warehouse in advance for standard deliveries and retail distribution, but often for larger projects, components are ordered directly to the customer's site. In this case, the project manager assigned to the project will make a preliminary purchase order, which the procurement manager will check, modify, and send to the supplier. The organization has introduced a new ERP system last June, which has made processes clearer and more simplified. In addition to that, this made it easier to monitor inventory status and monitor inventory value. Company's suppliers and their logistics hubs are mainly located in Asia and Europe. If not thoroughly planned, orders from Asia are likely to create SC challenges because of long delivery times and large order quantities. Resource scarcity situations also pose their own challenges to order-delivery processes. Since there is no own production, purchases constitute a large part of the company's operating costs.

Table 3 Functions and responsibilities in case company's order-delivery process.

<i>Functions and responsibilities</i>	<b>Project manager</b>	<b>Purchase manager</b>
<i>Component deliveries for project delivery</i>	<ul style="list-style-type: none"> <li>• Picking list to warehouse for project delivery if delivery is from warehouse</li> <li>• Purchase request for components that are delivered straight to customer from supplier</li> </ul>	<ul style="list-style-type: none"> <li>• Checking the purchase requests and forwarding to supplier</li> <li>• Handling the order confirmation</li> <li>• Communicating between supplier and project manager about delivery e.g. schedules.</li> </ul>
<i>Inventory status</i>	<ul style="list-style-type: none"> <li>• Communication about emerged demand changes or observed challenges in inventory status e.g. delivery status meetings</li> </ul>	<ul style="list-style-type: none"> <li>• Handling the inventory status</li> <li>• Purchases to warehouse</li> <li>• Team leader for warehouse and logistics</li> </ul>

SC process is described in appendix 1. Due to the company's focus on the project business, not only the logistics team but also the project team participate in its SC process. The owners of the process are the teams - the project team and the logistics team. Process owners and one support team form the organization's swimming pool, where tasks and responsibilities move on their own lines and form the rivers to others as demonstrated by the swim platform model. The client and the supplier participate in the process. The process is modeled mainly based on the current situation, but it considers the pursuit of the ideal state, which is acknowledged by many of the company's employees.

Procurement process is described in appendix 2. This is a subprocess of main SC process described in appendix 1. Appendix 3. shows one of the most straightforward processes of the company – warehousing process, which should be given attention as it is one of the most significant subprocesses of SC for customer experience.

The solution presented to the case company is a piloted in SC processes of the projects division. The solution is specifically designed to organize the way in which the SC operates, but it can be extended to other activities within the company. Prior to this assignment, the company has not systematically measured performance. Performance measurement has relied heavily on interpreting financial performance indicators drawn from mandatory reports. Long term development has been monitored only in key figures of financial statements. The SC solution offered to the company aims to such solution that it can be replicated to the other core processes of the organization. The actions taken in the case company to boost the adoption of performance driven approach in operations is discussed in more detail in chapter six.

### **4.3 Strategy and critical success factors**

The company has defined its strategy based on four key pillars – expanding current operations, developing an all-inclusive solution for controlling energy production, storage and consumption, creating partnerships around a smart energy ecosystem, and quick market entrance hoping to reach large enough customer base to sustain operations. The company’s mission is to solve imbalances in electricity production caused by using only green energy sources. Vision of the company is to provide scalable virtual power plants as part of an ecosystem built around smart energy solutions.

2017 was characterized by strong growth and professionalization of operations. The company adopted a new ERP system and developed logistics and HR operations. New distributors joined the network and company partnered with several energy companies. Challenges emerged in resource management due to high demand, which lead to delays in deliveries. R&D operations require more efficient processes and better time management.

The company has divided its sales operations to wholesales and projects divisions. These two key processes, as well as R&D process and supporting processes are illustrated in Figure 18. Wholesales division delivers standardized products through retailers, and thus key goals are focusing on expanding distributor network and delivering better tools for retailers. Projects division focuses on larger, more customized deliveries. Bidding process

and active screening of potential projects characterizes this division. Key goals in this area relate to more accurate budgeting and pricing decisions, aiming to reach better profitability and more accurate and reliable delivery schedules, thus improving also customer experience. Solutions presented in this graduate thesis focus on projects division.

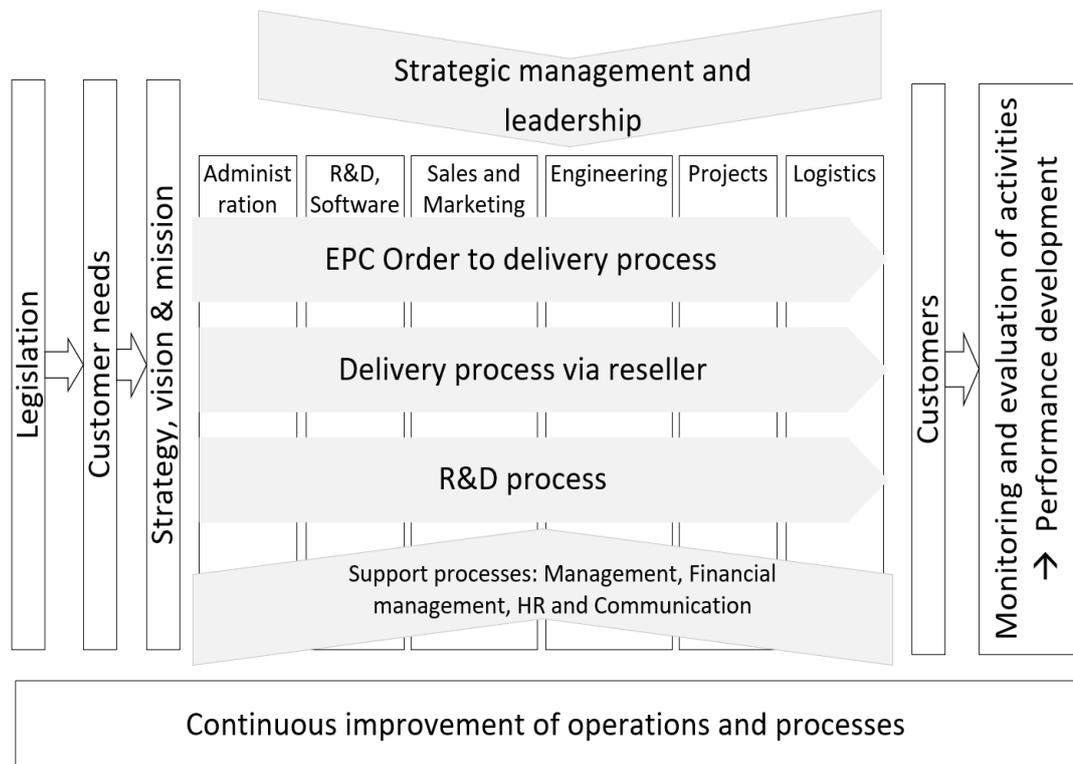


Figure 18 Case company's process map

Within upcoming years, the company will adopt a quality management system and increase efficiency in purchases and logistics. Due to failing schedules and poor resource management, logistics costs have been high as many projects have required partial deliveries. The use of adopted ERP system should be increased for project budgeting and scheduling, as well as demand planning and inventory management. Moving the data from individual Excel worksheets and emails to a centralized resource planning and management system should enable more accurate measurement and automation of common stock orders.

Based on the strategy, company has identified several success factors:

- Successful delivery
- Competent and motivated staff
- Transparency of operations
- Profitable business
- Collaboration with retailers
- Efficient and timely competent internal communication (Specially project deliveries)
- Process development
- Innovation
- Customer satisfaction
- Increasing customer willingness to buy (New orders)

As the performance measurement system is to be piloted in SC operations of the projects division, key success factors are now discussed from the SC standpoint. The mission of SC operations is to support further growth. This is enabled by developing SC processes and activities in collaboration with other SC related parties. Key development areas are:

- SC processes
- Automatization
- Project management
- Support for growth prospects in project business
- Risk management
- Strategic collaborations

With process development it is intended to move information flow from individual email accounts and spreadsheets to a centralized resource management system. Process standardization is supposed to improve quality by normalizing the way products and services are provided. Process automatization is supposed to reduce the workload in routine tasks, but it can be implemented only after standardized processes have been adopted. Process development has encountered some resistance to change, as people would like to continue working like always before. This is a common issue in project management as well as

purchasing. Very little project management support tools are used within the organization. Each project manager has own practices for delivering projects and no common project model has been established. Collaboration between teams has been increased a lot, but there are still issues with transparency. A centralized resource planning system is supposed to help increase transparency within the organization. Customer profitability assessment should be incorporated to project management, so that the managers could allocate more resources to serving the most important customers. General practices for project meetings could also be defined to improve efficiency of meetings.

More emphasis should be put on risk management in SC. Only primary suppliers have been added to items data in the ERP system, and information regarding secondary suppliers for specific items is hidden in procurement team members' spreadsheets. Regarding to risk management, back up plans for purchasing should be also given more specific routines to enhance company's risk management. A dynamic environment requires scalable SC to meet the fluctuating demand. Elasticity should be added to static cost structures by reorganizing operations. The company ought to focus more on core processes and seek long-term resilience with strategic partnerships and outsourcing. By evolving common processes with partners such as suppliers, retailers and different service providers, company can reach scalability and flexibility in its operations to fit changing demand and find cost efficient solutions. Especially when the change in demand is harder to predict, company should seek solutions that transfer costs from fixed to variable. Well established partnership allows flexible balancing between costs and efficiency. The key development areas create the objectives for short term operative measurement. The success factors for company's project delivery SC are:

- Availability of components
- Resource management
- Sufficiency of working capital
- Functional processes
- Project scope and materials
- Project design and execution
- Profitability of projects
- Growth of project business

## **5 PERFORMANCE MEASUREMENT SYSTEM DESIGN AND IMPLEMENTATION**

This chapter reveals how the company's strategy and critical success factors are derived to a performance metrics and implemented into the enterprise resource planning system. Chapter begins at taking a view of created project model for performance measurement system implementation in the case company. This project model was used in implementing SC metrics in case company and is usable for further implementations of performance systems in case company. A new framework was created to meet the needs of case company. The framework is created based on the models presented in literature review. Based on the created framework, this chapter explains, how the measurement system can be built by breaking down the framework into detailed phases of development.

Later this chapter discusses on how to set the operating principles for chosen measures to make the use of measurement system the most efficient and to guide managers to the right path of measuring. Chapter ends on practical chapter that looks at detail every chosen measure and discusses how it is implemented into ERP. This subchapter also discusses about the measures that were left for future implementation, since they were not possible to implement at the time. Lastly few figures of ready measurement system will be presented.

### **5.1 Implementation project**

The project model is based on taking the best practices from project models presented in literature review. Project model was then adapted and tailored to fit this specific case company. The empirical part of this thesis tries to follow the same structure in chapters as the project model suggests. At the end of this thesis project the implementation project will be in the last phase, which is continuous assessment and improvement. The project model is designed to fit not only the SC process, but all the case company's core processes where the performance measures will be implemented later in 2018. The rest of the measured processes are in the second phase of implementation and metrics for those are presented this thesis. The project was executed by traditional project management means.

The project had defined its primary constraints the were scope, time, quality and budget. The scope was to implement a PMS to support a better management culture. Resources were allocated to the project and a project schedule was made. The project kept its schedule well.

1. Performance measurement system design
  - a. Defining the project
  - b. Commitment of management
  - c. Identifying of strategy and critical success factors
  - d. Selecting measured dimensions and metrics
2. Performance measurement system implementation
  - a. Building measures into an ERP system
  - b. Testing and checking
3. Using the PMS
4. Continuous assessment and improvement

The phases include lot of empirical research to be done in order to be completed. At the first phase of this project, performance measurement system design phase, few meetings were needed to set up in order to initiate the project. At those meetings the objectives for the project and measurement system were set. The commitment of management, especially middle managers (team managers) was also discussed in the meeting as rules and recommendations for managers were set. In one meeting, corporate strategy, critical success factors and their interaction were discussed. Based on these meetings, strategic metrics for the company were determined with the CEO. These metrics are defined to support managerial decision-making in top management and are presented for the entire organization. These measures answer the most common questions about corporate performance.

Quality manager, CEO and team managers were then put to discuss about measurement needs in team level. Based on a draft created in this discussion, each team manager was allowed to create their own performance measurement system. Their subordinates were not included at this phase, as the concept of measurement is relatively new to the employees. This is the first prototype of a performance measurement system and should be rede-

defined with personnel when more experience is gained regarding performance measurement. If a measure is predefined in ERP system, it takes less than five minutes to adopt that metric. For most custom metrics, this is possible within an hour or few. Therefore, customization of the performance measurement system does not take much resources and initial selection of metrics can be arbitrary. For those metrics that do not require additional data collection, past data will be available in ERP system even if the metric is defined in future.

After defining the performance measurement system in ERP system, the measurement system was tested by importing data and assessing the quality of obtained results. If there were inconsistencies in results, calculation formulas were adjusted accordingly and if the issue was not found, the integrity of data and the quality of data collection process was evaluated. Some metrics were abandoned due to poor consistency caused by manual data collection process. Most of these abandoned metrics relied on timestamps, which were misleading if the underlying process was not executed properly. These metrics could be reconsidered if manual data entry is replaced by an automatic material handling system which tags incoming and outgoing packages correctly at the time of delivery.

The supervisors will use implemented performance measurement system in management. Their experiences were surveyed and will be discussed in chapter six. Future development of the defined performance measurement system is not in the scope of this thesis, but some suggestions will be presented in the final chapters of this thesis.

## **5.2 System design and metrics selection**

The measurement system is based on a new framework in which division of responsibilities is centric. Often in SMEs, the challenges lie in resource allocation and scheduling. When schedule is tight, responsibilities are neglected. The framework created is supposed to help define clear roles and responsibilities in the organization. It is based on FPM framework proposed by Pekkola et al. (2016). The developed framework adopts slightly the idea of permanent and non-permanent gauges from FPM framework, but the determination and division of the meters is not based on long-term financial metrics and strategic

meters. In this new framework, metrics are divided based on the user group – senior management and team managers. The basic idea remains, as the measurement needs of top management are more of a permanent nature, and it is important to look cross-seasonal performance development. Although these metrics focus on long-term development, they can be replaced or adjusted if needed. These metrics are mostly financial. On team level, metrics are more operational and require frequent updating. There is no need for between the periods comparison, as the sampling frequency is short enough to enable continuous monitoring. These metrics are also influenced heavily by the current situation of strong growth, where processes are redefined often. This reduces the long-term comparability of these metrics, and currently used metrics may be replaced if situation changes and more suitable metrics are required. The developed framework has been developed based on the needs of a case organization, but it is also applicable to other SME companies. In a modern environment, resilience and constant adjustment is required. Requirements change and so should the metrics to meet the future demands. Nothing is permanent, and operational measures are based on underlying processes. If these processes change, perhaps the metrics should change too. The framework presented in Figure 19 divides more responsibility to team level, and each team gets their own metrics.

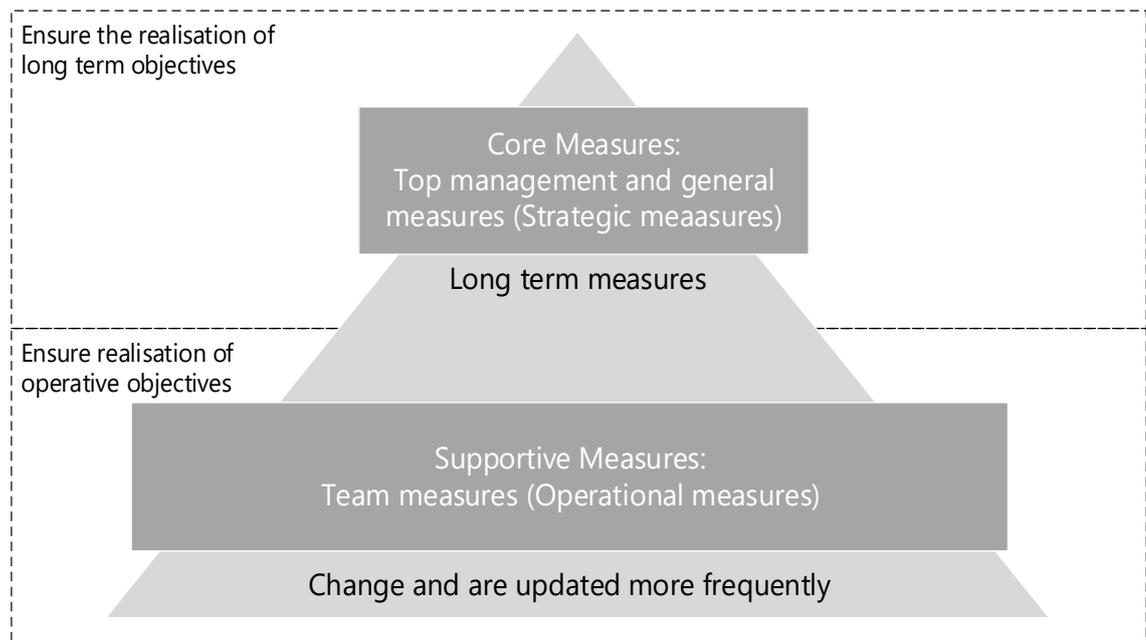


Figure 19 New framework based on FPM

Team leader is responsible for the performance of the team, but all team members may monitor team performance through a team-specific dashboard. The CEO is responsible for general performance, which is a product of integrating team level performance. Key challenges are measuring performance in cross-organizational processes and avoiding team-centric optimization. Different organizational levels are considered in the framework, as metrics are divided to four levels:

- Corporate
- Business areas
- Teams
- Individuals

Based on the organization hierarchy in Figure 20, Appendix 4 shows how metrics are divided to different parts of the case company. It illustrates the complete performance measurement system using different levels of hierarchy. This illustration demonstrates how different business areas influence team level metrics. In practice, business area determines a common template for all teams to which each team manager may add their own metrics tailored to suit their needs. General meters indicate metrics defined to be used by top management. These are also used to communicate overall performance to personnel.

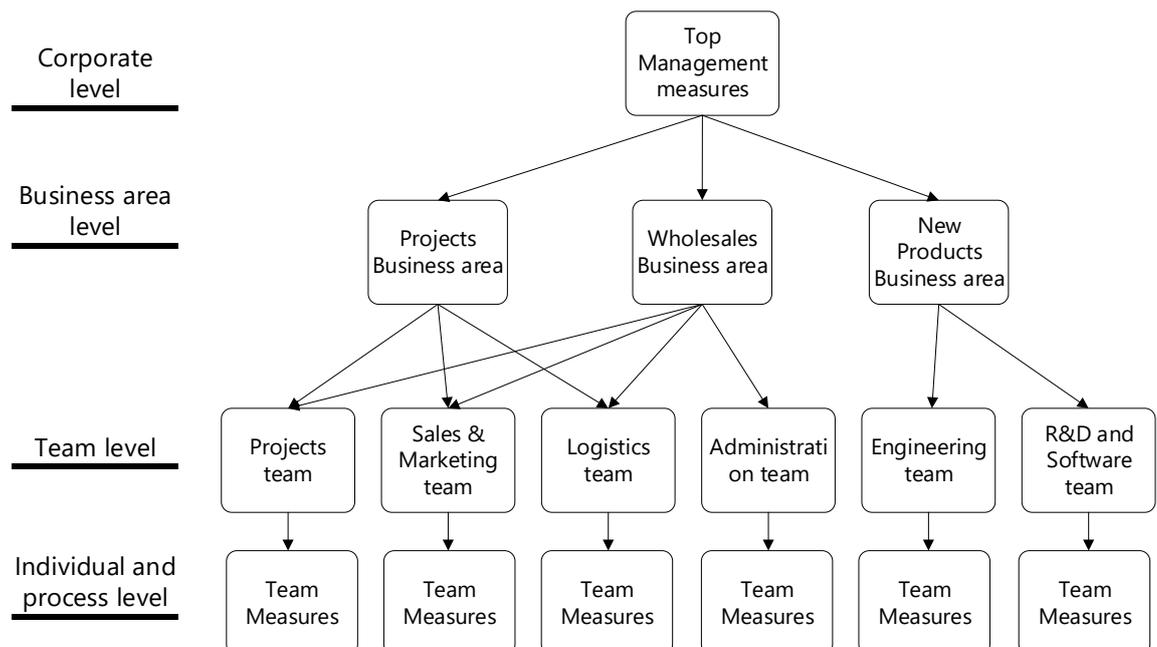


Figure 20 Measuring levels in case company

No previously defined performance measurement solution was adopted per se. Multiple models were considered and pros and cons evaluated. BSC was considered a good foundation for building a comprehensive performance measurement system. It is important to note that system templates are just tools for defining a custom, company specific performance measurement system that complements the PMS and fits organizational culture and should not be adopted as is. Like previously discussed literature suggests, strategy is an important factor to consider when designing a performance measurement system. BSC was used as a tool of decomposing strategy to smaller building blocks covering all aspects of performance. Resulted strategy map (Figure 21) is very similar to the visualization of causal relations proposed in Kaplan & Norton (1996). Strategy map is based on those critical success factors that were identified in chapter 4.2.

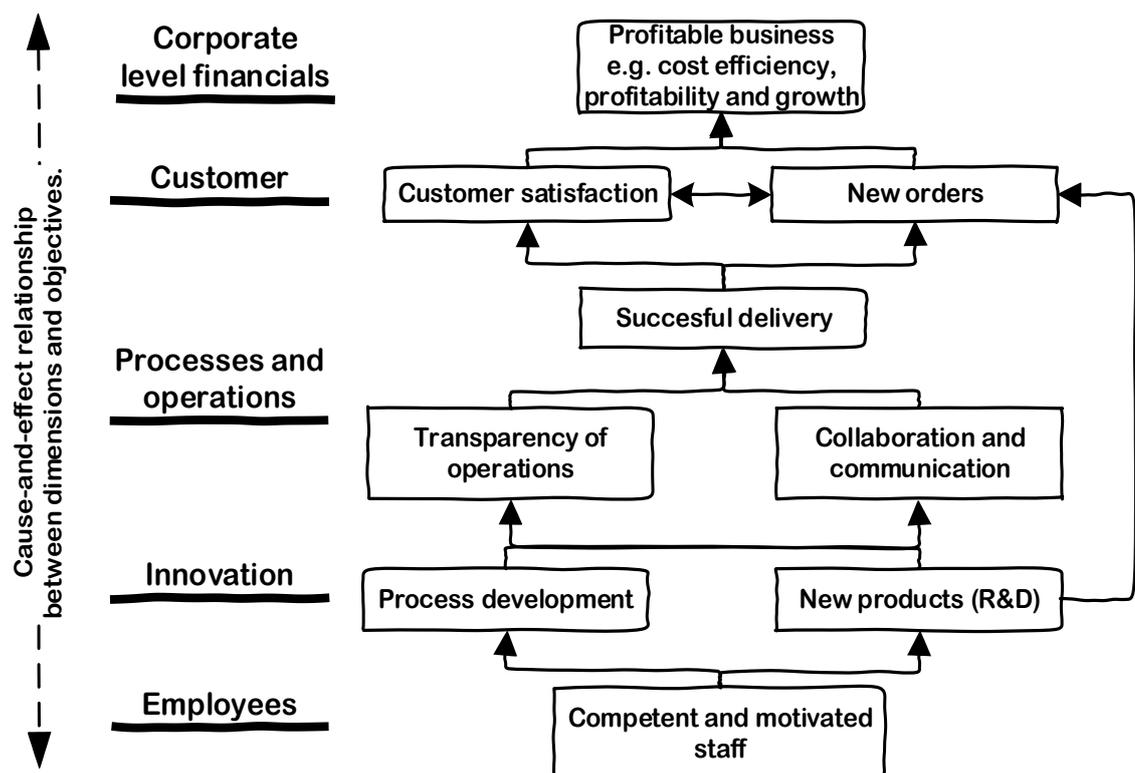


Figure 21 Strategy/ cause-effect map of the case company's strategy

Corporate strategy map can be constructed as a more specific version for individual processes, for example the SC in projects division. This allows to see the critical success factors that determine success in projects business. These success factors are presented in Figure 22.

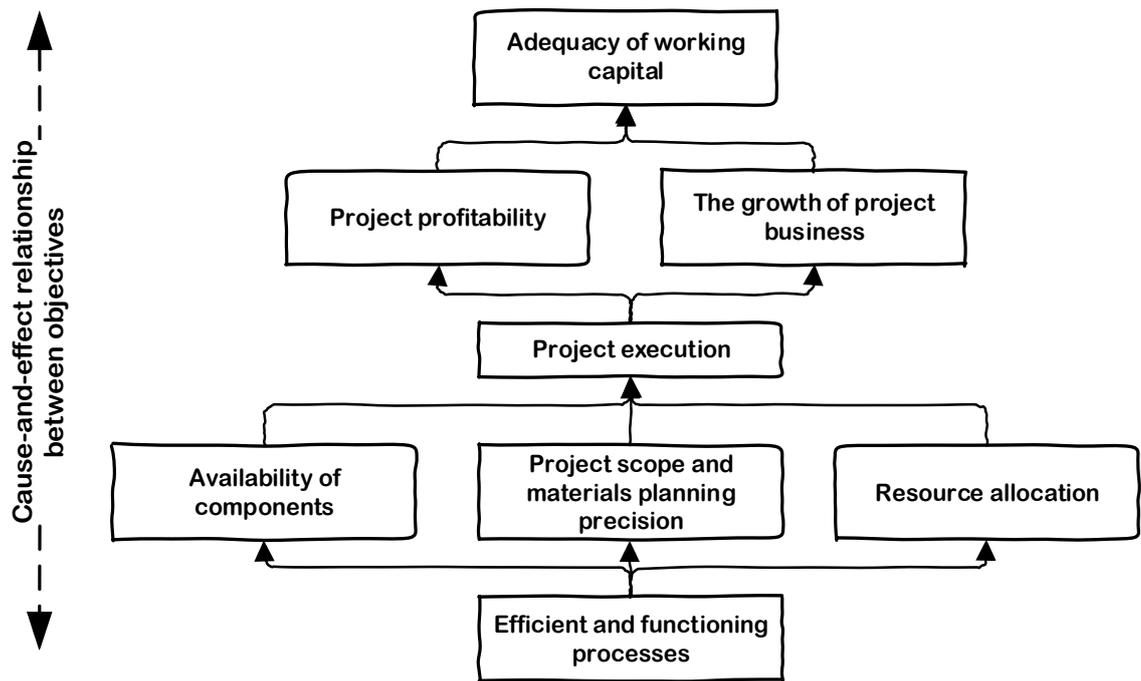


Figure 22 Decomposition of performance in project deliveries.

Figure 23 below illustrates how performance measures are build up based on critical success factors and how they tie up into their dimensions. Figure also illustrates well, how performance measures differ between different levels of observation.

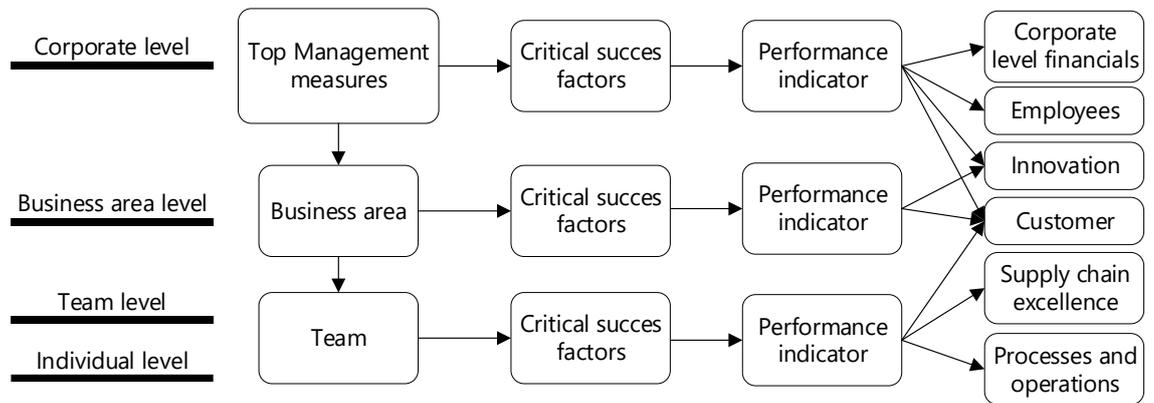


Figure 23 Illustration of critical success factors breaking into measures

As illustrated above, the case company’s measures were derived from critical success factors. Critical success factors were defined for the company based on the proposed framework and strategy map. Resulting performance metrics are shown in table 4 below. Table also presents a short explanation for chosen success factor. Table 4 is for the whole case company and Table 5 is for project delivery SC.

Table 4 Business level goal mapping

<b>Success factor/ Goal</b>	<b>Objective</b>	<b>Measure</b>
<b>Successful delivery</b>	Functioning SC e.g. delivery precision	Logistics and projects team measures
<b>Competent and motivated staff</b>	Working environment supports creative and high-performance working.	Employee satisfaction and change (top management)
<b>Transparency of operations</b>	Operations are documented and reported according to processes	Quality of documentation (project team)
<b>Profitable business</b>	Ensure the business to grow with a healthy cost structure	Working capital, Sales margin (top management)
<b>Collaboration with retailers</b>	Enables scalability and creates flexibility through outsourcing.	New partners (top management)
<b>Efficient and timely competent internal communication</b>	Communication is handled properly to meet the customers' expectations in project deliveries.	Engineering and Project team measures
<b>Process development</b>	Improve quality by normalizing the way products and services are provided	Process development (projects team)
<b>Innovation</b>	New inventions ensure growth of business	New products (top management)
<b>Customer satisfaction</b>	Specification of customer needs	Customer satisfaction (top management)
<b>Increasing customer willingness to buy (New orders)</b>	Enables growth. Includes both current and potential new customers.	New orders (top management)

These top-level goals are measured either with corporate level metrics or team level metrics depending on whose responsibility it is.

Table 5 Project delivery supply chain team level goal mapping (both project and logistics team)

<b>Success factor/ Goal</b>	<b>Objective</b>	<b>Measure</b>
<b>Availability of components</b>	Minimize the number of write-offs, store only necessary products	Days inventory in hand
<b>Personnel allocation</b>	Maximizing utilization rate through resource management	Count of receipts and fulfillments
<b>Availability of components</b>	Ensure availability with reasonable safety stock	Inventory value change
<b>Sufficiency of working capital</b>	Optimize the amount of working capital	Inventory turnover
<b>Functioning processes</b>	Regular just in time deliveries	Order processing accuracy
<b>Project scope and materials</b>	No adjusting for unfinished projects, Ensemble has been specified in advance	Budgeted cost vs. actual
<b>Project design and execution</b>	Project is completed according to the schedule	Schedule accuracy, Quality of documentation, process development
<b>Resourcing</b>	Workloads are monitored, and information is used to improve resourcing	Open projects, Closed projects
<b>Profitability of projects</b>	Projects must meet a defined profitability estimate to be accepted	Projects gross profit percent
<b>Growth of project business</b>	Business expands at predefined rate	Opened projects watt peak Opened projects sales price Price per power unit

### 5.3 Setting operating principles

Operating principles govern the way data is collected and processed in PMS. These common principles are important to ensure the reliability and comparability of selected metrics. A template for recording principles of measurement was created for the case organization. This template challenges the person responsible for a given metric to think about the source and the consequences of different results produced by the metric. Template lists factors to be documented about the selected metric. These factors are defined so that they guide the person filling the template to consider important aspects regarding a performance meter. Template is presented in Table 6.

Table 6 Example for documentation of performance measurement operating principles

<i>Documentative factor</i>	<i>Measure: (name, e.g. Profitability)</i>
<i>Goal or objective for measure and the means to achieve the goals set.</i>	Objective: increased profitability, means: observe the outcomes to identify problem areas.
<i>Responsible for results</i>	CEO, CFO, Team leader (team)
<i>Reporting purpose and principles</i>	Purpose: Notice when realized projects don't meet the desired outcome of profitability to make corrections (measured value drops below critical limit) Principles: Correct actions taken by projects managers if critical limit is met
<i>Reporting frequency</i>	Monthly
<i>Critical limit</i>	e.g. min. 25% profit by project
<i>Data source and warehousing</i>	ERP, dashboard and profitability report
<i>Calculating principles</i>	$((\text{Recognized revenue} - \text{total cost}) / \text{total cost}) * 100\%$
<i>Visualization</i>	ERP dashboards and monthly meeting PowerPoint presentation.

Goals and objectives give context to the measure, as they determine the target that should be reached with the underlying process. A good result in performance meter should indicate that a business objective has been reached and the company is doing well in that area.

Perhaps the most important field of this template is person responsible for the measurement, as it ties the responsibility about the results to someone. It is important to note that this person should be able to influence results with his own actions. If results are poor, he should react and try to find out the cause of poor performance. Corrective action should be taken rather sooner than later when it may be too late to recover. Reporting purpose defines to whom the results should be reported and why this thing is measured. This is important, as it ensures that the person responsible for measurement understands why this thing is measured.

Reporting frequency determines the interval at which data is analyzed and reported. This helps set routines. Common guidelines should be set for reporting frequency to reduce information overload at top management. Critical limits define the level at which corrective action must begin at latest. Principles of data collection and calculation help understand how the metric is formed and what are the factors affecting the outcome. This is important especially for those who are measured by the metric. Visualization method is a nice addition to documentation, as some metrics will be visualized in ERP system and some may be visualized with some another way. This helps to find the visualized information later easily. Using this template, case organization created documentation for all metrics to be used by logistics team. An example documentation is presented in table 7 below. This illustrates how the template is to be used in case organization.

Table 7 Documentation of inventory turnover measurement operating principles.

<i>Documentative factor</i>	<i>Measure: Inventory turnover</i>
<i>Goal or objective for measure and the means to achieve the goals set.</i>	Increased service level and optimization of working capital.
<i>Responsible for measurement</i>	Sourcing Manager
<i>Reporting purpose and principles</i>	Purpose: Notice when realized inventory turnover don't meet the desired level to make corrections (measured value drops below critical limit) Principles: Correct actions taken by Sourcing Manager if critical limit is met
<i>Reporting frequency</i>	Monthly
<i>Critical limit</i>	Turnover rate <4 per item
<i>Data source and warehousing</i>	ERP, dashboard
<i>Calculating principles</i>	$[\text{Cost of Sales} / \text{Average Inventory Value}] = \text{Inventory Turnover Rate}$
<i>Visualization</i>	ERP dashboards

#### 5.4 Implementation to ERP

Bititci et al. (2016) researched the impact of visual performance metrics on company performance. They noted that visual metrics are great for communicating and engaging staff, as well as aligning operations with strategic goals. Some companies benefitted more than the others, but all companies found positive impact on the performance. Especially milestones were found useful, as they help everyone understand why a product or system or innovation has come along, and what they need to do to enable it.

Case company has decided to visualize most metrics with their ERP system. This system is connected to a database which holds the data gathered to be used for measuring performance. The company does not have any other centralized data storages, so all the data should be available in a single access point. There is a collection of business intelligence and analytics tools available in the ERP system supporting performance measurement.

This cloud-based ERP system can be scaled for mobile phone, tablet or desktop usage. As a cloud-based system, available storage capacity and processing power can be increased on-demand. Supported by a global cloud engineering company, the actual data is replicated to multiple data centers around the world.

In adopted ERP, each user has their own dashboards. These dashboards are partially customizable by the user, but the admin can force some components on them based on user groups. Some user types also have a possibility of sharing their dashboard with other users, for example a team manager may share his/her dashboard with their team. Dashboard is essentially a visual workspace that gives users instant access to accurate and relevant information they need to perform their job. These dashboards consist of key performance indicators that may be visualized with several alternative portlets, producing colorful trend graphs, histograms, pie charts, gauges etc. There are over 75 premade performance indicators available, and admins can create new indicators based on custom SQL queries.

General measures are performance measures intended to be used by the entire organization. These metrics answer the questions employees might have about overall performance. Top management, or the CEO, is responsible for success in these measures. Project teams can see these measures, but they do not impact the performance assessment of project teams. Of these metrics, profit margin and the number of new orders were implemented to the ERP system. profit margin tells the overall profitability of operations, including all sales channels New orders are reported as a number of new orders, although it could be measured in financial terms. General metrics are described in table 8.

Profitability of project business is measured with separate, project team specific meters. No prebuilt solution was available in current release for measuring customer satisfaction so defining a custom solution was left for a later date. This could be implemented as a web survey integrated to the ERP system through an API, but at the moment resources are too limited to implement. This metric is required by quality management system, so it will likely be implemented in some form soon after this thesis is complete

Table 8 General measures

<b>Measure</b>	<b>Implementation boundaries</b>	<b>Practice</b>
<b>Sales margin</b>	Not a standard KPI in ERP	Difference between two standard KPI's (sales – cost of goods sold)
<b>New orders</b>	Standard KPI in ERP and it can be added into dashboard as KPI or trend graph.	Adding the KPI into dashboard into a suitable way e.g. trend graph or individual KPI or listing.
<b>Customer satisfaction</b>	Not a standard KPI in ERP.	Customizing an online form to gather customer satisfaction data. Data is then converted in ERP into a customer satisfaction rate and comparable between projects. Creating a custom KPI on data gathered.

Team specific metrics for logistics team cover procurement of the project business, warehousing and delivery. As financial metrics, SC performance is evaluated using inventory value change, Inventory turnover and days' worth of inventory at hand. These describe state of SC from different aspects and are very general and common performance metrics. The other three logistics metrics are order processing accuracy, count of receipts and count of fulfilments. Order processing accuracy tells how many of the delivered orders were faulty. Delivery fault may occur in collection, packaging or delivery. The other two metrics are used mainly for resource allocation and planning purposes. Performance metrics are described in table 9.

Table 9 Logistics team measures

<b>Measure</b>	<b>Implementation boundaries</b>	<b>Practice</b>
Inventory value change	It is a standard KPI in ERP.	Adding the KPI into dashboard into a suitable way e.g. trend graph or individual KPI or listing.
Inventory turnover	It is a standard KPI in ERP.	Adding the KPI into dashboard into a suitable way e.g. trend graph or individual KPI or listing.
Order processing accuracy	It is not a standard KPI in ERP. This measure must be customized for use.	Creating a custom KPI on existing data in ERP. Data will be collected by collecting user notes, that have type anomaly report.
Days inventory in hand	It is not a standard KPI in ERP, but it can be built on standard measures.	It is based on a formula that calculates standard KPI's formula is $\text{Days}/(\text{Cost of goods sold}/\text{inventory})$
Count of receipts	It is not a standard KPI in ERP. This measure must be customized for use.	Creating a custom KPI on existing data in ERP. KPI uses a dynamic search that calculates receipt records for given time filters.
Count of fulfilments	It is not a standard KPI in ERP. This measure must be customized for use.	Creating a custom KPI on existing data in ERP. KPI uses a dynamic search that calculates fulfilments records for given time filters.

Project team forms the customer interface of project business. They create purchase orders, handle sales orders and send delivery requests to logistics team. Financial metrics for project team are opened projects sales price, and non-financial metrics are open & closed projects, opened projects power unit sum ja price per power unit. Opened projects power unit sum, opened projects sales price ja Price per power unit communicate the status of project business from different aspects. These metrics can be used to report op-

erating volume and project profitability. Open & Closed projects supports resource management and tells about sales volume. Project team has several measures that are not listed at KPI dashboard. These measures are listed in Table 10.

Table 10 Projects team measures

<b>Measure</b>	<b>Implementation boundaries</b>	<b>Practice</b>
Gross profit percent of project	Cannot be visualized on dashboard	Accessible through a dynamic report
Budgeted cost. Vs. actual on project	Cannot be visualized on dashboard	Accessible through a dynamic report
Open & Closed projects	This measure must be customized for use.	Creating a custom KPI on existing data in ERP. KPI uses a dynamic search that calculates project records that are created/ closed for given time filters.
Opened projects power unit sum	This measure must be customized for use.	Creating a custom KPI on existing data in ERP. KPI uses a dynamic search that calculates the sum of used power unit on project records for given time filters.
Opened projects sales price	This measure must be customized for use.	Creating a custom KPI on existing data in ERP. KPI uses a dynamic search that calculates the sales price set on project records.
Price per power unit	Can be built on custom measures.	Comparison between custom KPI's. (opened projects sales price and opened projects power unit sum)
Process development	Is not measurable in ERP	-
Quality of documentation	Is not measurable in ERP	-

Figures below illustrate how ERP system visualizes the performance metrics. Not all metrics are illustrated here, and the data is drawn from test environment in an isolated sandbox using a random test database, so results presented do not tell about the real situation in case company. That is also why some measures display not available instead of a real number.

Logistics team									
INDICATOR	TODAY	THIS WEEK	LAST WEEK	THIS MONTH	LAST MONTH	THIS QTR	LAST QTR	THIS YEAR	LAST YEAR
Inventory Value	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
Inventory Turnover	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Days Inventory on Hand	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Anomaly reports	0	0	0	0	5	5	0	5	0
Count of receipts	0	0	0	0	6	6	0	6	0
Count of fulfilments	0	0	0	0	3	3	0	3	0

Figure 24 Logistics team measures

Figure 24 illustrates a table view of different performance metrics and their values in different units of time. Figure 25 shows a gauge of open engineering, procurement and construction projects compared to the previous year.

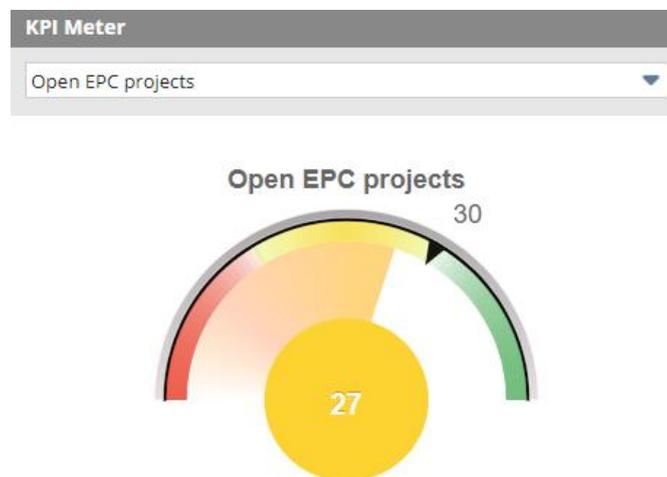


Figure 25 Example of KPI meter

Figure 26 shows a monthly moving average of number of total orders. Moving averages can be calculated for different time frames and the graph can be changed to a bar plot if desired.

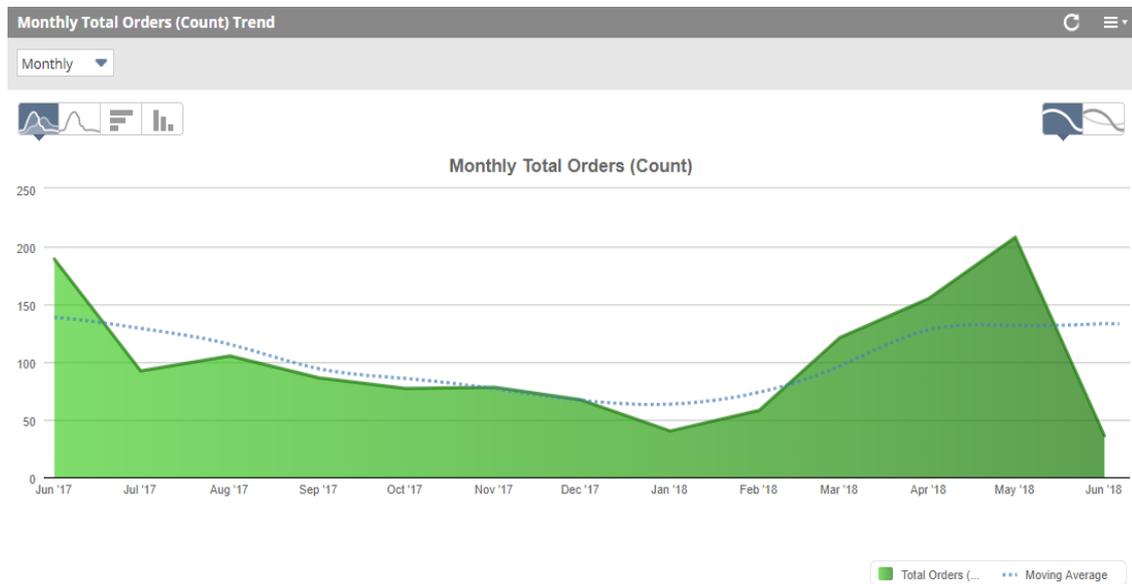


Figure 26 Example of trend graph

## **6 PERFORMANCE MANAGEMENT PRACTICES AND RECOMMENDATIONS**

For this thesis, three interviews were conducted. For these interviews, two team managers (TM) were selected from the teams involved in project business area. TM1 serves as the head of logistics and procurement, and TM2 is the leader of project managers. These team managers represent roles presented in table 3. HR manager was selected to represent an alternative point of view. Chapter 6.1 is based on interview of HR manager, and for chapter 6.2 both team managers were interviewed separately. Some of the findings presented in chapter 6.2 are also based on the interview of HR manager. Chapter 6.3 is based on the follow-up survey, which was sent to team managers four months after the initial interviews.

Chapter 6.1 describes what led to the point where performance management system was considered necessary, chapter 6.2 describes the ideal state within four to six months from adoption. Chapter 6.3 presents the results of follow-up survey and compares ideal state to the actual state four months after the implementation. Not all development goals of chapter 6.2 can be expected to be reached in short amount of time, but by comparing the observed results to the ideal state helps to identify future development needs.

### **6.1 Actions taken before performance management implementation**

The case company is in the middle of a transformation from a small business to a much larger, more professional company. The greentech industry is growing rapidly and keeping up with the pace requires professionalization of operations and management culture. Responsibility of strategic decision-making has shifted from the owner-manager to the Board of Directors, which sets the strategic guidelines for the CEO. In 2017, organization structure went through a major change, as the newly selected CEO divided personnel to functional teams. In this restructuring process, the CEO began rolling new, more professional management practices to the company. This consisted of introducing regular meetings to all organizational levels, aiming to help planning and setting performance targets at all corporate levels.

Eventually this led to a new, performance focused strategy which introduced one-on-one discussions between managers and subordinates. High-level performance targets were set, and milestones were defined for new initiatives. All goals were based on S.M.A.R.T framework, meaning that the goals should be specific, measurable, achievable, realistic and timely. At this point, the term measurement was introduced to the organization. It was the first sign of change in management culture to more data driven and performance focused. It also indicated that the outcome of development initiatives would be followed, and actual improvement assessed in a quantifiable manner.

The first version of performance measurement system was introduced in early 2018. Essentially it was a slideshow where performance targets were listed for all teams and teams discussed progress in team meetings. Beyond simple yes/no questions, no quantitative or qualitative assessment was made. Some teams failed to monitor their progress, so responsibility of monitoring performance was moved higher on the hierarchical ladder. This created the need for a joint performance measurement system, as it is hard to quantify team-level progress without data describing the actual progress. The ultimate goal of this centralized performance assessment program is to create a merit-based compensation system, in which employees can influence their personal income levels by their own actions.

According to the HR manager, who works for an external HR service company, employees of the case company are not that aware of the new strategy. There is a need of improvement in communication between the top management and the team members. Poor communication may partly be a result of gaps in managerial competencies and/or attitudes of some team leaders. At the moment, performance targets are too general, which makes it possible for some team members to avoid direct responsibility.

HR manager sees much potential in performance measurement system, hoping that it will align operative actions better to the strategy and help clarify the strategy to the employees. The performance measurement system is also a risk management tool, and it can be used to communicate about success and improvement to external stakeholders. TM 1 thinks that performance measurement system can help managers make better decisions based on actual data, which will also aid in one-on-one discussions as managers can base their

arguments on facts. However, some team members do not see data collection very important at the moment, which undermines the integrity of data.

CEO defined common management practices, yet most of the managers failed to honor those. Attitudes vary between individuals, some were reluctant to even participate the training managers were given regarding the new practices. In restructuring process, some technical experts were promoted to managers even though they had little to no desire to manage other people in addition to their current tasks. This explains much of the gaps in managerial competencies, as the finest experts are not necessarily the best managers. There are plenty of small teams, and communication between these teams is not very efficient. This creates inconsistencies and inefficiencies in corporate processes, as different teams may well perform the same tasks unaware of each other. Team level optimization hinders overall performance, as multiple teams are involved in key processes. Process ownership should be moved to higher organizational level to enable better integration of teams and improve understanding of companywide processes.

The primary form of implementing the strategy with new CEO was through office meetings. Members of all teams participated in those meetings. These were monthly meetings, in which the CEO announced general news and discussed about performance of each team. These meetings were set up to give other teams better view of the entire organization and the responsibilities of each team. Informing teams about progress and achievements of other teams also creates collective pressure for teams lagging to catch up.

Performance goals for teams were set by team managers in collaboration with the CEO. Timeline and resources and actions required to meet these goals were discussed in team meetings once in every two months. In those meetings, team manager clarified the overall business strategy to team members and discussed how the strategy impacts the team. Workload estimates were defined for each team member and tasks assigned based on skills and workload estimates. Besides team meetings, team managers were told to arrange one-on-one meetings with all members in their team. In those meetings, team manager caught up on work related matters, such as accomplishments, overall atmosphere, workload, wellbeing at work and issues. Each team member was asked to define three to

five points of improvement for the next year. Then the manager discussed about target levels and timelines to meet the expected level of improvement.

## **6.2 Changes in management culture**

According to the HR manager, change in management culture should come from the top management. The change process was initiated by the Board of Directors. During this process, more responsibility has been transferred from founders to the CEO, and the relationship between the CEO and Board of Directors is a key point of improvement. More training is required to improve managerial competencies in middle management, as most of the managers were selected by their expertise in team-specific business area instead of their ability to lead people. Some focus points could be communication, feedback, change management, and adaptivity.

Team managers feel that they have got plenty of support from top management. The change process moved in phases, beginning with introducing the concepts of measurement, target setting and performance assessment. TM1 thinks that data driven performance metrics have improved his ability to conduct his work, as he can monitor inventory cycle times and working capital levels. Performance metrics provide valuable feedback and help note causal relations between his team's actions and their effects on performance. A profound understanding of calculation principles is important for analyzing the reasons for change in some performance indicators. This helps to identify anomalies in operations, which is something TM 2 also says to use performance metrics.

Both team managers note that the intervals should be redefined for most of the metrics. Now information is presented in too much detail, and they feel that monthly numbers are sufficient enough. Reducing the resolution of measurement helps to remove unwanted noise in data. Both managers acknowledge that team members are not used to performance measurement, and TM2 believes that employee level performance measurement may be hard to implement due to cultural resistance. HR manager sees employee level measurement useful, as it helps her to identify changes in performance and aid those who may be in the need of HR services.

TM 2 highlights that there has been a merit-based compensation system for salesmen, but it was not well designed and did not align well with strategy. All interviewed managers are in favor of a performance-based compensation system, but it should be a bonus and not reduce current income levels. Most team members value constant income levels with few bonuses over larger variability in monthly income. HR manager sees that team members should be more involved in discussions on what kind of compensation system there should be. She thinks that performance goals should perhaps focus more on cross-organizational core processes instead of teams, as this may help better align goals with business strategy. Putting more emphasis on entire value chain could provide more customer focused approach to operations.

All managers like ERP system as a preferred tool of measurement, as it visualizes information and can be tailored to suit their needs. According to the managers, information is presented in easily digestible form for their team members. All employees use ERP system on daily basis, so it is a natural place for presenting the information. When an employee logs into the ERP system, dashboard is the first thing he or she sees. This forces everyone to at least take a glimpse of current performance ratings.

Inspired by the change in management culture, HR manager came forward with an initiative to adopt an annual HR cycle to support PM. In the past there has been several recurring actions, such as employee satisfaction surveys. These would be complemented with individual performance goals and yearly performance assessment. Managers and team members would engage in one-on-one discussions more frequently and managerial performance would be assessed as well. With individual performance measurement, income levels could be compared terms of salary to output. This sort of comparison would identify those employees who are paid too little compared to their value for the company and thus are likely to be unsatisfied. HR manger notes that it is team managers' responsibility to make sure their team members have the ability to perform, and it is CEO's responsibility to ensure that teams have sufficient resources to meet the performance targets. Efficient communication to both directions in organizational hierarchy is a key of success.

Both team managers highlight the importance of communication between the top management and the employees. Uncertainty creates room for rumors, which may urge to resist change. The most important development initiatives should be communicated to employees through office meetings, newsletters etc. where everyone is presented with the same, unaltered information directly from the top management. The CEO is expected to back up his decisions with facts and well-argued rationale. Correspondingly, project managers are expected to organize more status meetings to communicate stakeholders about progress made in larger delivery projects.

Changes in organizational culture are slow and might take years to fully develop. Strategy was first presented to the employees a bit over year ago, but it is still unclear to most of the employees. Short-term goals in developing organizational culture include familiarizing employees with strategy-based decision-making in operative actions, performance measurement and data driven organizational learning. When performance is measured, bottlenecks are easier to discover, and results of process development initiatives can be assessed more reliably. Managers are expected to inspire employees and give more credit to those who perform well, as well as improve communication between different teams and organizational levels.

Long-term development initiatives, are beyond the scope of four months between the initial interviews and the follow-up survey. Those initiatives include establishing a management culture where decisions are based on information rather than opinion or intuition, irrationalities in business processes are actively screened, performance is systematically assessed and knowledge about the past is leveraged to create best practices and improve operating principles in the present.

Interviews can be summarized to several key factors representing the ideal state. Results of the follow-up survey are compared to these key factors.

- Improved fact-based argumentation capabilities for managers in one-on-one discussions
- Demonstrated change management skills in coping with change resistance and introducing new ideas
- Improved decision-making based on data rather than of gut feeling
- Strategy is incorporated to daily operations
- Performance management system produces reliable, useful and accurate data about important factors influencing performance

### **6.3 User experience survey**

A survey was conducted to follow-up the interviews. The survey was sent to the managers four months after the performance measurement system was implemented and the initial interviews conducted. In this survey, managers were asked questions relating to the performance measurement system, management culture and future development needs. The survey was constructed keeping in mind those key factors identified in previous chapter representing the ideal state. Questions were indirect to avoid handing the ‘right’ answers to the respondents. The survey consisted of multiple choice questions and paragraph fields to open ended questions. Part 1 assesses PM tools and their implementation to the ERP system. It is focused on the perceived quality of performance metrics and managers’ understanding of calculation principles.

The second part of the survey assesses management culture, more specifically how managers have used performance metrics and how performance measurement has impacted organizational culture. There are some questions to assess resistance to change as well as communication between managers and team members. The last part of the survey is quite brief and consists of few text boxes where managers can write their ideas about most important future development needs.

The survey was conducted using a structured online questionnaire sent to the managers via email. High response rate was expected as all managers volunteered for this project and the survey was a follow-up of initial interviews. Both managers responded to the questionnaire in time and individual responses were analyzed knowing what they had said in interviews.

Results of the follow-up survey are presented in table 11. Team managers did not use much of the spread in alternatives, so responses were aggregated to either positive or negative, instead of strongly positive, slightly positive, slightly negative and strongly negative. Both managers agree on that most performance metrics are well selected and aligned with business strategy. Some fine-tuning is expected in next iteration, but nothing too major. Managers understand how performance ratings are generated and what factors influence those ratings. They feel that they have been provided with enough information from the top. However, both managers think that measured results are not accurate and reliable enough.

*" Current level of data input from users into ERP system is not good enough in order to establish and implement more detailed and personalized metrics. This is something to consider heavily in the future of process development and change management." - Team manager 1*

*" Lack of accuracy due to insufficient imported data. Not enough new projects to evaluate the functionality properly." - Team manager 2*

Table 11. Follow-up results.

	Team manager 1	Team manager 2
Performance metrics are well selected	✓	✓
Performance metrics are aligned with business strategy and core objectives	✓	✓
Measured results are accurate and reliable	✗	✗
I understand how metrics are calculated and what influences them	✓	✓
My team has adopted the concept of performance measurement and assessment	✓	✗
Performance management system has been used to support one-on-one discussions	✓	✗
My team has been able to cope with change	✓	✓
I have received enough information about performance management	✓	✓
My team has received enough information about performance management	✓	✗

✗ Disagree

✓ Agree

Team managers feel that the data is too insufficient at the moment for generating reliable results. This has hindered the adoption of performance management system in daily operations, as managers are not confident enough to make decisions based solely on the data. Team managers said that they are going to use performance data to improve business processes and detect anomalies but identifying the ‘normal’ state of operations can hard without enough of past data. Team manager 1 has been more active in adopting the performance management system and says that it has helped him to do his work as is now possible to discuss facts instead of guessing and gut feelings. The other manager says that the actual benefits are yet a bit unclear, but the overall evaluation of the team performance will likely be easier. There have been changes in organizational structure and some

changes are also likely to happen in the near future. Thus, team manager 2 would rather wait a bit and see how the organization shapes before fully adopting a performance management system.

*“The upcoming organizational rearrangement in the company is still unclear. Implementing any performance management measurements in full scale seems unreasonable until we have a clear organization structure.” - Team manager 2*

Regarding the implementation of performance management system, both managers named organizational culture as the most significant development area. They were also concerned about change resistance and noted that introducing individual performance measurement must be done carefully. Team 2 was more reluctant to the change during the initial interviews and has remained that way during the trial period. Perhaps a performance-based bonus system could be a way of introducing performance management to the team.

*“As a rather young company, we have had practically no performance measurement system in use before. So, the whole idea of measuring individual performance on multiple levels at day-today basis requires careful introduction. The system needs to be seen as a way to achieve personal benefits, to get the approval from the employees.” - Team manager 2*

In addition to organizational culture, team manager 1 highlights the importance of managerial competencies. Change management is a challenging subject, and managers may need coaching to better cope with change resistance.

*“As the organization is still fairly young there are no culture on fact-based performance measuring. The management has not been consistent on all teams and team members have been reluctant and/or not able to think and/or discuss about performance measurement due to either resistance to change or missing competencies/knowledge on the subject matter. These should be developed either through managerial training and coaching or by hiring competent managers into key positions.” - Team manager 1*

Besides some shortcomings mentioned earlier, team manager 1 does see much potential in performance management system and thinks that it is beneficial in tackling process development challenges.

*“The implemented PMS is a great starting point to set up a fact-based measurement system which will help managing the employees to perform at their best and to point out and tackle process development challenges.” - Team manager 1*

Comparison of the ideal state and results identified in follow up survey is presented in table 12 based on the key factors listed in chapter 6.2.

Table 12. Comparison of ideal state and actual results

Ideal state	<i>Actual</i>
Improved fact-based argumentation capabilities for managers in one-on-one discussions	<i>Improvement was seen in one of the two teams.</i>
Demonstrated change management skills in coping with change resistance and introducing new ideas	<i>Change management skills were demonstrated only to some extent, perhaps partially due to the summer vacation season when it is hard to gather all team members around the same table</i>
Improved decision-making based on data rather than on gut feeling	<i>Data was used to detect anomalies in both teams, but lack of data in project business reduced the usability of the data</i>
Strategy is incorporated to daily operations	<i>Both managers feel that performance management system supports strategy implementation, as business objectives and team goals are aligned with corporate strategy</i>
Performance management system produces reliable, useful and accurate data about important factors influencing performance	<i>Overall quality of the data was deemed inadequate due to improper use of the system by end users and due to little amount of accumulated data available to the project team.</i>

## **7 CONCLUSIONS**

This chapter is divided to two themes – organizational culture and performance management supporting tools. First, conclusion regarding the cultural development are presented in chapter 7.1 followed by recommendations regarding the organizational culture in chapter 7.2. Then, conclusions about performance management tools are presented in chapter 7.3 followed by recommendations regarding the improvement of those tools. Chapter 7.1 summarizes findings that answer supportive question 1 and chapter 7.3 discusses findings that are related to supportive question 2. Findings presented in these conclusions are based on literature review, interviews, follow-up survey and personal observations within the case organization.

### **7.1 Conclusions about management culture**

The case company decided to use only team level metrics, which are easier to introduce to the employees than individual level performance metrics. This can make it more approachable and reduce resistance to change, but it makes performance-based compensation systems harder to create, as joint compensation schemes enable free-riding. It is acknowledged in the literature that individual performance measurement may boost productivity through compensation systems where each employee can affect their own income levels. On the other hand, individual performance measurement may increase stress levels especially if the employees are not accustomed to being measured. As demonstrated by the interviews, negative attitudes towards individual performance measurement already exist in the case organization.

It is managers' responsibility to define goals and boundaries but deciding the best way to get there should be left for those that are actually on the journey. Allowing freedom inspires creativity and thus enables innovation and organizational learning. Setting individual development targets can help employees to prioritize and strengthen their understanding of strategy and objectives. Together with freedom comes responsibility, which may help to separate the good ones from the average.

Even though individual performance goals may not be adopted, compensation schemes can still leverage performance ratings. By literature, performance ratings do not tell much if they are subject to rater's personal conception of reality. Thus, more robust rating methods are required. A simple, less biased way of assessing performance could be asking if managers and team members would want to be involved in same project team with person x, and how much they would be willing to pay per month for his services. This could help to identify those who are paid too little or too much compared to how valuable they are to the company as per peers.

Based on the interviews and the follow-up survey, some teams have been more reluctant to change than others. No major changes in organizational culture can be expected during the short trial period, but team managers did find some benefits from adopting performance management system. In purchases, where volumes are higher, and data can be collected faster, enough of data accumulated during the past year, so the manager was able to argue focus points in one-on-one meetings based on numbers instead of gut feelings. In purchases, data was also used to detect anomalies and improve business processes.

One of the managers was more passive than the other, explaining that implementing a new operating practice seems unreasonable until the organizational structure is clear. While this is understandable, organizations do change rather frequently, and slow adoption of new practices can be explained only partially by desire to wait for future changes. Future changes are uncertain, and it would be better to begin adopting the concept of measurement in time, even if the team structure eventually changes. If other teams do adopt new practices and others do not, changes in organizational structure may yield to an undesirable situation similar to mergers and acquisitions, where teams coming from different organizations have different practices and their cultural views conflict when personnel are mixed. Common operating principles should exist between managers, and teams within an organization should have similar culture. Common practices help improve mobility and integration between teams.

## **7.2 Recommendations for developing management culture**

Based on the results, more training is required to help employees cope with change. Strategy is still a bit unclear for some employees, and they do not see the benefits of performance management. It is essential to make employees understand how important accurate input of data is to performance management and business process improvement. Shaping the organizational culture requires more active dialog between the managers and team members regarding the strategy and the importance of performance measurement in performance management.

Coaching is recommended to help managers improve their competencies regarding change management and proactive communication to both directions in organizational hierarchy. An alternative for coaching is hiring new, more competent change managers, but improving the skills of existing managers is the recommended way, as they already understand the business operations, have some knowledge about individuals' capabilities and may have higher influence on their existing subordinates.

At this point, it seems that there is more room for improvement in organizational culture than the performance management system itself. The trial period was only four months, so the implementation process is still underway. As the next steps, it is recommended to introduce the calculating principles of performance metrics to the employees, so that they would understand what factors influence performance. For example, team members could choose one metric and add it to their personal dashboards. Then they would familiarize themselves with the way the metric is constructed and follow the development of the performance metric with their manager. This should encourage a dialog between the manager and the subordinate about how performance is constructed.

## **7.3 Conclusions about performance management tools**

Implemented PM tools cover multiple aspects of business operations. It was great to see that team managers put real effort to defining team level metrics based on business objectives drawn from strategy. The CEO, the quality manager and other senior managers did commit their time for defining common, corporate level metrics for the company.

They engaged with team managers to actively discuss about best team level business objectives and the most important metrics teams could use, as well as common operating principles and project model for efficient implementation. This shows that the top management is committed to the change and values the initiative to adopt an ISO-9001 compatible PMS. Often times, development initiatives fail due to lack of managerial commitment from the top.

Defined performance metrics cover both financial, and non-financial sides of business operations. Adopting non-financial performance metrics is a major leap forward towards more customer-centric operating principles. Before this project, little attention was given to SC performance in terms of successful deliveries, although it is the part of the SC that customers see and interact with. Measuring performance in SC has revealed issues in delivery processes and enabled tackling them.

Most performance metrics were easily implementable to the existing ERP system. Although specifically asked not to think about the practicality of implementation, most managers relied heavily on business area specific documentation of the ERP system when nominating potential performance metrics. This may have limited their creativity a bit, but at least the selected performance metrics were easy to visualize. In workshops, senior managers came up with two additional performance metrics that are not followed in ERP system. Process development, is measured as number of process models and instructions defined for project team. This is used to track progress towards meeting the requirements set in ISO-9001 standard, and results are presented in a PowerPoint slide during the weekly meetings. Quality of documentation is measured as the accuracy of documentation in project deliveries. The results of this metric are assessed in team meetings.

Only two limitations emerged in the system during the implementation project. Dock to stock time could not be calculated, as there was no datetime field in database for timestamp of dock time. Current setup does not define dock area as a warehouse, which makes it impossible to monitor for how long incoming cargo stays in docking area. Similar issues emerged in calculating order processing time, as packaging time is recorded as a date, but other timestamps are recorded in datetime format. Accurate calculation of order processing lead time was not possible with current configuration. These metrics are

likely implemented in the future, as the company adopts a warehouse management system which improves performance measurement significantly in logistics. This package defines docking areas and enables more detailed monitoring of warehouse operations. The current logistics module in ERP does not support SC measurement with non-financial measures. The core modules are built mostly financial performance measures in mind, so there is a limited number of prebuilt non-financial performance metrics available. WMS module is to be implemented in late 2018, and metrics presented in this thesis are partially based on examining the possibilities this module enables.

Despite good overall quality of implementation, several issues exist in produced data. Most of these issues are related to the way users use the system and could be fixed either by programmatically forcing users to input more data, or by developing organizational culture in such way that end users would see data collection more important. At the moment, most employees seem to fill only mandatory fields in the system. This creates issues to performance measurement in project business, as projects are not closed, and they are left to hang up inactive for months after completion. CRM does not have reliable data, as address is the only mandatory field for creating a new customer and no other fields are filled. Customer entities are divided to leads, prospects and actual customers, but the status is never updated after initially setting one. This means that the customers will hang in the initial state forever even if the status has changed as a result of a new offer. In addition to that, only successful offers are fed to the system meaning that the company has little to no knowledge about failed offers and total hit rates.

Implementing the performance measurement system has revealed some weird use cases of the system during the four months' time. It seems that the user roles are too loosely defined, and access control is not strict enough, as people other than warehouse workers have decided to print picking lists from the system and export them to Excel for further analysis. It is nice to see that people have adopted the concept of performance analysis and data driven process improvement, but that kind of use patterns distort process chains in the ERP system. For example, each time a picking list is printed a timestamp is created. Printing multiple picking lists causes multiple timestamps, which makes it impossible to distinguish between the real ones and the fake ones. More training is required to help users extract information from the system correctly for further analysis.

By default, ERP system lists reference values for performance metrics over different time periods. According to the managers, there are currently too many time periods, which makes it harder to read the metrics quickly. This is something that should be addressed in configuration during the next iteration of performance measurement system.

Not all teams have measures that can be influenced by the team, for example the R&D team has average sales per new product measure, even though they are not the ones selling the product. According to the literature, this is an issue which can negatively impact the attitudes in R&D team towards performance measurement. Little to no improvement in sales can be expected as R&D engineer is not the one who is selling the product. Thus it would be unfair to base their bonuses on someone else's work. A better measure could be user satisfaction or contribution margin of the new product.

Based on the follow-up survey, performance metrics are well selected and aligned with business strategy. Only minor tweaking is required regarding the metrics during the next adjustment round. However, the quality of data produced was not satisfactory because of the low number of projects during the trial period and poor input of data by end users. This is something to concentrate heavily on in development of performance management tools.

#### **7.4 Recommendations for developing performance management tools**

Currently performance measurement is structured around teams, which might yield local optimization at the cost of overall performance. More attention should be given to overall understanding of business processes, integration between teams and process level performance. Perhaps more joint measures should be defined, so that teams would have to cooperate more to meet defined performance targets. In process level measurement lies some challenges, because without direct responsibility of results it is likely hard to see much improvement.

In the future, operating principles should be defined for measuring performance in business network. The case company engages in partnership with suppliers, retailers and research institutes, but costs and benefits of these partnerships are not assessed. Assessing

suppliers' performance would help make better purchasing decisions and measuring retailers' performance could reveal differences in customer satisfaction between different retailers thus helping to identify best practices for project deliveries. PM in business network is a prerequisite of achieving ISO-9001 quality certificate.

In literature, measuring flexibility was given high priority. The company should try to identify efficient ways of measuring SC flexibility. Perhaps a more distinct differentiation should be made between those metrics that are used mainly to improve operative decision-making and those that are used to measure team performance. Warehousing related processes should be given more attention when the company adopts a warehouse management system (WMS) in the near future. WMS module overcomes most of the limitations of measurement in current environment but cannot cope with someone printing picking lists or messing with something else not directly related to the delivery process.

If settled use cases are desired to be retained, business processes must be thought of in more detail to avoid issues in measurement when ERP system is used in some other way than it was originally planned to be used. Employees should perhaps be asked about their current accustoms, e.g. *who needs the data, when and for what purposes?* Being aware of the way end users use the system helps to configure performance metrics better.

A significant development area is the quality of raw data, which both interviewed managers found insufficient. Major shortcomings were in the amount of data available, and in the reliability of the measured data. Availability of past data can be expected to improve with time, but the quality of inputs should be addressed rapidly. If data is not fed to the system according to the common process models, reliability of the data is easily compromised. Training the employees would be less time-consuming way of improving data quality, but if it does not work proper input of data can be forced programmatically through customization of the ERP system. At the moment, most fields allow free-form text input, but declaring the data type explicitly would present a runtime error message to the user each time they try to insert textual data to numeric fields etc.

## 8 SUMMARY

This thesis was written as an extension of a previous term paper to further develop common management practices in the case company and help the company comply with ISO 9001 quality management standards. Continuous improvement and evidence-based decision-making are some of the key principles of ISO 9000 series, and this creates the need for systematical performance assessment and process development in the case company. The product of this thesis is a performance management system, including the supporting performance measurement tools and their implementation to an existing ERP system.

This thesis examines the existing literature on managing performance, defining performance metrics and setting performance goals based on business objectives. It positions performance measurement as a tool of performance management, which is a subgroup of a much larger quality management context. It discusses the traits of good performance metrics and performance goals, proposes several performance management frameworks including but not limited to balanced scorecard, performance pyramid and performance matrix. Empirical section of this thesis combines the strengths of multiple frameworks to a solution tailored to the case company and presents a sample system to be tested in supply chain context.

This is a constructive thesis where empirical section is mostly based on interviews with several key managers and the CEO of the case company. User feedback was asked from managers after a four-month trial period, and this feedback was used to construct recommendations for further development. Findings of this thesis suggest that change management is an important success factor when implementing a performance management system as cultural change is perceived by managers more important than performance management tools or individual objectives. The scope of this thesis was limited to managerial experiences, and the results of this thesis cannot be generalized without cross-organizational validation and further research in employees' experiences. Managerial competencies were identified as an important success factor, but no further research was conducted on what kind of managerial competencies are perceived valuable in the case company, although some of these limitations are addressed in change management literature.

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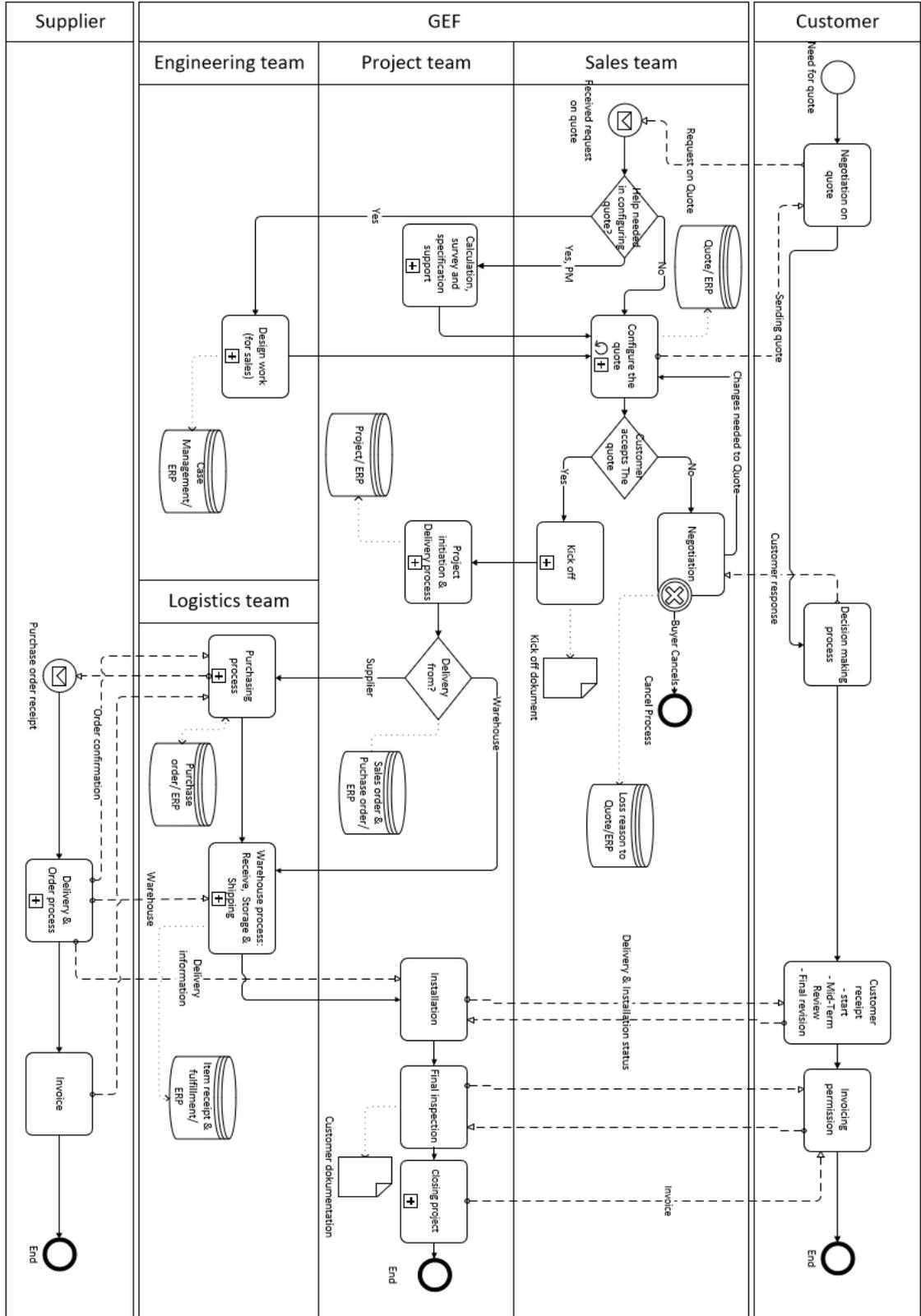
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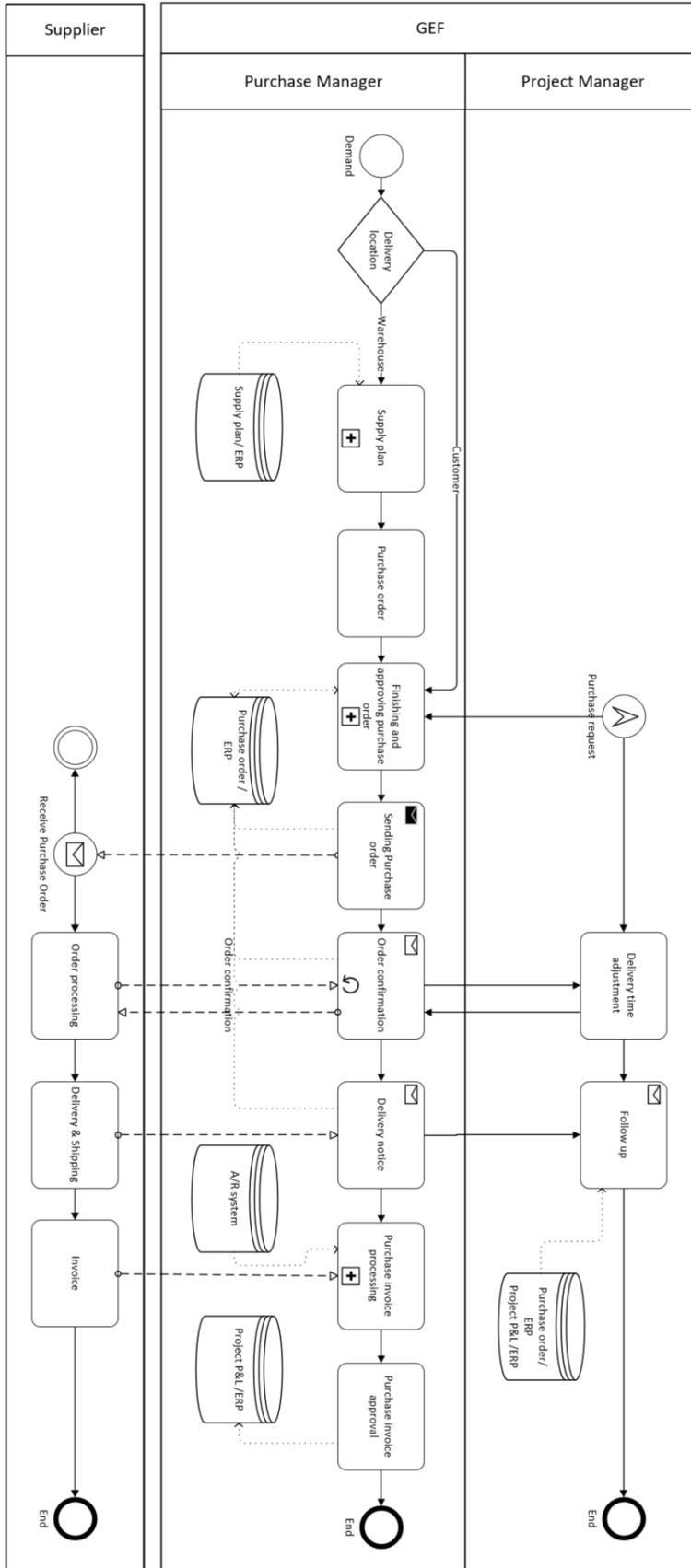
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# APPENDICES

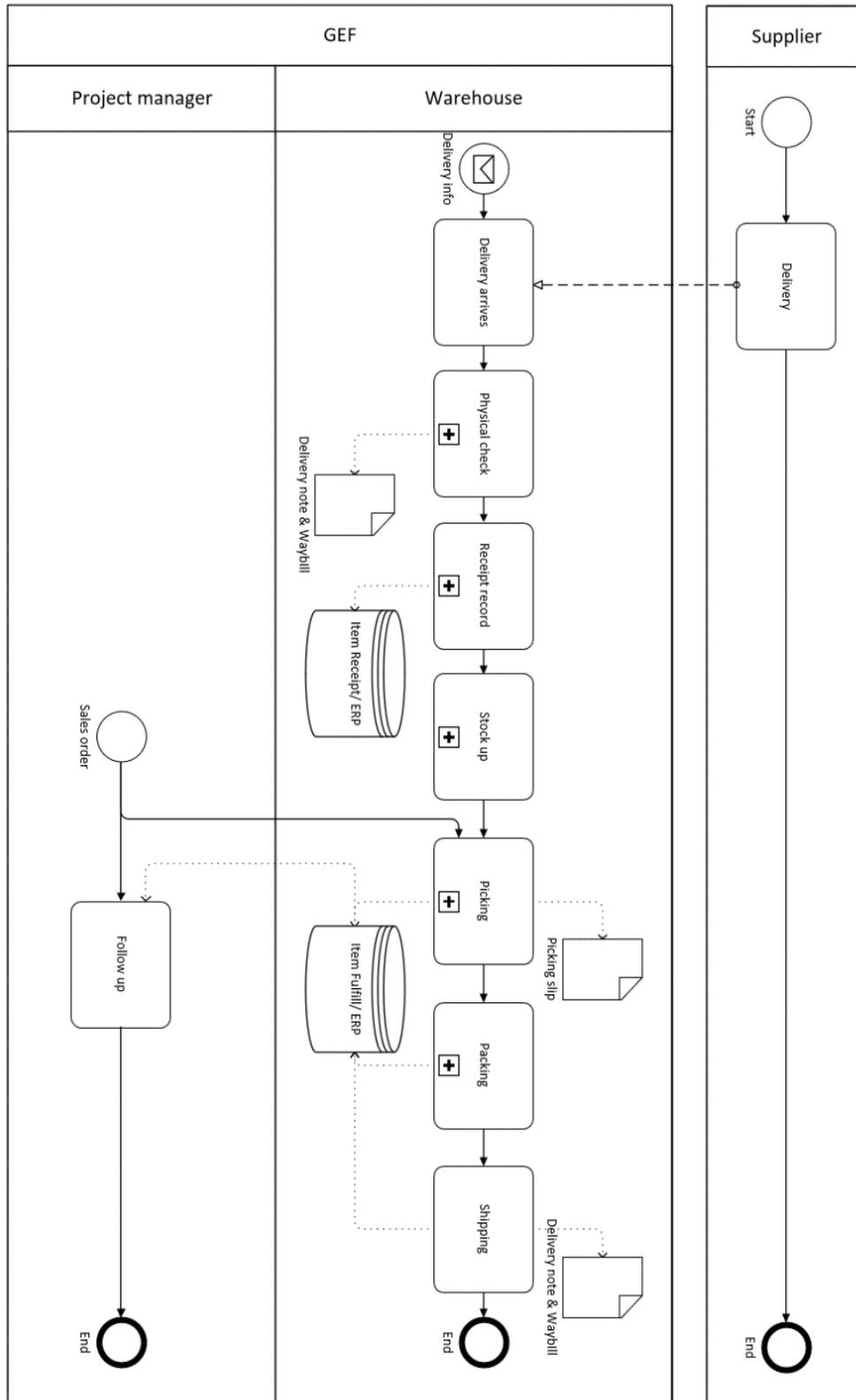
## Appendix 1. Supply chain process



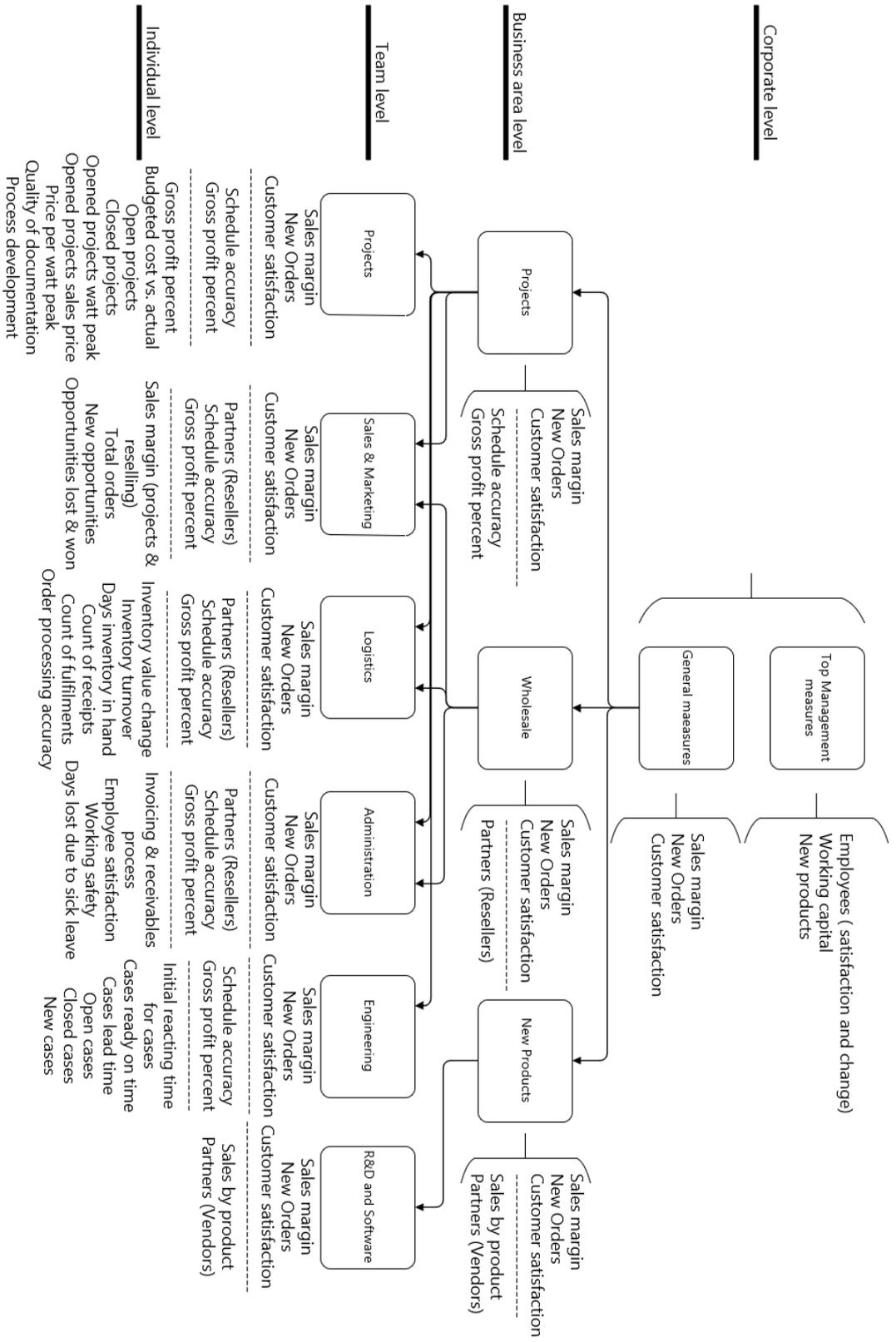
## Appendix 2. Purchase process



### Appendix 3. Warehouse process



# Appendix 4. Measures



# User experience survey

## Part 1: Performance management tools

Questions of this section are related to the performance measurement system and its implementation to the ERP system.

### How do you feel about following claims?

	I strongly disagree	I disagree	I agree	I strongly agree
Performance metrics are well selected	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Performance metrics are aligned with business strategy and core objectives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Measured results are accurate and reliable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I understand how metrics are calculated and what influences them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

continues...

Appendix 5 continues...

Do you feel the need to change performance metrics?

- Yes, most of them
- Yes, some of them
- Maybe fine-tune some current ones
- No, not at all

Any feedback relating to performance measurement system?

Your answer

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## Part 2: Management culture

Questions of this part are related to management culture and the impacts of performance measurement to organizational culture.

For what purposes have you used performance measurement system?

- Identifying anomalies in daily operations
- To develop processes in my business area
- To support one-on-one discussions
- To give credit to those who deserve it
- To improve decision making

continues...

Appendix 5 continues...

## How do you feel about following claims?

	I strongly disagree	I disagree	I agree	I strongly agree
team has adopted the concept of performance measurement and assessment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Performance management system has been used to support one-on-one discussions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My team has been able to cope with change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have received enough information about performance management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My team has received enough information about performance management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What benefits has performance management system created to the management culture?

Your answer

---

Any feedback relating to management culture?

Your answer

---

continues...

Appendix 5 continues...

### Part 3: Future development needs

This is the last section of this survey and it focuses on future development needs.

Regarding the implementation of performance measurement system, what are the most significant development areas?

- Organizational culture
- Performance metrics
- Overall performance measurement system
- Managerial competencies
- Other: \_\_\_\_\_

**Why?**

Your answer \_\_\_\_\_

**Any feedback relating to future development needs?**

Your answer \_\_\_\_\_

**Any other comments?**

Your answer \_\_\_\_\_