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Defining IT performance metrics during value creation – from business demand to deployment

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This study was conducted in the form of a project for an international company. The objective is to determine how effectively the current metrics at the case company support a transition towards a more agile and Lean organization. The objective is to also propose metric changes with balanced focus on all relevant aspects of measurement covering the entire value chain. The proposed metrics should also help in transitioning towards a Lean and agile organization.

The study consists of seven sections and it was conducted following a qualitative case study method. It is based on first carrying out a current state analysis to determine the company's current IT performance measuring practices and the desired state of measuring and then exploring existing knowledge and industry best practices for solutions.

The current state analysis revealed four key focus areas: business value, quality, agile metrics, and visibility from idea to benefit realization. To conclude, the current state of measuring IT performance in the case company was not supportive of a transition towards a Lean and agile organization with not enough focus on all relevant aspects of measurement.

The outcome of this study consists of a proposal, where a gap analysis shows the gap between the current state and the desired state of measuring including the recommendations on how to help move towards the desired state. Placing more focus on measuring customer satisfaction and enabling agile development teams in choosing metrics relevant to their work was suggested as well as a lead time metric to provide more visibility from idea to benefit realization from the time perspective. The expected improvements by implementing the proposed changes include more relevant and accurate measurements.

Keywords	KPI, Agile, Lean, Business Value, Quality

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Tämä opinnäytetyö suoritettiin projektin muodossa kansainväliselle yritykselle. Tavoitteena oli määrittää, kuinka tehokkaasti nykyiset suorituskyvyn mittarit kohdeyrityksessä tukevat organisaation siirtymää ketterän toimintamallin ja Lean-toimintamallin suuntaan. Tavoitteeseen kuuluu esittää kehitysehdotuksia nykyisiin mittareihin, jotta ne kattaisivat kaikki olennaiset mittaamisen näkökulmat koko arvoketjussa. Ehdotettujen mittareiden tulisi myös tukea ketterän toimintamallin ja Lean-toimintamallin omaksumista.

Opinnäytetyössä on seitsemän osaa, ja se suoritettiin kvalitatiivisen tapaustutkimuksen strategialla. Tutkimuksessa suoritetaan ensiksi nykytila-analyysi, jossa määritellään yrityksen nykyiset suorituskyvyn mittarit IT-alueella sekä mittaamisen tahtotila. Tämän jälkeen esitetään olemassa olevaa teoriaa ja toimialan parhaita käytäntöjä.

Nykytila-analyysin löydökset johtivat neljän painopistealueen valitsemiseen: arvoon, laatuun, ketterän mallin mittareihin ja näkyvyyteen ideasta lähtien hyötyjen realisointiin asti. Opinnäytetyön löydökset osoittivat myös, että nykyiset kohdeyrityksen IT:n suorituskyvyn mittarit eivät tue organisaation siirtymää uusiin toimintamalleihin. Mittarit eivät myöskään ole tasaisesti painottuneet huomioon ottaen kaikki mittaamisen olennaiset näkökulmat.

Insinöörityön lopputulos koostuu kehitysehdotuksesta, jossa puuteanalyysi näyttää puutteen mittaamisen nykytilan ja tahtotilan välillä. Lisäksi puuteanalyysissä on suosituksia, joita seuraamalla yritys voi ohjata toimintaansa tahtotilaa kohden. Opinnäytetyön kehitysehdotuksen suositusten mukaisesti keskittymällä asiakastyytyväisyyden mittaamiseen voidaan saavuttaa tarkempia mittaustuloksia. Tämän lisäksi antamalla valtuudet ketterän kehitystyön ryhmille valita itselleen olennaiset mittarit saadaan olennaista tietoa suorituskyvystä. Lead time -mittarilla yritys taas voi parantaa näkyvyyttä ideasta lähtien hyötyjen realisointiin ajan näkökulmasta.

Avainsanat	Suorituskyvyn mittarit, ketterä malli, Lean, arvo, laatu

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Appendix 1: Interview questions

List of Abbreviations

VC	Value creation
SLA	Service level agreements
UC	Underpinning contracts
KPI	Key performance indicator
IT	Information technology
E2E	End to end
AMSD	Application management service desk
CSAT	Customer satisfaction
IN	Incident
SR	Service request
GSD	Global service desk
SAFe	Scaled Agile Framework
SMO	Service Management Office
WIP	Work in progress
FLR	First line resolution

1 Introduction

1.1 Case company

The case company for this study operates globally in the metal industry and is among the leading companies for their product scope. The organization employs over 10000 people worldwide having offices in America and Asia with the headquarters located in Europe. This study is conducted in the form of a project for the IT department of the case company. The IT department is responsible for helping the business employees to perform at their best which is achieved by the delivery of services in the form of applications for business, people and processes enabling the business to execute its strategy.

1.2 Business challenge

Business operations demand changes to enhance their ability to provide value to customers. Measuring IT performance is very important when these changes are made as the IT department in the case company has a significant role in the value chain, and therefore they have a large impact on business benefit realization. A holistic understanding of the ability to perform enables better decision making both for business and IT while also allowing the organization to track their performance and identification of improvement areas around quality, efficiency, speed of delivery and planning accuracy. The case company is currently undergoing changes to its operating model, and as a part of this understanding of what metrics would support a transition towards a Lean and agile organization is required.

The current KPI's at the IT department of the case company are largely focused on measuring projects executed following the waterfall development model while focusing mainly on measuring the speed of delivery. The metrics assist employees in shifting performance to the direction the case company as an organization wants to develop, and therefore they should be evaluated to determine whether they do so or not. Since the operating model work in the case company is ongoing, the measuring of value should be performed in a way supportive of this agenda.

The current KPI's for the IT department of the case company measure performance in a way that does not provide enough understanding of the overall ability to perform and the visibility from the idea to benefit realization is missing. The KPI's only cover a limited scope of IT operations in terms of value chain and the focus is currently only on aspects of speed and planning accuracy. Consequently, they cannot be used as indicators for business or IT decision making nor do they address critical dimensions such as quality or business value.

1.3 Objective and outcome

The objective of this thesis is to determine how effectively the current KPI's for the IT processes support a transition towards a Lean and agile organization and propose metrics supportive of this purpose. The entirety of the value chain from IT perspective should also be covered focusing on all the relevant aspects of measurement. The proposed KPI's must also cover measuring in development work following either the waterfall or agile model. Measuring starts when business operations demand a change and ends when it is completed in the target organization or audience.

The proposed metrics should aim to change the mindset and focus into value and benefits for the end-users. It is also imperative for these KPI's to guide employee actions towards the desired state. The new metrics should use criteria such as fit for the purpose, robust, easy to use, maintainable and deployment readiness to successfully measure IT performance. The outcome of this study is an analysis of the measuring practices currently applied in the demand, development, and service management processes. The analysis includes strengths and weaknesses of the measuring practices, lists of the KPI's used for each process and the reasons why they are measured if known. The ultimate outcome of this study is a proposal recommending possible metric changes to support transitioning towards a Lean and agile organization.

1.4 Scope and structure

This thesis excludes all the IT Operating Model processes involved in governance and is restricted to Demand, Development and Service chain with change management in-

cluded in the scope. Benefit realization which comes after change deployment is excluded from the scope but possible findings in the interviews or literature are documented and presented to the case company. The scope meeting was recorded and can be found in Appendix 1.

This study has been conducted with methods including research of best practices in Lean organizations for measuring and the best practices for measuring the performance of agile development and an overview on what kind of KPI's the case company is currently measuring in the IT processes. This includes interviewing people with potential insight or knowledge on what the desired state of measuring would cover.

This thesis consists of seven parts of which the first section serves as an introduction to the business challenge, objective and scope of this study, and the case company. The second section is a demonstration of the tools and methods used in building the research and the third section provides an analysis on the current state in the company regarding the business challenge in this project. The fourth section includes the conceptual framework for this study and in the fifth section, an analysis and the results of this study are presented along with the proposal. The validation of the proposal made to the case company is described in the sixth section and the final section presents the discussion and conclusion of this thesis.

2 Methods and material

This section focuses on the research design along with the methods and data collection which are used for this study.

2.1 Research design

The study uses a qualitative case study method and it is conducted through five phases which can be seen in the diagram below.

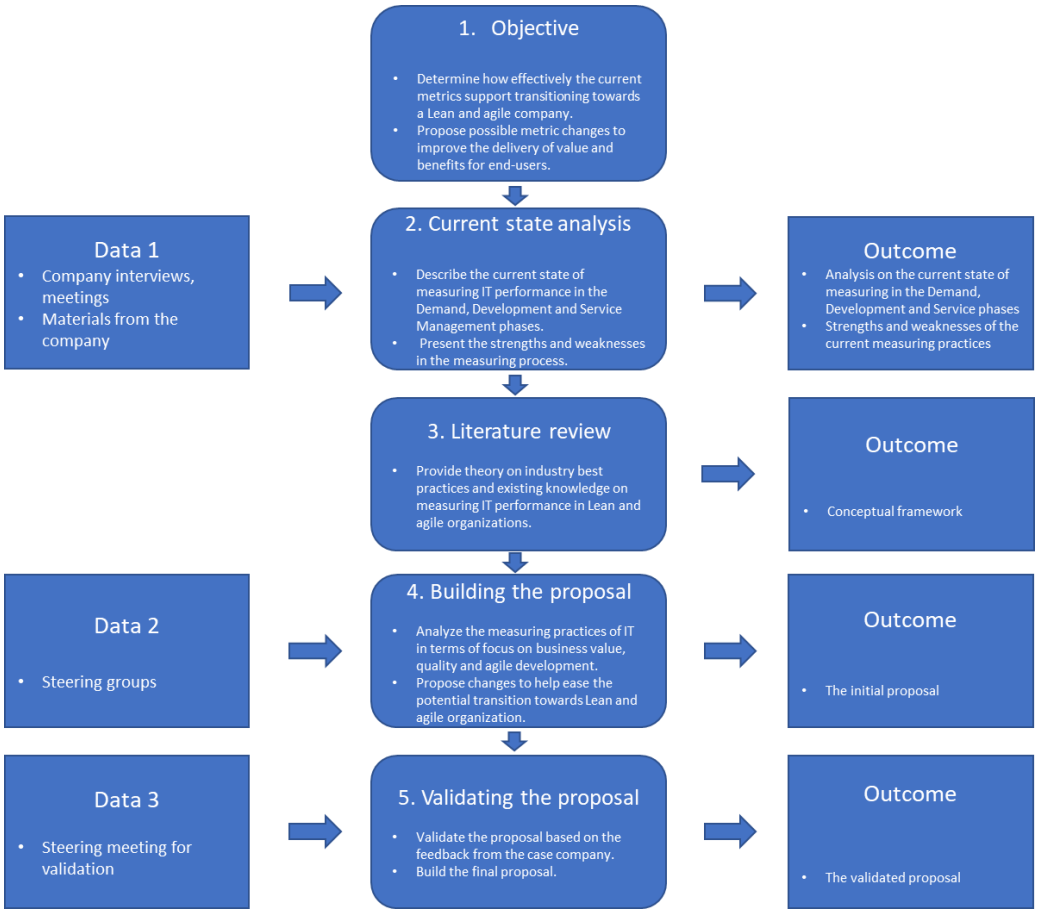

Figure 1. Research design diagram

As the diagram above depicts, the first step of this study was to define the objective of the study. The business challenge and outcome of the thesis were defined during this phase.

The current state analysis was discussed in the second stage and it start by a description of the present measuring processes for the Demand, Develop and Service chain and change management, and explaining the strengths and weaknesses of them. This was followed by an analysis on whether the current measuring practices are lacking according to the Lean principles, agile and waterfall development models. The objective of this phase was to provide a comprehensive view on the current state of measuring including the strengths and weaknesses in the current measuring process. The outcome of the current state analysis was an overview of the present measuring process along with the strengths and weaknesses in it, and the topics which were researched in the next step.

This was followed by the third stage which focused on the examination of relevant literature to acquire a more comprehensive understanding on KPI's. This stage was dedicated to finding the industry best practices and existing knowledge on how KPI's are applied in Lean organizations with the purpose of acquiring knowledge and discovering best practices regarding KPI's for Demand, Development and Service chain in Lean organizations. Literature related to measuring IT performance in development work following the agile model was also a research focus in this stage. While researching these areas focus was placed on finding knowledge on how to focus on business value and quality in performance measurement. The outcome of this phase was the conceptual framework which was applied when building the initial solution for the case organization in the next phase.

The following step was designing a proposal which comprised of the research results on how the current performance metrics support transitioning towards a Lean or agile organization. The data consisted of steering groups held to ensure the project stays aligned with the customer expectations. The outcome for this step was the proposal on improving the measuring of IT performance resulting in possible new KPI's to cover the entire value chain from the IT perspective while supporting a lean and agile transition. It is also imperative that there are KPI's which can be applied for both agile and waterfall development models.

The last step of this study was the validation of the proposal and it included a steering group with the case company where the initial proposal was presented to the project instructor. Following the steering group, the company feedback guided the final steps to

be taken in this project and the final version of the proposal was built with the approval from the case company. The outcome of the final phase was the polished version of the preliminary proposal.

2.2 Project schedule

The following table illustrates the initial project schedule.

Table 1. Thesis project schedule

TASK NAME	START DATE	DUE DATE
Project kick-off	31/10/2019	01/11/2019
Gate 1: Introduction	01/11/2019	22/11/2019
Gate 2: Methods and materials	23/11/2019	20/12/2019
Steering meeting 1	12/12/2019	12/12/2019
Christmas holiday	20/12/2019	10/01/2020
Gate 3: Current state analysis	10/01/2020	10/02/2020
Interview: Demand & Development Process Manager	18/02/2020	18/02/2020
Interview: Head of IT Project Management Office	19/02/2020	19/02/2020
Interview: IT Quality Manager	20/02/2020	20/02/2020
Interview: Head of Operating Model	21/02/2020	21/02/2020
Interview: Manager - Service Management	21/02/2020	21/02/2020
Interview: Head of Maintenance & IoT Solution	25/02/2020	25/02/2020
Interview: Head & Planning Manager of Customer Sales and Solutions	27/02/2020	27/02/2020
Interview: Head of Service Management & Testing	28/02/2020	28/02/2020
Interview: Manager - Service Management	03/03/2020	03/03/2020
Gate 4: Conceptual framework	10/02/2020	15/03/2020
Gate 5: Building the proposal	15/03/2020	01/05/2020
Steering meeting 2: Feedback on proposal	04/09/2020	04/09/2020
Gate 6 & 7: Validation and Final words	04/09/2020	14/09/2020

Table 1 illustrates the schedule for this project in which the kick-off was held on 31st of October in 2019 and the project was finished in September 2020. Several meetings were

held for steering during this project and a total of nine interviews were conducted with seven managers who were chosen for their roles in the company. Initially the schedule was planned so each gate would take one month to complete, but there are some differences between the planned and actual starting and ending dates. A steering meeting was held where the feedback necessary to validate the proposal was received from the case organization.

2.3 Data collection and analysis methods

The data used for this thesis is collected through various sources which include company interviews and meetings, internal documents, and existing knowledge and industry best practices on how to measure IT performance during value creation.

Internal documents provide information on the current state of measuring practices in the case organization. Interviews and meetings provide the case organization's perspective on what the current measuring practices in the scope of this project might be lacking. Meetings are held throughout the project timeline to ensure the project stays on track and the case organization is kept up to date regarding the progression of the project. Interviewees have the chance to give their insight and opinions on how the current IT measuring process could be improved. The data for this project was collected as the table on the next page shows.

Table 2. Data collection table

Participants/role	Type of data	Description	Date	Documentation
Instructor, IT Quality Manager, Head of Project Management Office	Kick-off	Introduction to the business challenge and the participants	31.10.2019	Notes
Instructor, Metropolia Supervisor	Scope meeting	Decisions on what is included in the scope of this project	12.12.2019	Notes
Instructor, Head of IT Project Management Office	Interview	The current Development Management metrics and project steering	19.2.2020	Notes, recording
Instructor, Demand & Development Process Manager	Interview	The current state of Requirement Management and Continuous Development process metrics	18.2.2020	Notes, recording
Instructor, IT Quality Manager	Interview	The current state of metrics from the Quality Management perspective	20.2.2020	Notes, recording
Instructor, Manager – Service Management	Interview	The current state of metrics in the Application Management process	21.2.2020	Notes, recording
Instructor, Head of IT Project Management Office, Head of Operating Model	Interview	The current state of Demand, Development and Service Management process metrics from the business point of view	21.2.2020	Notes, recording
Instructor, Head of Maintenance & IoT Solution Team	Interview	The current state of demand management metrics	25.2.2020	Notes, recording
Instructor, Head & Planning Manager of Customer Sales & Solutions	Interview	The current metrics in the Customer Sales & Solutions area	27.2.2020	Notes, recording
Instructor, Head of Service Management & Testing	Interview	The current metrics in the Service Management & Testing area	28.2.2020	Notes, recording
Instructor, Manager – Service Management	Interview	More on the current metrics in the Application Management process	3.3.2020	Notes, Recording
Instructor	Steering meeting: Validation of the initial proposal	Feedback from the project stakeholders to validate the proposal	4.9.2020	Notes, recording

As Table 2 shows, nine interviews were carried out to gather information sufficient for analyzing the current state of measuring performance in the case company. A scope meeting was held in the beginning to define what is included or excluded from the scope of this study. Finally, a steering meeting was held where feedback on the initial proposal was received from the case company to validate the proposal and carry on to preparing

the final version of the proposal and the thesis. The interview questions can be found in Appendix 1. Table 3 below illustrates the internal documents analyzed for the current state analysis of this study.

Table 3. Internal documents

	Document name	Number of pages/other content	Description
A	Case company operating model handbook	~100 pages	Case company operating model
B	IT Scorecard	~30 ppt slides	Current KPI's
C	Case company project management methodology	~50 pages	Guidelines for project management
D	Application Management Service Desk Performance report	35 ppt slides	Application Management metrics
E	Monthly Service Integration catch-up	39 ppt slides	Service Integration metrics
F	Bonus target results 2019 & Bonus target framework 2020 – Customer Sales & Solutions	9 ppt slides	Customer Sales & Solutions agile metrics
G	Application Management Service Level Agreements and KPI's	7 ppt slides	Service level agreements and KPI's for Application Management
H	Service Integration and Application Management Process KPI documentation	29 ppt slides	Key performance indicators for SIAM process
I	Requirement Management & Continuous Development 2019 KPI's	13 ppt slides	KPI descriptions for Requirement Management and Continuous Development processes

As seen in Table 3, several internal documents from the case company were analysed to help in understanding the current state of measurement practices in the organization. Next, carrying out the current state analysis is described in Section 3.

3 Current state analysis

The current state analysis is the part of this thesis where the present state of measuring IT performance is described along with the actions already taken to help reach the desired state in the case organization.

3.1 Metrics

The IT scorecard consists of the key performance indicators in which business operations are interested. The metrics in the scope of this study are listed in the table below.

Table 4. IT scorecard KPI's

Metric	Why is it measured
Number of IN/SR Inflow & Outflow	Measure the load of IN and SR.
End user satisfaction & response rate	Understand how satisfied users are with the IT service.
On time delivery	Measure service delivery performance by workgroups.
Budget planning accuracy	
Project time to market	
Project on time delivery	
Rate of requirements responded within 14 days	Understand and followup IT's responsiveness towards business.
Continuous development time to market	Understand and track the speed of delivering requirements to fulfill continuous development needs.
Continuous development on time delivery	Understand and monitor accuracy of the time and capacity planning, ensure continuous development is carried out according to agreed schedule.
Number of P1/P2 IN	Identify downtime in IT landscape and avoid problems that could impact availability and reliability of IT services.
Number of problem tickets / P1 & P2 IN	Take corrective and preventive actions that would avoid incident recurrence.

The current KPI's in the IT scorecard and the reasons for measuring them are illustrated in Table 4 above. As visualized, KPI's are extremely focused on delivery speed and on time delivery of projects which also applies to continuous development. This is in place to ensure the projects uphold the promise for delivery speed while staying on schedule. The KPI's for service area measure customer satisfaction, track incidents aiming to understand user satisfaction and to identify problems that might arise with the availability or reliability of services. Response time to requirements is currently the only KPI in the

scorecard related to demand management, and it is measured to understand and follow up the responsiveness of IT towards business.

The current KPI's for the requirement management and continuous development processes can be found in the following table.

Table 5. Requirement management and continuous development KPI's

KPI name	Why is it measured?
Rate of requirements responded within 14 days	Ensure time is not wasted because there is no response to business by demanding either approval, cancel or acknowledging a requirement is being worked on.
Rate of requirements decision making within 60 days	It ensures the prioritization of important requirements because if commitment is not made within 60 days the matter might not be so urgent. Point out improvement areas in requirement commitment decision making.
Continuous development time to market	Set a target on how fast solutions are produced, aim for improved delivery speed.
Continuous development on time delivery	Track and point out improvement areas in the ability to plan and predict continuous development.

As Table 5 above illustrates demand management has two KPI's which are focused on how fast responding to requirements is and how quickly decisions regarding requirements are made. The KPI's for continuous development focus on how fast continuous development is carried out and it also measures the ability to predict and plan continuous development. The measurements are in place to understand how responsive IT is towards business, and to prioritize requirements so urgent matters can be focused on while looking for improvement areas pointed out by these metrics. Continuous development metrics encourage faster delivery speed and staying on schedule. Development management processes current KPI's are listed in the following table.

Table 6. Development management KPI's

KPI name	Why is it measured?
Time to market	Focus on development speed.
On time delivery	Ensure delivery is done within promised schedule.
Budget planning accuracy	Provide transparency to funding and improve planning accuracy.

Development management currently has three KPI's used to track the progress of projects as depicted in Table 6. These metrics are focused on financial forecasting, delivery speed and delivering on schedule to ensure the promised delivery speeds are upheld and finishing the deliveries according to schedules. The aim of financial forecasting is to guarantee funding is as transparent as possible while improving the planning accuracy. Table 7 on the following page lists the currently used KPI's for the application management process.

Table 7. Application management KPI's

KPI name	Why is it measured?	Included in IT scorecard?
Mean-time-to-resolve	Helps understand resolution times and identify measures to improve it.	No
Reduction of incidents	Track the increase of incidents and identify measures to reduce them.	No
Hop-count	Report and identify measures to reduce hop-count.	No
Reducing the overall resolution times	Help understand time to resolve service requests or incidents and identify measures to improve overall resolution time.	No
Cumulative resolution time	Understand the cumulative resolution time of incidents or service requests and identify improvement measures.	No
Incident resolution time	Report and identify measures to improve resolution time of incidents within agreed levels.	No
Release satisfaction	Prepare and report performance of a release while seeking feedback to improve release process.	No
On time delivery	Identify measures to improve the release process.	Yes
Hypercare defects	Track the number of incidents after release and identify ways to reduce them.	No
Monthly inflow / resolved / unresolved ticket count		No
Customer satisfaction		No
AMSD resolved		No
First level resolution %		No
Response time		No
Ticket distribution		No
AMSD individual CSAT		No
CSAT score		No
On time delivery for change requests		No
End to end resolution time		No

As shown in Table 7, application management KPI's focus on different service aspects such as customer satisfaction, speed of service, defects, incident and service request count, distribution of tickets and count of tickets resolved within the first level of service. These measurements are in place to track speed of service, track the number of incidents, understand how satisfied customers are, and to identify potential problem areas along with improvement opportunities to continuously improve service levels. The application management process also tracks critical service levels which are not included in the table.

The following table contains agile metrics currently measured in the Customer Sales and Solutions process.

Table 8. Customer Sales and Solutions KPI's for agile teams

KPI name	Why is it measured
Solution overall quality	To get an understanding how satisfied the users are with the solution overall.
Number of defects	Ensures better quality development and testing.
Requirement volatility	Metric supports improvements in sprint planning and requirement refining for better focus on customer value and reduces cost of re-work. Better control of requirements creep. Improved satisfaction of requirements leads to better customer satisfaction. Improvements in requirement volatility also has a positive impact on lead times and reduces the risk of sprint fails.
Improved lead time	Focus on development speed.

Agile metrics used by Customer Sales and Solutions process are illustrated in Table 8 above. These metrics are used on a team level with the purpose of tracking performance of teams. The approach to measuring in this process is unique when compared to others as each team chooses which of the above metrics is most fit for their project which ensures the use of metrics relevant to the project. This process also tracks performance using the metrics listed in the IT scorecard found in Table 3 to track overall performance.

3.2 Interview findings

This section introduces the findings from the interviews conducted for this study during the current state analysis phase. People from key areas of interest for this study were

interviewed to find the strengths and weaknesses found in the current state of measuring for the demand, development, and service management processes. The results from the interviews were analyzed to find themes among the discussed strengths and weaknesses in the current state of measuring. A table was created to demonstrate which strengths surfaced during the interviews and a similar table for the weaknesses was produced. The table below depicts what the strengths in the current measuring process are according to the findings made during the interviews.

Table 9. Recurring themes about the strengths in measuring during interviews

Strength	Interview occurrence
Requirement response transparency	3
Incident management	2
Delivery speed	1
Waterfall model metrics	1
Problem detection	1
Requirement decision making	1
Collaboration	1
Planning accuracy	1

Table 9 illustrates what the strengths in the current measuring process are according to the interviewees. The number of times strengths were mentioned during separate interviews are also presented to determine what the key strengths are.

Table 10 shows the interview findings regarding the weaknesses in the current measuring process.

Table 10. Recurring themes about the weaknesses in measuring in the interviews

Weakness	Interview occurrence
Business value	5
Quality	5
Visibility from idea to benefit realization	3
Customer centricity	3
Agile model metrics	2
Documentation	2
Data quality	1
Balance of metrics	1
Incompatible tools	1

Table 10 lists weaknesses according to the interviewees along with the mentions per weakness to determine key problem areas to consider during this study. Most prevalent issues based on the interview results are related to value which was brought up in five different interviews which was also the case for quality. Visibility from idea to benefit realization and customer centricity are the next problem areas which were shed light upon during three different interviews. Documentation, and metrics for measuring agile projects were discussed in two of the interviews. The other topics raised by the interviewees are not focused on in the literature research since the weaknesses with more occurrences are prioritized for this research as they also correlate with the business challenge introduced in the beginning of this study. Data quality is an exception as the interviewee who mentioned this problem pointed out the importance of this aspect for the organization through reliable arguments and links to a multitude of stakeholders should problems arise within data quality.

The key problem areas in the current state of measuring gathered by analyzing the interview results and considering the business challenge are shown in the figure below.

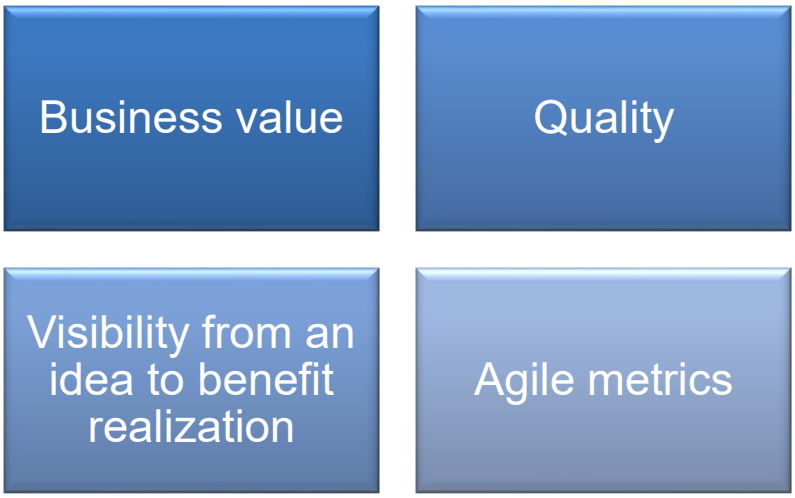

Figure 2. Key focus areas

Figure 2 illustrates the key focus areas for the case organization in the demand, development, and service management processes. These focus areas are chosen based on analyzing the interview data which indicates a need for change in these areas, and the business challenge pointing out their high priority status when proposing changes.

3.3 Conclusion of the current state analysis

The current measuring process ensures the demand, development, and service management processes' speed expectations are met while service area also focuses on the number of tickets and the severity of incidents along with customer satisfaction. Furthermore, metrics excluded from the IT scorecard are measured within some processes to provide information on other improvement areas found to be relevant for these processes. This indicates that the commonly determined metrics are not meeting the measuring requirements of each process which invites more problems as unique tracked metrics are scattered around the processes. Similarly, the guidelines and objectives set in the operating model are not followed in practice. The themes shown in Figure 3 highlight key focus areas which the interviewees described as having high

importance or currently requiring more metrics. The conceptual framework presented in the next section focuses on finding possible solutions by researching the existing knowledge and best practices for the key focus areas based on the interview findings with the focus on Lean and agile ways of working.

4 Conceptual framework

In this section of this study, theory relevant to this project is introduced to provide an understanding on how to effectively measure performance according to different methodologies.

4.1 The Lean approach

The core of the Lean approach revolves around creating customer value and eliminating every activity not obviously supporting this objective. The objective of Lean is to provide value improvements, flow optimization and waste elimination as a non-stop process. (Williams & Duray, 2012) Spacey (2018) states that business value can be defined as the generated benefits from an organization to its stakeholders including capital, assets, talent, social capital, knowledge, culture, intellectual property, brand value, advantage over competitors, products and services, and quality of life.

The Lean approach starts with specification of what customer perceives as value for a service which affects all IT operations as they aim to create value to customers. IT operations are often divided into three categories which are processes and activities without a doubt creating value, the ones which are necessary even though not creating value, and the operations which are not creating value nor are they necessary meaning the third category is classified as waste. (Williams & Duray, 2012, pp. 59-60)

Orzen and Paider (2016) state that to eliminate waste, we need to have a way of defining what waste is where the importance of correct metrics arises. Similarly according to Orr and Orr (2014, p. 234) metrics help in discovering bottlenecks in the infrastructure of an IT department, and it is also important to make an assessment on how a company is over or under-utilizing their systems.

IT operations run according to Lean principles benefit from using metrics as a way of providing feedback which translates to valuable information linking certain results to behaviors. This is a prerequisite of making correct adjustments as change impact is unknown without performance assessments provided by measurements. (Orzen & Paider, 2016) Delivering on time and on budget are important to focus on using metrics, while

scope and quality could be considered to deserve an even higher focus. Focusing on delivery speed and budget excessively might change the results so much the solution does not even bring the promised value, which means the customer satisfaction will definitely be influenced by the result. (Orr & Orr, 2014, p. 235) The Plan-Do-Check-Adjust method is among the most used for problem-solving and the checking and adjusting part of its cycle is not possible when there is uncertainty about the impact of a change being positive which is where measuring provides help. (Orzen & Paider, 2016)

The miscommunication between the IT department and its respective users can cause failures directly adding to waste because the user is not involved while making a purchase. Standardized processes may add their own burden while technology is adopted to use. As an example, documentation practices may be inconsistent resulting in the inability to provide the value that was initially promised of information technology because the process functions inadequately, therefore causing the documentation to be lackluster whether IT is implemented or not. (Orr & Orr, 2014, pp. 218-220)

4.1.1 Lean culture

Starbird (2017) states that most organizations adopting lean consider the importance of organizational culture therefore performing activities to help the growth of culture. While it is important to incorporate training as a tool for communication and development, transforming the culture of an organization is not restricted to these activities. To develop the culture organizations must pursue the change of everything together with a purpose. Furthermore, Wiengarten et al. (2015) state that the group oriented working culture is the basis for success in lean practices as team-based practices' effectiveness could be argued to be higher in an environment rich in collectivism. Part of this cultural collectivism is national while the other is organizational.

The concept of improvement kata shows how Toyota management of people and processes works daily, and for Toyota this means considering process improvement a part of routine daily management. This helps achieve the desired outcomes as processes are continuously improved by following the improvement kata. The routine must consider both efficiency maximization and waste reduction from the perspective of all areas to ensure optimization is not carried out by hurting other areas. (Rother, 2009)

There are four major factors negatively impacting the adoption of Lean principles thus resulting in a failure to achieve benefits. Upper management does not have the commitment or understanding of the impacts of lean, and they are reluctant about accepting the cultural change necessary for a successful lean implementation. Furthermore, the people working in the organization are mismatched to their jobs, and lean is not a fitting methodology for process improvement in the organization. (Starbird, 2017)

4.2 Agile methodology

Four values are described in the Agile Manifesto by Beck et al. (2001):

"We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

That is, while there is value in the items on the right, we value the items on the left more."

These values are essential as value cannot be delivered by only using appropriate processes and tools if teams are not enabled or motivated to effectively function as a team. To achieve success in a project constant customer feedback is needed and therefore traditional contracts are fundamentally flawed as they specify project scheduling, costs and requirements in advance which often results in the terms losing their meaning before the project is completed. (Beck, et al., 2001) For this reason, contracts should instead define the ways in which the customer and project team collaborate, while the ability to adapt to change is in itself what often determines whether a project will be successful or not. (Martin & Martin, 2006, p. 7)

While it is very important to provide documentation fit for purpose the focus should be on adding direct value to customers by providing them with a software that works. This can be achieved by ensuring the customer-supplier relationship is collaborative and open. Project plans are still required but it is important to understand they act as forecasts instead of commitment plans because in agile projects baseline changes are to be expected whereas sprint plans act as commitment plans. (Measey, 2015)

4.2.1 Agile project management

Project management in the agile model is different from the traditional approach since process customization and change to the pursued outcome often vary according to the customer needs. Nonetheless, agile methodologies are purposefully defined in a way that leaves room for tailoring and customization. This can be interpreted to mean appropriate processes may need implementation to fill the void. (Cobb, 2011)

The traditional measurement of repeatable processes does not fit the agile template since pursuing agility means processes should be reliable which means they are focused on outcomes that provide value to the customer. Agile teams might not be able to follow same processes in every project because the inputs vary greatly, and therefore teams must be adaptable as the focus after a project should lie in whether the delivered solution matches the vision and value expectations of the customer. (Highsmith, 2004)

The scaled agile framework suggests efficiency, value delivery, quality and agility should be key concerns for performance measurement. It is suggested that the delivery of value could be measured by focusing on the number of releases, value feature points delivered, release date percentage and architectural refactors. For quality, the suggestions are measuring defects, support calls, support satisfaction, product satisfaction and escalation rate percentage. (Leffingwell, 2018)

4.2.2 Measuring of the agile transition progress

Olszewska et al. (2016) suggest that quantitative measurement of a large-scale agile transformation should aim to answer four questions. These are: how did the responsiveness change, how did the throughput change, how did the workflow distribution change,

and how did quality of the product change. Eight metrics were proposed in their study to measure request journey interval, processing interval, functionality per money spent, number of releases per time period, commit pulse, flow, number of external trouble reports, and average number of days open for external trouble reports as depicted in Figure 3.

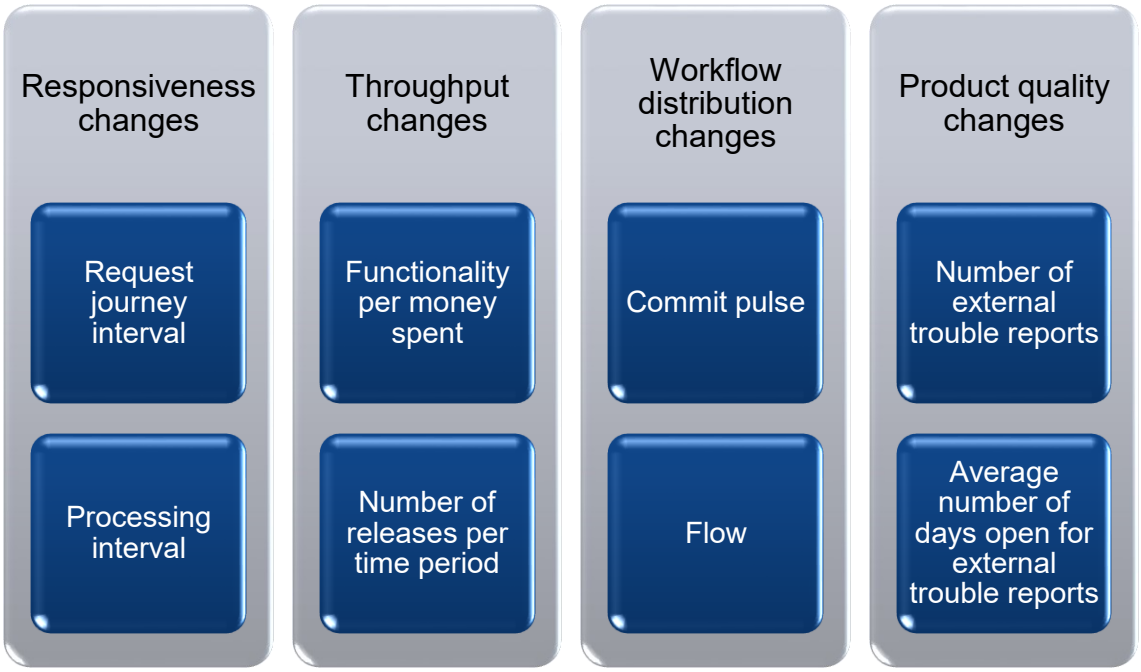

Figure 3. Agile transformation metrics

Figure 3 illustrates the metrics introduced by Olszewska et al. (2016) with the goal of answering questions relevant to agile transformation. The goal of the questions is to identify ways to improve end to end lead time, delivery of business value and efficiency.

4.2.3 Agile performance management

Organizations looking to be more agile must consider three practices in performance management to enable the transformation towards a more agile operating model. First, they need to create an environment where teams are empowered and have autonomy. This enables teams to focus on their output while following strategic priorities and predetermined directions. The objectives should be dynamic allowing changes according to shifting priorities and it is essential they are set collectively since committing to self-made

goals is easier compared to when they are set by others. Targets and performance should be transparent because teams and units can see their interdependencies which reinforces the characteristics of an agile organization. (Darino, et al., 2019) Literature on the agile methodology emphasizes the importance of measuring the performance of teams as the agile ways of working are dependent on the empowerment of teams. By choosing which metrics they follow, teams can track information relevant to their specific project. (Budacu & Pocatilu, 2018; Leffingwell, 2018; Cobb, 2011; Martin & Martin, 2006; Measey, 2015; Reddy, 2015)

In the agile environment where risk taking is encouraged to continuously develop individual performance continuous feedback is required from all available sources. Continuous feedback is gathered by leaders to evaluate how an individual is developing and this is carried out by collection of input from the people this individual has been working with. Technology can be of great help here as feedback can be gathered to evaluate how every interaction of an individual is experienced by others. (Darino, et al., 2019)

Successful implementation of agile methodology requires performance management and evaluation of employees by measuring how well they have been following the shared values, behaviors and mind-sets which are the enablers of agile methodology. This does not mean hard targets should be forgotten as they still provide valuable information when measured. (Darino, et al., 2019)

4.2.4 Scrumban metrics

Scrumban metrics can be applied to monitor the overall performance of teams in organizations. The cumulative flow diagram illustrates how much work in progress there is during different value stages which helps management pinpoint improvement areas by giving insight into burn-up, WIP, bottlenecks and cycle time. Lead time is used to indicate the agility of business through tracking delivered work items, and evaluation of the mean and distribution of service classes. Throughput demonstrates the delivered work item count within a period aiming towards optimization by continuously increasing the rate of delivering these work items. Measuring the aging of work in progress allows monitoring the flow of work items to evaluate whether it is stable or stationary, and the purpose of it to determine WIPs that are aging which usually indicates problems that should be inves-

tigated. Flow efficiency is measured to indicate where there might be waste in a system by measuring the ratio between work time and lead time. Takt time metric measures the time that passes on average between deliveries which helps determine what the maximum size of work items can be allowing more accurate commitments. (Reddy, 2015)

4.3 Measuring business value

The agile and lean methodologies have been two major topics for discussion in literature and the common goal in both is to deliver value to customers. Regardless of the extent of information on these methodologies, most of the existing knowledge does not provide metrics that could be applied to track the delivery of value (Cobb, 2011; Orr & Orr, 2014; Highsmith, 2004; Martin & Martin, 2006; Measey, 2015). However, the materials related to the scaled agile framework provide some solutions for this, (Leffingwell, 2018) even though the focus in metric balance has been shifting towards measuring outcomes.

According to Plumer (2010, p. 40) project success has four conditions to consider. Criteria for success must be determined with the stakeholders of a project before kick-off and repeatedly throughout the project lifecycle. The working relationship must be maintained with enough collaboration between the owner and manager of the project. Empowerment to the manager must be in place to ensure they can flexibly tackle problems should they arise. The owner of the project must be interested in the status of the project's performance. Furthermore, in his research Plumer (2010, p. 43) states that customer satisfaction is among one of the most acknowledged measures for the success of a system. When the expectations of customers are discussed, focus is placed on the participation and involvement of users while it is also important to consider factors such as leadership and trust when managing user expectations. The scaled agile framework suggests a different approach for measuring the business performance where value would be measured by placing more focus on the number of solutions and features delivered also tracking the release date percentage and architectural refactors. (Leffingwell, 2018)

The perceived performance of an information system is found to be the largest contributor to end user satisfaction. To measure end user satisfaction a survey focusing on 22 categories can be implemented by basing the questions on the expectancy disconfirma-

tion theory, equity theory and needs theory. The result of such a survey will provide an organization with the ability to measure end user satisfaction with an information system delivered. The validity of the measurement model was evaluated and found to be reliable. The quality of information accuracy, availability, reliability, being up-to-date, relevance, timeliness, completeness, presentation, accessibility is rated separately for each category by the expectation, perception, and importance on a scale from 1 to 5. Similarly, the system's quality is rated based on the response time, reliability, functionality, flexibility, user friendliness and ease of integration with other systems. The system's support service quality is rated accordingly based on the promptness, reliability, and responsiveness. The abilities of support service staff are also evaluated for each category mentioned earlier based on their technical competence, attitude, accuracy in record keeping while the provision of training courses is also evaluated on the same scale per each category. (Au, et al., 2008)

4.4 Measuring quality

Measuring the quality of a project can be challenging because a clear definition for quality is difficult to construct, which is why it is much more important to understand quality rather than defining what it is. Quality has philosophically been described for example as pursuing never ending perfection, fulfilling needs, the degree at which someone feels happy and the way of life. All these factors merged together provide a robust definition for what quality is and an understanding of what quality is must be acquired before it can effectively be measured. (Natarajan, 2017, pp. 2-3) Issac et al. (2006) state that customer satisfaction is widely acknowledged to be the basic principle for most topics where quality is discussed. Similarly, Leffingwell (2018) states that according to SAFe quality can be measured by focusing on support and product satisfaction, the number of calls made to support while also adding the metrics for the number of defects and escalation rate percentage.

Leffingwell (2018) suggests that quality metrics should aim towards reducing the number of defects and support calls on an organizational level while also diving deep into team performance measurements. Reddy (2015) states that quality can be measured through failure demand metrics which are used to track the amount of work items processed by the Kanban system due to the quality being poor. Furthermore, a system could be de-

veloped to log defects along with their root causes found in production because it enables the management to make informed decisions to tackle these issues. The other metric for failure demand is defect trends which visualize the rates at which new defects occur and old defects are closed to indicate if teams or the organization is improving.

The impact of blockers can be measured to prioritize blockers which are the factors that are causing delay in development. The list of blockers should include the frequency at which they are occurring and the measured impact it has on the system in hours, which is followed by weighing the impact allowing the identification and removal of the most severe delay factors ultimately leading to reduction in the lead distribution area. Measuring due date performance provides a metric which help determine the quality of estimates to report how accurate they are allowing insight on the system's efficiency, as work items with a fixed delivery date would require teams to begin working early to guarantee on time delivery in case they do not trust estimates to be accurate. Arrival rate distribution and service rate distribution metric tracks the arrival rate and delivery rate of work which is particularly helpful when suspecting instability in the system. By measuring this the organization or team can identify the reasons behind instability which helps them take actions to improve. (Reddy, 2015)

4.4.1 Data quality

The creation of data advances through requirements which show what it represents, how it intends to represent reality in source systems and how it is assumed to represent reality. In a situation where the input data is not appropriate one may question the data produced by the analysis. Standards related to data are in place to ensure data can be used as a tool to consistently approach problems and they define the ways how to meet the requirements. (Sebastian-Coleman, 2013)

A dimension of data quality could be defined as a characteristic of data which can be measured, as it is useful in the definition of data quality expectations needed for measuring an existing dataset. Measurement is performed by determining how extensively the data being measured meets the expectations of said data quality which often translates to knowledge of what characteristics are distinctive to this dataset and the assessment of their presence in the measured dataset. (Sebastian-Coleman, 2013) Wang et al.

(1995, p. 629) state that the quality of data has three distinct characteristics which are data reliability, semantic integrity, and physical integrity. Figure 4 illustrates the framework by Wang and Strong (1996) describing data quality is divided into intrinsic, contextual, representational and accessibility elements.

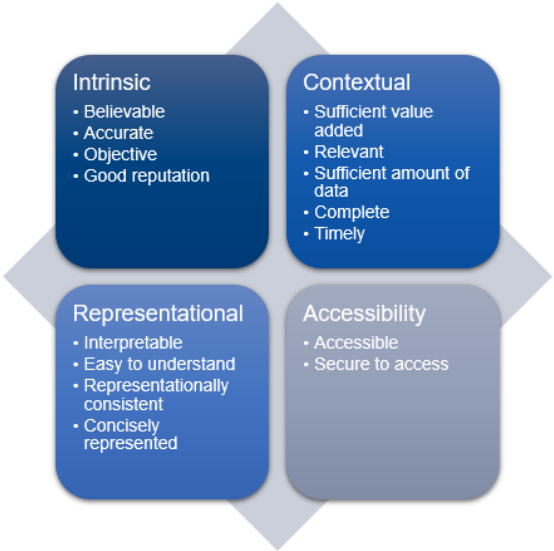

Figure 4. Data quality dimensions

As shown in Figure 4, accuracy, objectivity, believability, and reputation are all elements of intrinsic data quality whereas value added, relevancy, timeliness, completeness, and appropriate amount of data represent contextual data quality. To have a high representational data quality, a dataset must be interpretable, easy to understand, representationally consistent, and consistently represented while accessibility data quality elements include data accessibility and access security.

4.5 The balanced scorecard for IT

Kaplan and Norton (1996, p. 24) state that The Balanced Scorecard can be used by executives to translate the vision and strategy of a company into performance metrics as it provides a comprehensive framework. Measuring outcomes without focus on performance does not allow people to know how to reach desired outcomes and focusing on performance while leaving outcomes without measurement does not show how im-

provements in operations contribute towards business expansion. Therefore lagging and leading indicators of the strategy of a business unit should be balanced as this is what makes a good balanced scorecard. (Kaplan & Norton, 1996, pp. 31-32)

The IT BSC is an adaptation of the generic business balanced scorecard and it can be adapted to different environments quite easily allowing IT project evaluation, IT performance and IS performance measurement, and among other addressed issues ensuring the IT and business strategies are aligned. The agility of IT can be measured through the IT BSC after adjustments have been made to the four perspectives presented in it. These perspectives are user orientation, business contribution, operational excellence, and innovation and competitiveness. To achieve agility user orientation aims to provide user satisfaction, and initiation and maintaining of relationships that are agile with them. The business contribution perspective seeks to ensure the business contribution gained from agility in IT by time to market reduction is reasonable. From the operational excellence point of view agile IT BSC aims towards structural, procedural, and developmental agility in IT so that services and applications are delivered to add value to business. Finally, from the innovation and competitiveness perspective purpose is to ensure the organization has the tools necessary to innovate and maintain its' competitive ability in the environments constantly changing. (Rdiouat, et al., 2015)

4.6 Summary of the existing knowledge and best practices

Organizations must be careful when making decisions on which metrics are chosen as a wrong set of metrics may prove to work against their purpose which is to find improvement areas in the organizational performance. Many practices are available for companies seeking to improve their performance measurement practices and the related literature emphasizes that the practices are not carved into stone and the successful implementation of measuring practices requires time as there is no template guaranteed to fit the needs of every organization.

While there certainly is an abundance of knowledge related to the agile methodology and lean principles, the information does not dictate how the performance of IT processes should be measured. These methodologies are rather focused on the ways of working and for agile this means focusing on delivering solutions through iterations which is sup-

posed to enhance the ability to respond to changes in a volatile environment. While this may be true it must be noted that the available literature has its basis on agile software development and majority of the conducted research on the application of agile methodologies does not focus on how the agile metrics are applied in other types of organizations. Consequently, implementation of agile practices must be managed with care even though the core objectives can be beneficial to many corporations in the present market where scope changes are to be expected due to the volatile nature of the market. The existing literature on performance measurement in agile development offers ways to measure which are better suitable for this kind of projects where the traditionally used metrics fail to provide relevant information.

According to studies organizations often focus on the process and technology aspect of a Lean transformation, but it is imperative to remember that to achieve success in a Lean transformation the cultural aspect must be considered since majority of the recent knowledge on Lean emphasizes that without the correct culture organizations tend to be unable to sustain the transformation.

To measure the business value of projects, the best practices suggest the answer can be found in measuring how satisfied customers are with the delivered services. An extensive survey focusing on 22 categories related to the expectations, perceptions and importance of an information system is suggested for measuring the end user satisfaction with the information system. Adopting the use of such surveys could help determine the performance regarding the delivered business value.

Figure 5 illustrates the relationship between the chosen existing knowledge and best practices for research and the current problem areas in the organization.

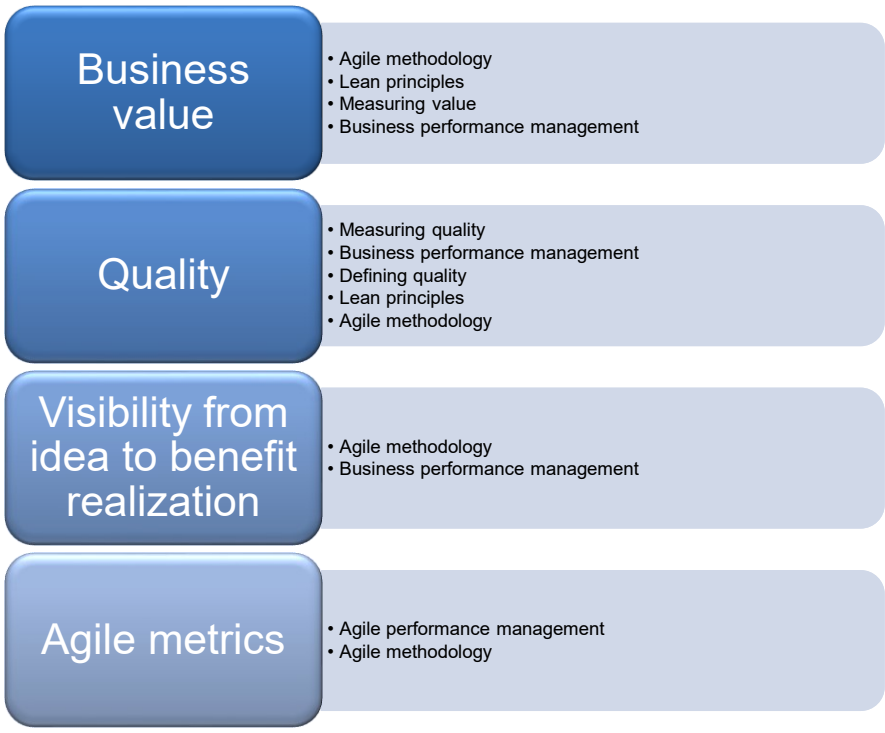

Figure 5. Conceptual framework

As shown in Figure 5, the existing agile methodologies and lean practices were researched for solutions related to measuring IT performance with the focus on business value and quality of projects. Similarly, focus was placed on visibility from idea to benefit realization and data quality as the importance of these categories was found to be major in the case company. While the literature research was conducted, the links found between the current strengths in the organization and the existing knowledge was also considered to find evidence on how the current metrics are performing according to best practices.

5 Proposal

In this section of the thesis proposal is built according to the current state analysis which includes the strengths and weaknesses found by interviewing key stakeholders. Key focus areas (see Figure 3) for the case organization were found in the current state analysis and relevant existing knowledge and best practices was researched to propose possible changes for improvements in these areas.

5.1 Overview of the findings

The interviews revealed that the current metrics are best applicable when the projects being measured follow the standard waterfall model while the measuring of value and quality in these projects could be focused on more. These are also the focus areas highlighted based on the interview findings which suggest that the current metrics are not having enough focus on the value and quality of delivered services. The Balanced Scorecard approach also emphasizes the importance of the balanced focus in metrics to measure performance. The business challenge suggested visibility from idea to benefit realization to be one of the weaknesses in the current measuring process and interview findings support this hypothesis.

To measure quality focus should be placed upon understanding what quality is, which has been described as the pursuit of perfection, needs fulfillment, the degree at which someone feels happy with what they have and as a way of life. Considering these dimensions and understanding on how the delivery of quality could be enabled starts to form. Consequently, in the case company this translates into the fulfillment of business requirements and it also indicates the quality of solutions is also visible in customer satisfaction while the pursue of never-ending perfection could be understood as a solution not causing problems for the business and to have a minimal number of defects from production.

Research on the existing knowledge and best practices provided information on how the right set of metrics can be used as a tool to measure the current state of an organization when considering an agile transformation, and by continuously tracking the same metrics also provide data on how the transformation is progressing through changes in meas-

urements. Furthermore, literature suggests the organizational culture has a large impact on successfully implementing Lean in an organization and even more so sustainability of the implementation.

The literature research revealed that the best practices for measuring agile development is often performed on a team level and the information on measuring the performance of an entire organization following the agile methodology is scarce. The agile methodology provides useful metrics for measuring the performance of a team when the initial requirement is expected to change, and the primary purpose of the metrics measured in agile development is to help the team and management in determining where improvements can be made. The agile manifesto emphasizes the importance of employees and human interaction, collaboration with customers, change response and working solutions. If the processes and tools, contract negotiation, sticking to a plan and thorough documentation are traditionally valued more, the focus is rather different from the agile values. From the measuring viewpoint this shows that traditional metrics still serve a purpose depending on which methodology is followed during development work, and the IT department's overall performance can still be visible from the reports.

5.2 Building the proposal

While carrying out the current state analysis, documentation was analyzed to acquire the information on the demand, development and service processes and meetings were held to decide whom to interview and to prepare the template to be followed during interviews. The initial business challenge was to determine what kind of metrics would support a transition towards a more Lean and agile organization. Later, the decision was made to involve a list of metrics used across different processes in the scope of this study along with the reasons behind measuring them if currently known. A steering meeting was held to clarify how the proposal would be built, and it was decided that the recommendations would include potential metric improvements. The recommendations are focused on how to help ease a transition towards a Lean and agile organization while placing more focus on performance from a business value and quality perspective.

The proposal includes an analysis in which the current state of measuring in the case organization is compared against the existing knowledge and best practices. Solutions

are then recommended based on the analysis and the research results, and as the following step the analysis and the recommended solutions are presented to the case company representatives chosen for two workshops. The resulting feedback serves as the required data for validating the proposal in the sixth section of this thesis.

5.3 The evaluation of the current metrics against the existing knowledge

The current state of measuring in the case organization is focused on the development speed as is the case with handling requirements. Customer Sales and Solutions measures metrics for both demand and development management, and while the metrics in the IT scorecard are used, a large number of the executed projects follow the agile methodology which results in the IT scorecard metrics becoming irrelevant as the agile model does not result in rational measurements with the traditional methods. Similarly, the continuous development process is facing problems with the projects following the agile model. The service management processes focus on measuring other factors as well, such as the number of defects, customer satisfaction and the number of tickets as well as hop-count.

The following figure visualizes the value to be expected by implementing the proposed changes to achieve improvements in the key focus areas determined in the current state analysis of this study.

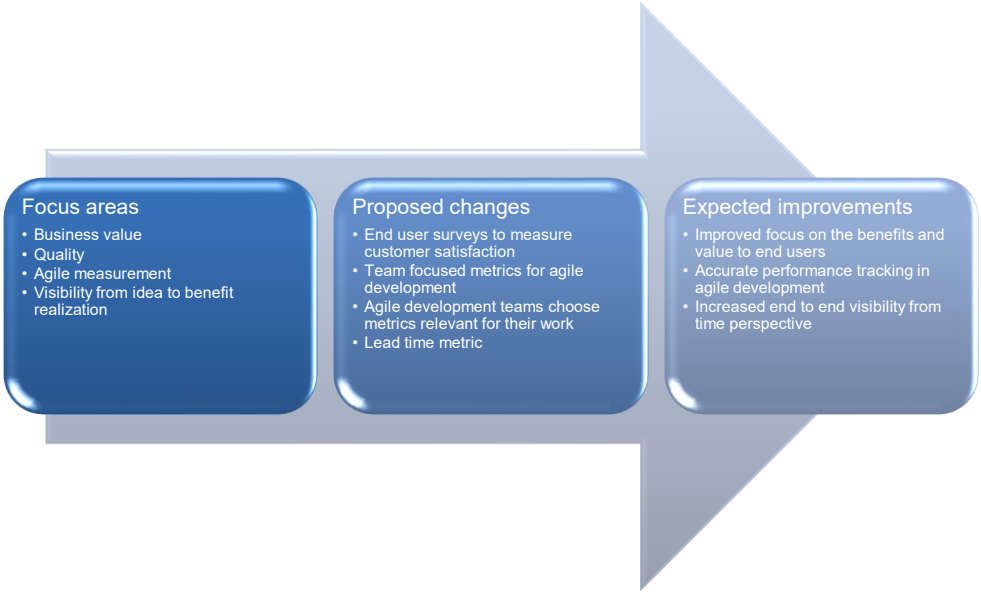

Figure 6. Proposal

As Figure 6 demonstrates, the literature on Lean principles and agile methodologies present possible changes and improvements to the focus areas in this study but the literature does not mention substantial examples on how the application of the proposed methods affected the focus areas through practical examples. The scarcity of information related to metrics directly measuring the business value indicates that the application of a straightforward metric measured in the case company to address this focus area might be challenging since the value of a project can change depending on the expected outcome. The constraints of value were numerous based on the literature and this provides further evidence against the application of a uniform metric to measure business value. It could be argued that the delivery of business value can be expected to improve as the ways of working ingrained in the agile methodology. In theory, following the methodology should ensure that the customer is involved in the cycle from requirement to deployment which should make it more likely that the solution offers the expected value. However, the researched literature provided insufficient evidence to support this claim. It was suggested that the business value could be measured focusing on the end user satisfaction.

Literature showed that quality is widely accepted to be measured through the measurement of customer satisfaction. Similarly, business value is closely related to the categories that are considered during measuring customer satisfaction. This supports the expectation to improve the measurement of value and quality by focusing on the end user satisfaction, however this claim is only supported by the existing research if the success of a delivered solution is accepted as the delivery of business value and expected quality.

The importance of understanding quality was emphasized in literature and the most accurate existing definition for quality was introduced, suggesting that the customer involvement from the beginning of a project would help in measuring quality since this helps in understanding what the customer perceives as good quality. From this viewpoint measuring customer satisfaction could be used as a tool for tracking quality of projects. As the company is applying the agile methodology for the projects where it is suitable, the proposal includes commonly used agile metrics to ensure performance reports are as accurate as possible.

Considering that the case company is undergoing changes to its operating model, metrics should be supportive of a successful transformation towards a more agile and lean organization. It is important to note that the existing knowledge researched for this study suggests that creating customer value while eliminating waste is the core of it. Lean has its origin at the Toyota company in Japan where the organization focused on improving the way the business operates daily. The management style aims to reduce waste while boosting the efficiency of production. When considering a Lean transformation, it is imperative to remember Lean principles include the culture inside an organization, unlike the agile model which is a methodology originally designed for software development. If a Lean culture is to be adopted successfully and sustainability for it is to be achieved, it is imperative to remember that first an understanding on what level the employees' understanding of Lean skills are and what kind of constructive behaviors already exist in the company.

The visibility from idea to benefit realization through measuring is a current problem area in the case company. The existing measuring practices researched for this study did not provide much information on how to improve visibility from idea to benefit realization through metrics, which indicates that further research on this area would be required

before metrics comprehensively covering the visibility aspect can be proposed based on facts. However, the literature on agile methodologies suggest a lead time metric which could help in the ability to track project progression from idea to deployment.

One of the key focus areas for the case company was agile measurements and the proposal includes example agile metrics which could be considered when making changes to the measurement of agile projects. Unlike in the traditional waterfall model, the delivery of a solution is achieved through iterations and to ensure business requirements are met when changes to the baseline of a project are expected. As the expected outcome of a project is often changing through the project lifecycle, this means the estimated delivery dates and budgets may no longer be accurate which means that performance reports produced by the traditionally used metrics where the results are based on the initial estimates do not demonstrate performance from the viewpoint of business value and quality. If the project scope is changed as a result of business requirement, this results in a longer delivery time and more resources spent for development which in this case is not necessarily a negative thing, and therefore it should not be reflected into the performance reports as poor performance.

When decisions are made based to data, the quality of data should be up to standard to preserve the reliability of these decisions. Since the case company records data at the frontlines after which it is often passed through more than one system, the importance of source data meeting the requirements for quality is even higher as the information in more than one system is affected. To solve this data related issue the company could consider the application of data quality assessment. No reliable metrics were found after the information search, but research related to assessing the quality of data is available. If the current data quality were assessed, the case company would have the evidence needed to move forward with the measures necessary for improvements in this area. This focus area was supported with further evidence from the literature research stating that if the quality of data is poor to begin with, the reliability of the decisions made based on this data can be questioned which warrants increased focus on the subject. Further research on data quality would be required to propose a solution to improve the situation in the case company.

The case organization will unlikely completely steer away from the waterfall model in the foreseeable future and the current metrics provide the case organization with relevant performance reports for the development work following the waterfall model. This would suggest that the current metrics in use should be tracked and in addition to this the adoption of metrics that are better suitable for agile projects is in place.

5.4 Recommended solutions

The solutions introduced in this study are proposed to help cover the entire value chain ultimately improving the benefits and value realized by the end users. Table 11 includes a gap analysis where the measurement process gaps are identified and capabilities to improve the situation are presented.

Table 11. Gap analysis

BUSINESS REQUIREMENT	CURRENT STATE	GAP	NEW CAPABILITIES TO REDUCE OR ELIMINATE THE GAP	ISSUES & RISKS
Business value coverage by metrics	Metrics across the Demand, Development and Service Management are not having enough focus on business value	Major improvement needed particularly in Demand and Development Management processes	Tracking customer satisfaction in Demand, and Development areas in the form of a survey to customers covering questions related to business value of deliveries.	Measuring through CSAT does not provide results backed up by hard data.
Metric coverage for quality	Metric coverage for quality is limited mostly to the Service Management process where the occurrence of incidents, defects and satisfaction is measured. Data quality not tracked at all.	Major improvement needed particularly in Demand and Development Management processes	Clear definition for what quality is in each project with customer involvement, track end user satisfaction by surveying customers during the stages from idea to deployment. Measuring failure demand, impact of blockers, due date performance, arrival rate distribution and service rate distribution.	Difficulties in decisions regarding what quality translates into.
Metrics fit for measuring performance in agile development	No agile metrics with the exception of Customer Sales and Solutions	Need for improvement across all areas where agile model in use	Enable teams in agile development to choose relevant agile metrics to improve the accuracy of the performance reports. Measure the changes in responsiveness, throughput, workflow distribution and product quality to understand how teams are improving with the agile ways of working.	Preparing the right set of agile metrics to offer teams for choosing relevant metrics from. How much of the changes in performance can be said to result from agile?
Visibility from idea to benefit realization through relevant metrics	Measuring executed process by process, and provides little to none visibility from idea to benefit realization	Room for improvement but not the most pressing concern	Lead time metric from agile methodology to track time spent between the initiation and completion project.	A single metric might not make a big difference in visibility.

As seen in Table 11, it is suggested that the gap between desired and current state could be reduced by placing more focus on tracking customer satisfaction through the solution lifecycle. The issue with this type of measurement is that it is not based on data and only

serves as a soft measurement for value. It is also proposed that the measurement of customer satisfaction could act as an indicator of quality. Based on the research on Lean principles other types of metrics could also be adopted to improve the measurement of quality, which would provide data for the failure demand, blockers impact, due date performance, arrival rate distribution and service rate distribution. The difficulties in measuring quality arise since understanding quality is required to acquire any sensible measurements.

To achieve improvements in the tracking of agile development, it is proposed the case company enables the agile teams to choose from a set of agile metrics resulting in relevant data on their performance reports. As such practices are already in place it would be beneficial to take advantage of the existing metrics and practices to minimize the work required to make changes. It is also recommended to track the changes in results from these agile metrics to see how the case company is progressing in responsiveness, throughput, workflow distribution and product quality aspects. A question could be asked when providing the agile teams with a selection of metrics, do the metrics include enough variety and at the same time not too much, which is the challenge when thinking about such a solution.

The proposal includes a single change to improve end to end visibility which is a recommendation to adopt a lead time metric. This would provide a tool to track how much time is spent after the initiation of a project to reach the completion. The problem with this solution is that it would most likely not make a substantial impact on the visibility on its own.

The recommended customer satisfaction survey is rated on a scale of 1 to 5 where the end user expectation, their perception and importance. First the quality of the information's accuracy, availability, reliability, being up-to-date, relevance, timeliness, completeness, presentation, and accessibility are rated. The quality of the system is also rated based on the response time, reliability, functionality, flexibility, user friendliness and ease of integration with other systems. The quality of the system's support service is then based on the promptness, reliability and responsiveness, and the abilities of the support service staff are evaluated based on their technical competence and accuracy

in record keeping. Lastly the provision of training courses is evaluated. Next, validation of the proposal is described in the sixth section.

6 Validation of the proposal

The sixth section of this study presents the validation of the initial proposal to the case company.

6.1 Overview of the validation

The validation of the initial proposal in this study was conducted by the case company instructor gathering feedback from the stakeholders for the proposed changes and improvements. This method was chosen since it was the most efficient way to ensure that the validation is finished within the schedule of the project as the prevalent situation made it difficult to host validation workshops. After gathering the feedback, a steering meeting was held where the required changes were discussed and next steps regarding this study were decided. Data quality was decided to be excluded from the key focus areas as it is an important finding.

6.2 Development ideas based on the validation

Data quality was removed from the key focus areas in the current state analysis and is instead to be viewed as an enabler of business value and quality since the quality of data must be at a sufficient level to ensure relevant measurements. The gap analysis found in Table 11 required some minor changes as the measuring of business value and quality is not executed merely from a project perspective. The steering meeting for validation of the proposal shed light on the importance of how the proposed changes to the key focus areas should begin step by step.

6.3 Final proposal

The objective of this thesis was to determine how effectively the current metrics at the case company support a transition towards a more agile and Lean organization. The objective was also to propose metric changes with balanced focus on all relevant aspects of measurement and supportive of a Lean and agile transition. The outcome expected

by the case organization was fulfilled while metric changes were also suggested in the gap analysis found in Table 11 as expected. The following figure illustrates the improvements to be expected by implementing the changes proposed in this study.

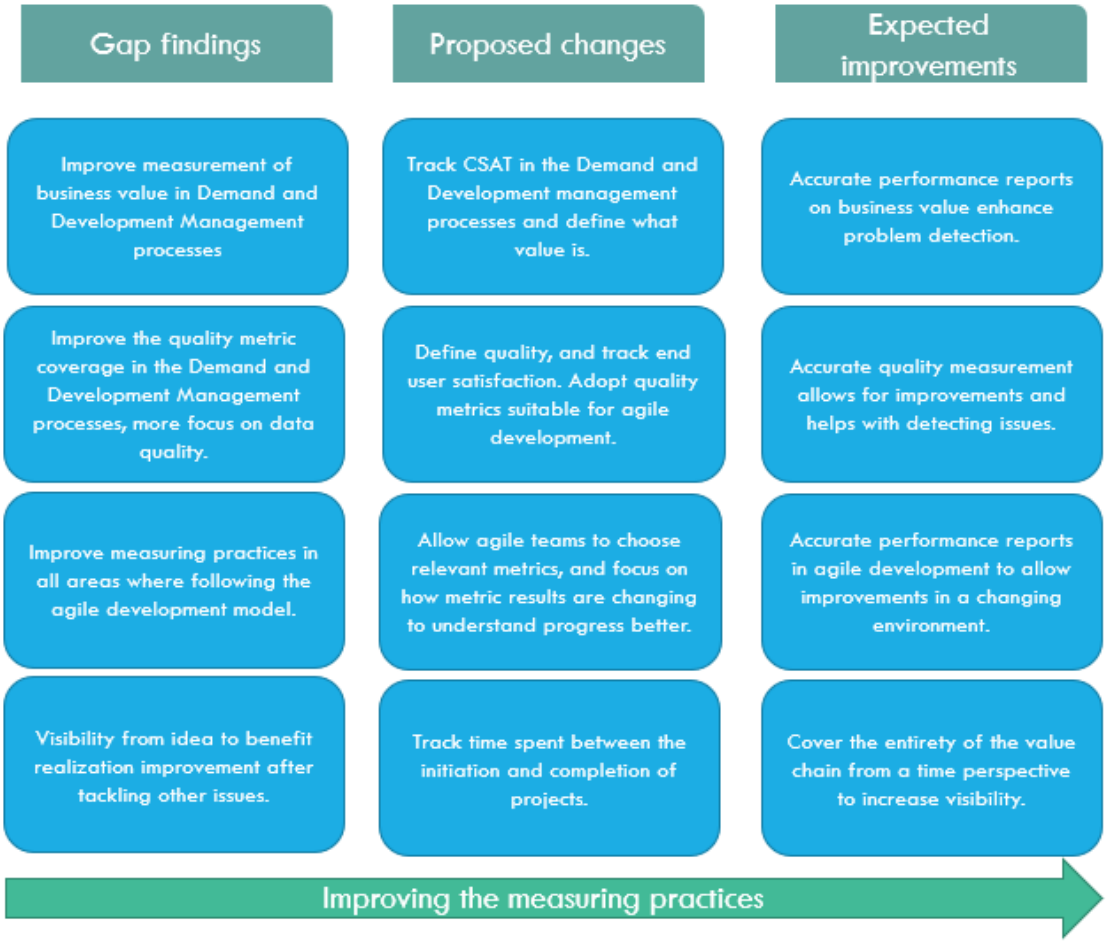

Figure 7. Expected improvements from the proposed changes

Figure 7 visualizes the findings from the gap analysis, and recommended changes with the improvements expected by implementing these changes. By placing more focus on the measurement of business value the case organization can expect improved accuracy in the results of measuring business value which would help in detecting issues arising during development. The changes proposed in this study include placing more focus on defining what the expected value from development is enabling its measurement while tracking customer satisfaction more in the Demand and Development Management processes.

Increasing the metric coverage for quality helps with more accurate measurement while helping with issue detection throughout the value chain. Proposed changes for improving quality coverage include clarifying what quality is and adopting KPI's to measure quality in work conducted following the agile development model.

Increased focus on the measurement of agile development work by metrics suitable for this purpose provides more accuracy in the performance results which helps increase the responsiveness to change which is vital to the agile ways of working.

Increasing the visibility from idea to benefit realization helps the case organization in tracking development through the entire value chain from a time perspective which could be executed by implementing a lead time metric introduced in the agile methodologies. Next, discussion and conclusions are presented in the seventh section.

7 Discussion and conclusions

The final section of the thesis focuses on the summary and conclusion of the thesis by providing the executive summary, evaluation of the thesis and the final words.

7.1 Executive summary

The objective of this study was to evaluate how effectively the current measuring practices focus on business value, quality and other relevant aspects of measurement while supporting a transition towards a more agile and Lean organization, which was achieved as the analysis provided insight from this perspective. Furthermore, the question regarding whether the current KPI's covered measurement in both agile and waterfall development models was found to be lacking in the current state of measurement as it is largely focused on the waterfall model, while the current practices are not aimed enough to change the mindset and focus into value and benefits for the end-users. As the outcome of this study was to propose changes to the current measuring practices on a general level, detailed metric changes were not proposed in this thesis. The following figure visualizes how the proposal was built.

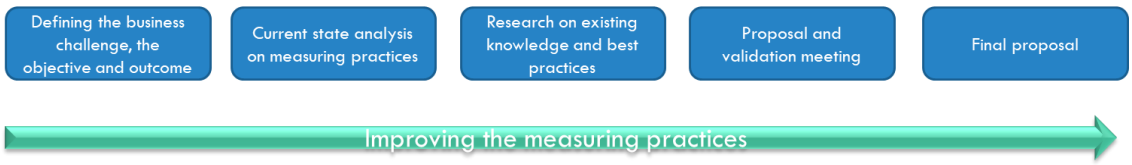

Figure 8. Building the proposal

Figure 8 above provides a visualization of the proposal building process and as is shown, business challenge, objective and outcome were defined in the beginning. The following step was the current state analysis on the measuring practices in the case organization including analyzing internal documents and stakeholder interviews. After this, research on existing knowledge and industry best practices was conducted which together with the current state analysis provided a basis for building the proposal. Finally, the proposal was validated in a steering meeting with the case company instructor and the final changes to the initial proposal were made.

The following figure presents the challenges, findings and the recommended changes proposed as well as the improvements expected by implementing the changes.

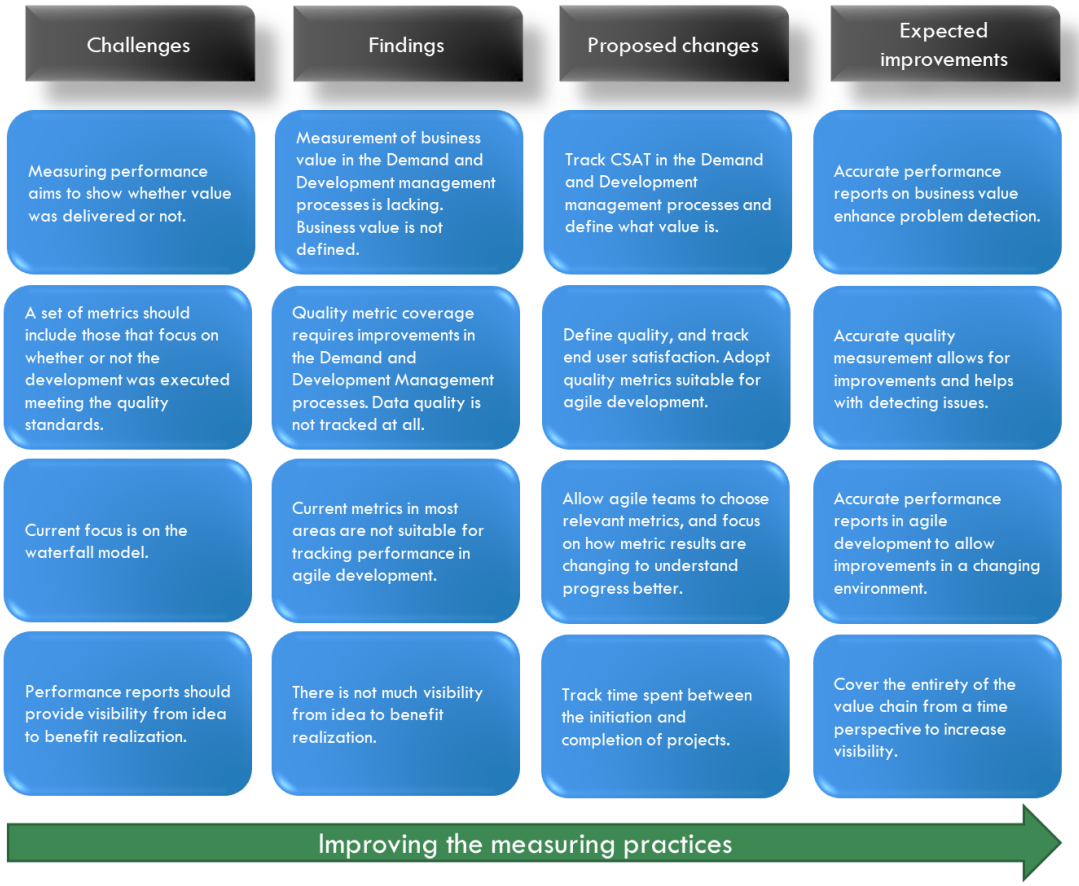

Figure 9. Basis of the proposal

Figure 9 above presents a summary of the findings in the current state analysis and the corresponding challenges along with the changes proposed to improve the situation. Finally, the improvements expected by implementing these changes are summarized.

Performance measurement should aim to report whether value was delivered or not, and the findings in the current state analysis suggest that business value measurement is lacking the most in Demand and Development Management processes while business value is not defined. The recommendation to help solve this problem is to begin the tracking of customer satisfaction in the Demand and Development Management processes while also clarifying the definition of value. By implementing these changes more accurate performance reporting which helps in the detection of issues can be expected.

Metrics should show if the development work meets the quality standards. The current state analysis showed that the quality metric coverage is lacking in Demand and Development Management processes while data quality is not tracked at all. For this reason, quality should be defined to enable its measurement paired with tracking end user satisfaction to see what the performance level is like quality wise. By implementing these changes, the case company can expect more information regarding the quality of development work.

As the current metrics are largely focused on the development work executed following the waterfall model, they are not suitable for performance tracking in the agile development. The case company should allow agile teams to choose metrics that are relevant to their work to achieve more accurate performance reports, and management could focus on how the results are changing over time to gather insight on how well people are adopting the agile ways of working.

Performance reports should provide visibility on how development work is progressing from idea to benefit realization and such visibility does not currently exist in the case company. Tracking the time spent between the initiation and completion of development work would help cover the entirety of the value chain from a time perspective to increase the visibility from idea to benefit realization.

7.2 Evaluation

As this study was conducted on a general level, further research would be required to implement a comprehensive set of metrics to cover the entirety of the value chain. The interviews conducted during the current state analysis also indicated that some of the IT processes are currently in different maturity stages which further complicates the proposal of uniform metrics for measuring IT performance in the case organization. The results of the study may have been more relevant by narrowing down the scope and focusing on each area one by one making it easier to pinpoint problem areas requiring development. The proposal consisted of recommendations on how to begin improving the measuring practices in the case company, and consequently more research is required to make the solutions transferrable as they mainly point towards the direction where measuring practices should transition. The proposal in this study provides the

case company with a starting point which helps guide the work still required to transition towards the desired state of measuring IT performance in the organization.

The objective of this study was to determine how effectively the current measuring practices in the case organization help in a transition towards a more agile and Lean organization. Furthermore, the objective was also to propose changes to the metrics to have metrics with a balanced focus on all relevant aspects of measurement, supportive of a Lean and agile transition. Addressing the outcome was conducted through providing a gap analysis in which the gap between the current state of measuring and the state suggested by industry best practices is presented along with the recommended changes and the improvements expected by implementing these changes. The gap analysis could have been clearer by providing a more detailed analysis on the gap for each key focus area. To conclude, the objective can be considered achieved although there could have been improvements in the building of the proposal.

The validity of this study could be improved by conducting the interviews after some research into relevant theory since it could have helped in preparations for the interviews. The number of interviews conducted helped understand how the different processes in the case organization report performance with a different focus which helped determine the current state in an efficient manner. The data collection and internal documents analyzed for this study were listed comprehensively while the method of analyzing the interviews might be chosen differently to achieve more specific results. The data from internal documents was recorded in detail and the interviews revealed how the operating model guidelines are not how the IT processes currently operate. The conceptual framework applied to determine the gap between the current state in the case company, and the industry best practices and existing knowledge was recorded in an academic manner. The proposal was concisely built based on the gathered information and, therefore it can be considered relevant for the case organization. Theory included multiple data sources to verify the reliability of the information and theories from different areas were applied to one another to make the conclusions more reliable. The collection of data for the research and interviews was conducted in a short time which was one of the limiting factors during this study because of the schedule, and it could have been improved by reserving more time for data collection.

7.3 Final words

The challenges and solutions introduced in this study are increasingly relevant for organizations looking to transition towards a more agile and Lean organization as responsiveness to change and waste reduction are becoming more and more important in the volatile competitive environment. This opportunity to work for an international company in a project closely related to the type of work I am looking to chase in my future career has been a tremendously valuable learning experience for which I would like to thank all the contributors from the case company as well as the instructors from the university, who helped in making this happen.

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Appendix 1: Interview questions

1. Could you go over what responsibilities your role in this company holds?
2. Review together the summary of the current KPI's in your specific area and why they are measured.
3. What is good in current KPI's? Why?
4. What should be added or changed? Why?
5. Are the current KPI's having enough focus on customer centricity?
6. In your opinion, how could we better measure a) quality and b) business value realization?
7. Other comments regarding KPI improvements?
8. In your opinion, where should we focus when developing IT KPI's, especially regarding Lean & Agile transformation?