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Standardising an Asset Management Process

A case study of a pier inspection process at the Port of Gothenburg

Master's Thesis in the Master's Programme Design and Construction Project Management

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Cover:
Aerial view of Torshamnen at the Port of Gothenburg. (Göteborgs Hamn AB, u.d.)
Department of Civil and Environmental Engineering
Göteborg, Sweden, 2016

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ABSTRACT

This study addresses the desire to standardise a pier inspection process at the Port of Gothenburg. A process is in this report defined as a set of inputs converted into outputs to serve some kind of interest. Through studying the process of a pier inspection at the Port of Gothenburg, suggestions on how to standardise the inspection is developed. The study was conducted as a qualitative case study, with a set of interviews and observations to get a deeper understanding of different angles of the case.

Four highlighted advantages were found within process standardisation: improved process performance, improved customer confidence, enhanced readiness and simplified communication. It was found that there has to exist a mutual agreement of what is sought, when developing and implementing a standard.

In this study, two different perceptions of a standardised process were identified; a stable process where the responsibilities are clear, and a common nomenclature. The authors address these different perceptions through introducing a flow scheme that will facilitate a common nomenclature and an efficient and proper documentation. Further, a development of the Port's current data system, with increased compatibility to pier operations, is recommended.

For further research it is suggested that the flow scheme is developed in a deeper and more technical approach, and further investigate the compatibility of this standardisation, through an additional case study on another pier.

Key words: Pier inspection, harbour inspection, asset management, project management, process standardisation, ISO 55000

Att standardisera en förvaltningsprocess
En fallstudie av en kajinspektionsprocess vid Göteborgs Hamn

Examensarbete inom mastersprogrammet Design and Construction Project Management

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SAMMANFATTNING

Denna studie adresserar en önskan att standardisera en kajinspektionsprocess i Göteborgs Hamn. En process definieras i denna rapport som ett antal inputs konverterade till outputs för att tjäna ett specifikt intresse. Genom att studera en inspektionsprocess vid Göteborgs Hamn ges förslag på hur en standardisering av processen kan se ut. Arbetet är genomfört som en kvalitativ fallstudie, innehållande ett antal intervjuer och observationer för att uppnå ett djupare förståelse samt olika vinklar av processen.

Fyra fördelar identifierades vid standardisering av en process: ökad processprestanda, ökad kundsäkerhet, förhöjd beredskap samt förenklad kommunikation. Vid utförande och implementering utav standards måste det finnas en gemensam överenskommelse av vad som efterfrågas, vilket är icke-existerande i dagen process.

I denna studie identifierades två olika uppfattningar av vad en standard är; en stabil process med klar ansvarsfördelning, och en överenskommen terminologi. Författarna uppmärksammar dessa olika uppfattningar genom att utveckla ett flödesschema som är tänkt att främja en gemensam terminologi och en effektiv och korrekt dokumentation. Vidare rekommenderas en vidareutveckling av Göteborgs Hamns nuvarande datasystem, för att få ökad kompatibilitet till arbete med hamnar.

För fortsatt forskning föreslås en vidare utveckling av flödesschemat med en djupare och mer teknisk inställning, samt att fortsatt undersöka kompatibiliteten av denna standardisering genom fältstudier av kajinspektioner vid andra kajer.

Nyckelord: Kajinspektion, hamninspektion, förvaltning, projektledning, processtandardisering, ISO 55000

Contents

Preface

This Master's thesis has been performed at the Department of Civil and Environmental Engineering at Chalmers University of Technology, Sweden, from February to June 2016. The work with this Master's thesis has strongly benefitted from several persons that should be acknowledged.

We would like to thank Christian Koch, Professor, and Sjouke Beemsterboer, Project Researcher, at the Division of Construction Management. Your ideas and feedback have been of high value for us. Thank you for your time and enthusiasm throughout our process.

We would also like to thank Annika Oskarsson at the Port of Gothenburg for your support, access to information, and supervision. Thank you Dag Linghoff at ÅF for your interest in our study and continuous supervision. Finally, big thanks to all interviewees who participated in this study, for your time and eagerness to share your view of the case with us.

This Master's thesis constitutes the end of our education at Chalmers University of Technology. Through this study we have learnt a lot about the project manager's role and complexities in process standardisations that we will greatly benefit from in the future. Again, thank you to all involved.

Göteborg, June 2016

Johanna Hallgren

Rickard Olsson

Glossary

Main inspection – Huvudinspektion

Port of Gothenburg – Göteborgs Hamn AB (GHAB)

Plan and Building Act – Plan- och Bygglagen (PBL)

Specific inspection – Särskild inspektion

Status classification – Tillståndsklass (TK)

Swedish Transport Administration (STA) – Trafikverket

Task description - Uppdragsbeskrivning

Quantity description – Mängdbeskrivning

1 Introduction

The Port of Gothenburg AB (hereafter "the Port") is the largest port in Scandinavia and is covering 50% of the import of crude oil and 30% of the total international trade into Sweden (Göteborgs Hamn AB, 2015). Thanks to its strategic location, the Port can compete with the large European harbours in terms of oil tankers, cruise ships and "Roll on Roll of" ships (RoRo ships). The Port is a public company owned by the City of Gothenburg, and is responsible for the maintenance of the pier structures. (Göteborgs Hamn AB, u.d.)

Every sixth year, a larger investigation is made on each pier, called main inspection, to determine the status of the pier. This is in accordance to the Swedish Transport Administration's regulations, which the Port has decided to follow (Oskarsson, 2016). In a main inspection, the pier is closely inspected above, as well as below the water surface (Trafikverket, 2015). After that, the status of the pier is evaluated and a maintenance plan is developed. Furthermore, a budget is set for the maintenance work on the pier for the coming ten years (Oskarsson, 2016).

In this report, the ongoing main inspection of the pier Torshamnen at the Port is followed and evaluated. This pier is a part of the Energy Ports where tankers are loading and discharging crude oil. The main customers of Torshamnen are ST1 Refinery, Nynäs and Preem AB which are international oil companies refining and selling oil products. Torshamnen was built in 1967 (Göteborgs Hamn AB, 2012) and due to its age, it is in need of continuous maintenance work to retain the same functionality. Torshamnen has the greatest depth of the energy ports, 20,5 meters at its deepest. (Göteborgs Hamn AB, 2016).

The process of the main inspection is today hardly not mapped – there is no standard for how the inspection should be executed. The main inspection is therefore seen as heavy and hard to manage at the Infrastructure department that is responsible for the inspection process at the Port. Many describe the process as insufficient, inefficient and demanding regarding time, resources, and money.

An insufficient inspection can result in that sudden measures have to be taken, impacting the operations of the pier, which as a consequence might result in withdrawals of the customers. Since such a large amount of oil is imported through Torshamnen, a downtime would result in significant consequences for the Port, as well as for Sweden. Due to this reason, the General asset manager requests a standardised process of the main inspection. A standardisation can facilitate a controlled and smooth main inspection for all involved parties, resulting in that the quality of the inspection can be assured and decrease the risk of a non-operational pier.

1.1 Purpose

The purpose of this master's thesis is to investigate what parameters are influencing a standardisation process. Through this, suggestions on how to standardise the main inspection at the Port is developed and presented through a flow-scheme.

1.1.1 Research questions

- How can the main inspection at the Port be standardised?
  - What does a standardisation imply according to the involved actors and the future inspection processes?
  - Which driving forces influence a standardisation implementation?
  - How does a process standardisation influence the main inspection process?

1.2 Method outline

This master's thesis was performed as a case study at the Port of Gothenburg in Sweden. After an initial meeting with the General asset manager at the Infrastructure Department, the possible areas of investigation in their processes were discussed. A general literature study considering process theory and standard implementations combined with discussions with the thesis supervisor at Chalmers University of Technology led to the development of an outline for this thesis, and the decision to select one recurrent process in the organisation to study.

A deeper literature study was then made to present the already existing research in the area of process standardisation and standard implementation, which built the theoretical framework. The case study was performed through a series of interviews with the project management, specialist consultants, structural engineers and inspectors involved in the process, combined with field study observations and meetings participated. The results from the case was in the discussion analysed in relation to the theory in order to answer the research questions and the aim of this thesis, which are presented in the conclusions. A more thorough description of the methodology will be presented subsequent to the theoretical framework.

1.2.1 Limitations

The empirical results of the case study are focused on the process of the main inspection of Torshamnen. This study spans the process from the decision to conduct a main inspection to its closure when the results are handed over to the maintenance department. This thesis considers the process from a managerial view, thus it does not consider the pure technical considerations made in the process. Further, it should be noted that the results are based on interviews and thereby voices by single persons' perceptions of the main inspection process.

2 Theoretical Framework

In this chapter, the results from the literature study is presented, with the aim to provide the reader with information to better understand the case study. The chapter starts by defining and describing process and standard, followed by merging them into process standardisation. Subsequently, the reasons and effects of standardisations are brought up. Information management's relation to process management is studied. The established ISO standards are described in order to provide a basis of discussion regarding well established standards and their impact on organisations. Finally, asset management of infrastructure systems is evaluated, aiming to raise important aspects regarding the development of asset management and its standardisation.

2.1 Defining a process

In current business research, the definition of a process is a common subject of discussion. It appears to be important to define the concept of a process, maybe because most persons seem to have a perception about what they think it is, but there is no such established definition determining how much it contains and covers. This section is intended to concretise what a process is defined as in this report.

Jeong (2006, p. 63), does through George (1996), define a process as "any activity or group of activities that produce required outputs by taking a variety of inputs and adding value from the perspective of internal or external customers". Similarly, Davenport and Short (1990, p. 12) probably developed a more common definition of a business process as "a set of logically related tasks performed to achieve a defined business outcome". Pettigrew (1997) describes processes as how things transform over time. The definition used by Pettigrew (1997, p. 338) is "a sequence of individual and collective events, actions and activities unfolding over time in context". Finally, Project Management Institute (2013, p. 47) uses the following definition of a process: "A set of interrelated actions and activities performed to create a pre-specified product, service, or result. Each process is characterised by its inputs, tools, and techniques that can be applied, and the resulting outputs."

The reviewed definitions above all contain a set of inputs that are transformed into outputs in order to serve some kind of interest. Pettigrew (1997) does not specify the aim more than as a context, while Davenport and Short (1990) are more clear with their definition in achieving a defined business outcome. This area of difference likely depends on the context of the subject which the article is written for, rather than the definition itself.

The definition of processes does not seem to be an area of disputes, rather they have slight differences regarding how broad they are defining a process, which seems to depend on the context they aim to be used in. This can be associated to what Pettigrew (1997) describes in his article; that a process can have different shapes: it can, be linear as well as non-linear, directional or radical as well as irreversible or transformational. What is determining the way the process is expressed is the context in which it is framed (Pettigrew, 1997). This path of thinking is shared by the Project Management Institute, which means that in order to achieve a successful process, the business environmental factors must be considered (Project Management Institute, 2008). A process thereby seems to be defined as much more than the process itself, and in order to study a process its influences has to be studied.

Further, Pettigrew (1997) stress that studying the context of a process is essential when accomplishing a case study, in order to not make it solely becoming a description of the history of a case. This demonstrates the importance in how complex process studies are, and that the process research itself should be seen as a process in order to capture its real nature. This leads us to that the definition of a process used in this report:

A set of inputs converted into outputs to serve some kind of interest.

2.1.1 Achieving a successful process

In order to understand what characterises a good process in a comprehensible way, the concept Business Process Management (BPM) can advantageously be used. Zairi (1997, p. 64), defines BPM as: "A structured approach to analyse and continually improve fundamental activities such as manufacturing, marketing, communications and other major elements of a company´s operation."

Additionally, Zairi (1997) argues that BPM has to be governed by several rules, four of which are:

- Major activities have to be properly mapped and documented.
- BPM creates a focus on customers through horizontal linkages between key activities.
- BPM has to be based on a continuous approach of optimisation through problem solving and reaping out extra benefits.
- BPM is a result of cultural change and does not result simply through having good systems and the right structure in place.

Trkman (2010) gives a somewhat different take on BPM, arguing that since BPM can be used for a variety of reasons and that success may differ regarding method of analysis, a rather general definition is needed, stating that BPM "is successful if it continuously meets pre-determined goals, both within a single project scope and over a longer period of time" (Trkman, 2010, p. 126).

While Zairi (1997) uses a set of rules that governs whether the BPM is successful or not, Trkman (2010, p. 126) looks at set of critical success factors, defining them as "a limited number of areas, in which results, if they are satisfactory, will assure successful performance". Whereas Zairi (1997) only partly focus on cultural changes to achieve a successful process performance, Trkman's critical success factors are to a greater extent focused on organisational culture which are: top management support, project management, project champions, communication and inter-departmental cooperation, and end-user training. Top management is seen as the most important, as it is initiating and supporting the process being carried out. A project champion is someone who is constantly praising the benefits to the stakeholder, being a fierce supporter of the project and provides support to the project manager and the team by communicating with the top management to address their worries in the project.

Furthermore, Trkman (2010), states that there is no best way to manage an organisation's process and that each organisation must align their strategy and structure with its competitive environment in order to perform efficient. Therefore, each organisation should study their contingencies and align their process management programs. To reach long-term success and improved performance, the

organisation's business process needs to be linked to its strategy, and the understanding of the business process is essential to maximise the value from process improvement. (Trkman, 2010)

Considering the studied articles, it seems reasonable to draw the conclusion that communication, cooperation between departments, structured work and continuous end-user training are some of the most essential elements for a successful process performance. In contrast to Zairi (1997) and Trkman (2010), Langley (2007) looks at successful process performance in the light of process thinking, defining it as considering phenomena dynamically – in terms of how people, organisations and strategies are acting and changing over time. Neither Zairi nor Trkman mention the dynamic influence as a process success factor.

Further, (Jeong, et al., 2006) claims that process thinking is an approach where the most recurrent failings in the construction industry are addressed, such as high costs, long delivery time and adversarial relationships and uncertainties. However, Langley (2007), states that more process thinking is needed in the strategic organisation research, and that the knowledge about the dynamic processes leading to successful performance is underdeveloped. There is a need of process thinking in order to achieve a more dynamic and comprehensive picture of the reality. Also variance-based generalisations when studying process performance can be misleading, since it ignores the non-linear effects appearing in complex situations. Further, it is shown that when tracing performance through mapping the activities leading to it, the effect can be a failure, since the view of how performance is achieved becomes too narrow and generalised (Langley, 2007).

It does not seem to exist such thing as "one best way" to achieve a successful process. This can supposedly be due to that each process has to be looked at in its individual context, or that the meaning of project success is different to different stakeholders and the "one best way" is therefore hard to define.

2.1.2 Project management triangle

As made clear in Section 2.1.1, there seem not to be a "one best way" to achieve a successful process. A project that may seem successful to the client might be a complete failure for the contractor or vice versa. Another way of understanding why and how that is possible is to look at the project management triangle. It is often used in order to describe factors behind project success and to highlight the project priorities. Barnes (1988) conceptualised a triangle which describes a balance within the client's objectives in forms of performance, cost and time (see Figure 1). These are later known as Key Performance Indicators (KPI) (Toor & Ogunlana, 2010).

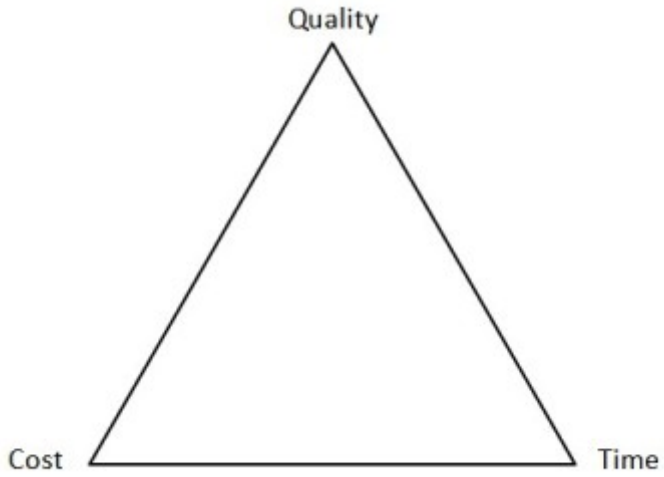

Figure 1 – Barnes' triangle, also known as the Iron Triangle (Stakeholdermap.com, 2015)

The first element, cost, represent to finish the project with all work made within budget. Cost control is important for delivering a successful project and has to be implemented down to each specialist in the project. Time is the next element. To reach success all work in the project should, according to Barnes (1988), be finished on time and into use by a target date. Last but not least comes quality. Quality has been defined as "fit for its intended purpose". Barnes (1988), further argue that an important tool of managing quality is to have detailed specifications. Sometimes the parameters are rephrased, e.g. performance instead of quality, and schedule instead of time (Jha & Iyer, 2007).

Another way of looking at a project success is in micro and macro perspectives (Lim & Mohamed, 1999). Where usually the client is looking at the macro perspective, with focus on eventual operational capability and long term gains of the project. The contractors and consultants are taking the micro viewpoint, mainly striving to achieve profitability and short term gains. Relating Lin & Mohamed's macro and micro standpoint to the figure above, the micro perspective would concern the cost and time elements, while the client is usually more concerned with the quality perspective.

2.2 Defining a standard

Standards have, according to Higgins & Hallström (2007) and Timmermans & Epstein (2007) strongly contributed to our industrialised society whereas they have made it possible to use the same railways, electricity and cars over the national borders. The importance of standards in our modern society is not hard to demonstrate and this section is intended to delineate the various definitions of a standard in current research and develop a single definition that will further be used in this report.

The probably most common definition of a standard comes from ISO/IEC, quoted by Münstermann & Eckhardt (2009, p. 3), namely:

> *"Standards are documents, established by consensus and approved by a recognised body that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context."*

This definition focuses on what a standard is, and what it is intended to achieve. While it focuses on the "what" and the "why", Brunsson & Jacobsson (2000) is to a greater extent focusing on the "how" in their explanation of a standard. They state that standards may effectively act as an alternative to different forms of authoritative rule. While organisations are fragile, and have a hard time controlling through direct orders, a standard may fill in gaps and coordinate the work that has to be done (Brunsson & Jacobsson, 2000).

Timmermans and Epstein (2010), talks about terminological standards, in terms of the professional language within a subject area uses a special terminology, which can be standardised through a terminological standard (Gubanov, et al., 2014). A terminological standard can for instance be an international classification of diseases, and aims to ensure that the meaning is the same over time and space (Timmermans & Epstein, 2010). Procedural standards, on the other hand, are specifying how the process itself should be performed. This kind of standards guide the user which actions should be taken when meeting different conditions through the process (Timmermans & Epstein, 2010). The definition of a procedural standard could easily be linked to the definition given by Münstermann & Eckhardt (2009), who also describes a standard as documents intended to set up guides and rules on how to act in different situations to achieve maximum degree of order.

Through what is stated above, the definition of a standard for this study will hereafter be:

> *"Standards are documents that provide guides, rules and terminological principles as a means to ensure that the way of working is the same over time and space. Additionally, it will act as a coordinator of what and how the approaching work should to be done."*

2.3 Process standardisation

While standards are defined as documents which gives guidelines and rules for activities, aimed at the achievement of the optimum degree of order in a given context, a standardisation is defined as the diffusion and adopting of a standard (Münstermann and Eckhardt, 2009).

Timmermans and Epstein (1999, p. 71), does through Bowker and Star (1999) define standardisation as "A process of constructing uniformities across time and space, through the generation of agreed-upon rules." Similarly, Gibb & Isack (2001) argues that standardisation is "an extensive use of processes or procedures, products or components, in which there are regularity, repetition and a record of successful practice (Gibb & Isack, 2001, p.46). Roy, et al. (2005), uses a slighty different, yet similar way of expressing how to facilitate and create consistency of a standard; namely process documentation, which is described as "a rigorous description of a process, procedure or policy to facilitate training, and development of consistency of operations and standards." (Roy, et. al., 2005, p.57).

Drawing on the statements above, Münstermann & Eckhardt (2009) is differing somewhat in their definition of a standardisation. In their rather brief definition they do not, in difference to the others, bring up what the reason for a standardisation is, instead they talk about standardisation in the sense of diffusing and adapting a standard. However, De Vries, (2006, p.63) seem to take a similar approach as

Münstermann & Eckhardt (2009), as she defines a standardisation as "through investigating how company standards are developed in company practice". This implies that the definition of a standardisation is both covering the adaption of a standard, as well as a means to develop consistency within a company.

The standardisation of a process can, according to Gibb & Isack (2001), vary from a detailed level, where documentation and procedures are totally described, to a more general level, covering the overall aim of the process on a more strategic level (Gibb & Isack, 2001). However, Roy et. al., (2005) states that it is inefficient to include project specific variants in the process standardisation. Instead, the common parts contributing to the process should be included to make it possible to link groups of operations to the process (Roy, et al., 2005). Furthermore, when using the standardisation, deviations and new versions of the process are documented and stored, to develop the process, create a base of knowledge, and to incorporate the accountability of the project manager (Roy, et al., 2005).

Regardless the level of detail that Gibb & Isack (2001) distinguish, de Vries (2006) characterise three components that are necessary for a standard to be of value for a company.

- *The standard should be there:* The demand for a standard start either within the organisation or result from external responsibilities. This demand should be evaluated, and a decision on whether or not to develop a standard is taken. If there shows to be a need of a standard, the next step is to develop it and get an approval of it. (de Vries, 2006)
- *The standard is known and available:* The next step for a successfully implemented standard is that it is made known to intended user and that they are aware of its existence. The better a standard is known, the higher the chances are for usage and that it is being used in the right way. (de Vries, 2006)
- *The standard is used*: The standard is only a success when it is used in practice and in the right way, and the users must be capable of understanding and using it. Feedback also has to be present, both to developers and users similar to the Deming circle – plan, do, check, act. (de Vries, 2006)

The researchers studied agrees on that a standard should be quite simple in order to be used. The last bullet point of de Vries (2006) is simple, but highlights an interesting aspect. There is simply no point of developing and implementing a standard if it is not accepted and used by the organisation. Timmermans & Epstein (2010) does similarly to de Vries (2006) underline the importance of social acceptance in order to create a powerful standard. This is done through building a society around the standard to tie people and things together. They claim that this is most easily done through having a cluster of creators, even though the standards theoretically could be created by one single person (Timmermans & Epstein, 2010). On the same note, Roy, et al. (2005) state the importance of having a simple documentation of the standard to make it of value for the users. For example, the design has to be consistent to incorporate a sense of common purpose. Long texts without clear importance should be avoided, while the descriptions should contain illustrations and concentrate on aspects supporting quality, safety and efficiency.

However, Timmermans and Epstein (2010) states that awareness has to be raised on that when standards are implemented into a social context there is often common

resistance and subsequent costs when implementing new standards. Further, Beimborn, et al. (2009), find indications of a risk of increased bureaucracy and centralisation of authority due to an implementation of standardisation, leading to elimination of managerial or individual decision making. Beside the fact that forcing change into employee's way of working almost always lead to resistance, the increased bureaucracy might also be a reason on why resistance is occurring when implementing new standards.

2.3.1 Process standardisation to improve efficiency

One of the most common arguments for standardising an organisation's processes is that it leads to improved operational efficiency and performance (Münstermann, et al., 2010). Münstermann et al. (2010) further concludes that a standardised business process is easier to operate than a non-standardised process and it is consequently completed with shorter cycle-time.

Münstermann and Weitzel, (2008) argues that there are four benefits of process standardisation greater than all else. The first one is improved process performance, meaning reduced cycle-time, reduced cost and improved process quality. Second, improved customer confidence, which is reduced probability for mistake and ability to cope with bigger process complexity. Third, enhanced readiness, which among others is the ability to react to regulatory changes and outsource business processes. The fourth one is simplified and increased communication, which is making activities more transparent, allowing benchmarking due to common key performance indicators, contributing in making it easier to react to unexpected changes thus increasing quality and efficiency, and simplified communication (Münstermann & Weitzel, 2008). Münstermann et al. (2010) concludes that the benefits stated above positively effects process time, cost and quality, see below.

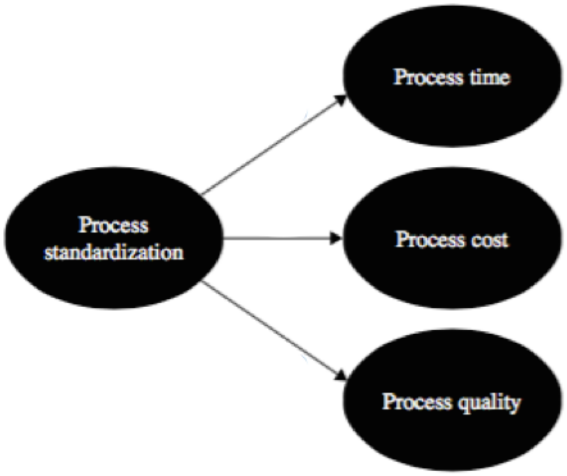

Figure 2 - Positive effects of process standardization (Münstermann, et al., 2010)

Additionally, standardisations help identify sources of delay and unnecessary process steps, which consequently leads to reduced costs. Eliminating errors, achieving economies of scale and facilitating communications is another example of cost reduction through process standardisation (Münstermann, et al., 2010).

Regarding the increase of process quality, Münstermann, et al. (2010) states similar to the arguments regarding the time aspect that process standardisation leads to

operational excellence or improved operational performance, which directly leads to higher process quality. As a conclusion, Münstermann, et al. (2010) argues that a process standardisation is necessary to improve process as well as quality performance.

Business process standardisation does however not suit all kind of businesses. As Schäfermeyer, et al. (2012) states, an increasing business process complexity makes it more complicated to establish standard operating procedures, making it more difficult and expensive to standardise business processes. Further, Schäfermeyer et al. (2012) conclude that spending resources on standardising a "unstandardisable" process is not worth the expenses and will not be successful. Furthermore, the research regarding standardisations of business processes is, according to Schäfermeyer et al. (2012) mainly focused on the manufacturing industry, which in general is more repetitive, and thereby request more research within business process standardisation.

A process standardisation has, according to Roy, et al., (2005) an area of usage beyond the production or process, as it can be used as an element of developing process thinking. To avoid clashes between different groups of professionals, a mutually developed standard process can improve the process in terms of fostering teamwork instead of working as separate units. The same documentation can also later be used to train new employees. (Roy, et al., 2005)

2.3.2 Using information management in process standardisation

In a project, there is an amount of communications instruments such as contracts, protocols and specifications. These documents are used by the different participants in the project including external consultants, subcontractors and are also to be stored for the future. Through this, the importance of a proper order in the documentation is emphasised (Perumal & Bakar, 2011). On the same note, Gyampoh-Vidogah, et al. (2003) concludes that engineers spend more time on looking for documents than using them, and that documents are created from scratch since it is too difficult to find a suitable template and thereby stresses the importance of managing documents.

Perumal & Bakar (2011), does similarly to Zairi (2009) in section 2.1.1, underline the importance that the project related information is documented with appropriate structure and properly standardised. However, Perumal & Bakar (2011) concludes that this is of even higher importance when it regards a project based business. According to them, the risk of misunderstandings decreases when all parties know in which way to structure, and accurately communicate their information to the other project participants. In addition, the documentation of a process can strongly benefit from standardised documents.

According to Perumal & Bakar (2011), standardisation of documents can increase the productivity through decreasing the confusion on elements that are recurrent among multiple projects. On the same note, Faraj & Alshawi (2004), highlights the advantages of standardised documentation through concluding that the globalisation of the construction industry strongly incentivises the necessity of standardisation of the documentation. However, it should be kept in mind that information management requires investments in time as well as effort to change the perceptions by employees (Gyampoh-Vidogah, et al., 2003). Furthermore, the information management solutions from different industries is not always successful, while the construction

industry perceives that other industries' techniques and technologies cannot be transferred and successfully adopted (Gyampoh-Vidogah, et al., 2003).

Conclusively, based on what Gyampoh-Vidogah, et al. (2003) stated above, it can be argued that if the standardisation process is not managed properly, the benefits described by Perumal & Bakar (2011) will not be achieved. Rather it would only result in a more expensive and drawn-out process.

2.4 International Standard Organisation (ISO)

The ultimate authority for the ISO organisation is the General Assembly, which is an annual meeting where members and Principal Officers meet. The Principal Officers are a part the ISO council, which take care of the majority of the governance issues. Within the council there is 20 members that are being rotated to make sure the council is representative of the community as a whole. (International Standard Organization, 2010)

The International Standard Organisation (ISO) is, according to Clegg et al. (2011), playing a central role in organisations today and is valued as one of the most important mechanisms in the subject of standards. It is a non-governmental organisation, developing and publishing written, formal standards (Higgins & Hallström, 2007). The producers of the standards are not academics, but professional standard writers and are, according to Clegg et al. (2011), very influential since their standards are seen as rational ideals that do not have to be justified more than by the committee system. Managers uses the influence of the standards as devices to shape what their organisations essentially do. As Boiral (2003) argues, the ISO standards are today used as a way to differentiate companies from their competitors even though the standards are not always requested by the client. Even ISO themselves are establishing their role through their slogan *Standards make the world go round* and to get certified to an ISO standard means to assure the compliance to a standard with help from a third party (Ivanova, et al., 2014).

Fundamentally, standards are optional. However, during the last 30 years national and international standards have grown in importance, which has resulted in that they have become more or less mandatory. Many countries have, according to Gibb & Isack (2001), standards incorporated within their legislation, which are sometimes also exported internationally. Additionally, the power of the voluntary, private standard associations have over time grown in power (Higgins & Hallström, 2007). This could be linked to the comment by Gibb & Isack (2001) who claims that standards exist in all organisations and projects today. Conclusively, the features of the ISO standards give both possibilities and advantages for the companies, like making them applicable for a broader field when not stating in which way the standard should be realised.

However, the value of a standard for a company does not go unquestioned. Martinez-Costa & Martinez-Lorente (2007) concludes in their analysis of 700 Spanish companies that organisations should not undertake a standard unless they are forced to by their customers, because the costs often appear to be greater than the gains. Additionally, they argue that companies should not choose suppliers that are using the ISO standard since that may cause additional costs for the supplier which ultimately could create added costs back to the client. Further critiques to these kind of standards

are that they rather describe what managers represent themselves as doing, than what they actually do, and that the standards rather shape the organisation than the practices (Clegg, et al., 2011). Minaar et al. (2013) states that since the standard is telling organisations *what* to do rather than *how*, the accessibility of the standard is questioned. Further, Higgins & Hallström (2007) are adding to the questionable view of a standard's accessibility by stating that the 30 years of grown influence has led to confusion between legitimacy and authority, and our perception of legitimate authority.

2.4.1 ISO 55000 – Asset management

For asset management, a new ISO series (ISO 55000) was developed and launched in March 2014 (Minnaar, et al., 2013). The ISO 55000 standard aims to maximising companies value of their assets. The ISO 55000 standard for asset management is, according to van der Westhuizen & Myburg (2014), helping the organisation to meet legal requirements as well as the expectations from all stakeholders. Additionally, the ISO 55000 standard is intended to help organisations achieve their goals through an efficient asset management. The introduction of an asset management system should assure that the goals are regularly and sustainably reached. (International Standards Organization, 2013)

An asset management system, gives according to International Standards Organization (2013) a structured model to develop, coordinate and monitor actions the organisation takes for their assets. The method also directs these actions to be aligned with the organisations aim (International Standards Organization, 2013). The standard is further describing what to be done, but not how to conduct it (Minnaar, et al., 2013). Thereby, it allows the management relatively high freedom regarding how to implement the standard to best meet their organisation's needs, while the standard sets the minimum requirements for an efficient asset management system. Also the trade-off between long- and short term actions is open for the management (Minnaar, et al., 2013). Since the ISO 55000 is intended to be universally applicable, it also becomes general in its descriptions. (Minnaar, et al., 2013)

2.4.2 Using standards as branding and assuring quality

As a result of our globalised world, companies expect a world class quality (Sivaram, et al., 2014). This desire has also forced companies to provide products and services with a world class standard, through using standardised strategies, for example an ISO or Total Quality Management standard (Sivaram, et al., 2014) (Singh, et al., 2011). Thus, a standard certification has an important signalling function. According to Timmermans & Epstein (2010), many companies only formally comply with well-known standards, as a marketing method, without even changing their processes according to the standard's principles.

Another reason why companies are implementing standards is that they are intended to assure that their maintenance processes are on a good level. The usage of standards is intended to help organisations identify what they are responsible for and to provide this information to relevant parties (Gilbert & Rasche, 2008). They also help the organisation to see to it that stakeholders are included in the accounting, auditing and reporting processes that organisations perform regarding different issues. In addition,

stakeholders also serve the benefit of checking whether the organisation is really complying with the standard that they have implemented, which is very important in the cases where the standards do not demand independent confirmation of obedience (Gilbert & Rasche, 2008).

A standard's partial intention mentioned by Gilbert & Rasche (2008) above is proved by Wright et al. (2012) as they found evidence of that there is a linkage between stakeholder management and financial performance, and that stakeholder management leads to improved shareholder value.

Reliability is one of the most important characteristics of any organisation, regardless of whether they are public or private (Too, 2012). Stakeholders of infrastructure will demand return on their investments, and to satisfy the variation of different stakeholders, organisations have to find a way to create value from their infrastructure assets. This puts pressure on the organisations, to better manage the performance when managing their assets and to meet the expectations of the stakeholders. In order to be effective and have an acceptable performance there has to be a good understanding of how to manage old assets that agrees with continued performance improvement of the organisation (Too, 2012). Further, Singh et al. (2011), pose that it is proved that standards not only have internal but also external functions. For example, the ISO 9000 requires the company to coordinate processes with external stakeholders such as customers and suppliers.

Based on what is stated above it can be argued that the development of the ISO-standards has been created through mutual agreements between organisations and other practitioners in need of documents, which are able to guarantee that a company's processes are sufficient. However, there are indications above suggesting that these standards are sometimes used only as a branding tool, and not even really used in practice. As a result, this might create a dishonest relationship towards the client and eventually even a more expensive project. In addition, the final product might not even have a better outcome than without a standard.

2.5 Managing infrastructure systems

Another way of achieving healthy assets, beside using the ISO 55000 standard, is persistent and continuous work with asset management. Any constructed facility that has to be maintained in order to retain its value over its life cycle is an asset (Froese, et al., 2003). Furthermore, as Amadi-Echendu (2004) argues, infrastructure assets is an important category of asset management, which requires a well-structured system in order to deliver a reliable service. Van der Westhuizen & Myburg (2014) further stresses the importance of a well-organised asset management register when managing large-scale infrastructure assets. Further, they list four essential functions for a measurable and sustainable service delivery of infrastructure systems, namely:

- Individual assets should be possible to associate to specific services
- The ongoing maintenance requirements should be realistically determined
- The control of ongoing maintenance work should be continuous to guide the work teams
- Functional failure reporting

To achieve this, van der Westhuizen & Myburg (2014) recommend an integrated asset management system that goes beyond departmental boundaries. Therefore, the data

has to be translated and processed to make it useful for the operational teams. To achieve this, van der Westhuizen & Myburg (2014) suggest the development of a common vocabulary among the management, engineers and employees in order to understand each other better, which is in line with the terminological standard described above through Gubanov, et al. (2014) in section 2.2.

A common drawback within many infrastructure organisations is, according to van der Westhuizen & Myburg (2014), that they are rather fighting fires than having a strategic plan for their maintenance work. This could, according to van der Westhuizen & Myburg (2014) be changed through more efficient mapping methods and the attached management of the information. An efficient and controlled register of the infrastructure asset management should, according to van der Westhuizen & Myburg (2014) provide full visibility from the strategic service delivery direction down to the maintenance task execution. According to van der Westhuizen et al. (2011), the asset management is shaped by the organisation it is framed by. To achieve a robust asset management system, they recommend a deep technical understanding of the physical assets, a clearly documented asset management system where the performance standards are set as a specific functional level, related to the organisational role descriptions. The technical knowledge is important in order to develop thorough maintenance strategies of the assets (van der Westhuizen, et al., 2011).

To summarise, the asset management of infrastructure systems requires strenuous and continuous work in order to perform well. This could advantageously be enhanced by going beyond departmental boundaries where a common vocabulary is necessary among the management. In addition to this, more efficient mapping and a register of the assets should provide full visibility all the way from managers down to task execution.

2.5.1 Standardising physical asset management

Several intents to develop standards and frameworks as a means to structure asset management are made in the literature. Even though they have in common that they identify a change of attitude related to the weighted importance of the asset management, they differ regarding how they address the phenomenon. While Froese et al. (2003) focuses on establishing a structure in the process, mapping the different activities included in the asset management, Jones & Sharp (2007) emphasises the importance of focusing on the desired result in organisational performance as a result of the asset management decisions.

Jones & Sharp (2007) establish a performance based built asset management process model, which is displayed in Figure 3. This model intends to link the asset management operations to the overall business performance of the organisation (Jones & Sharp, 2007). It addresses a problematic attitude related to asset management that it mostly implies unwelcomed costs for the organisation without seeing the gains in value added to the organisation. To overcome this, the asset management decisions in the Performance Based Model are based on the impact it has on the organisation's performance (Jones & Sharp, 2007).

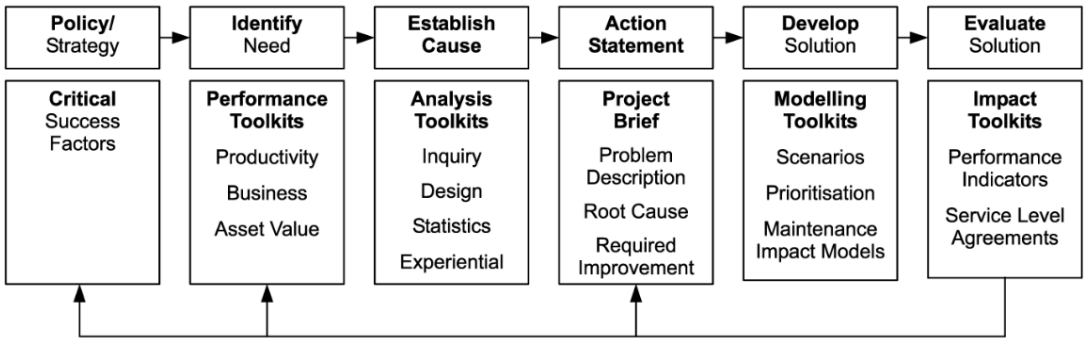

Figure 3 - Performance based built asset management process model (Jones & Sharp, 2007)

Froese et al. (2003) reviews three infrastructure asset management software systems, aiming to represent a typical selection of IT tools and techniques used in asset management for infrastructure, and use them as a base when developing a Generic Asset Maintenance Management Framework Model. The model contains five steps: Identify assets, Identify performance requirements, Assess performance, Plan maintenance, and Manage maintenance operations (Froese, et al., 2003). The process is then developed through a flow-scheme where activities are placed in relation to the different steps, see Figure 4 below. The activities themselves are not new within the asset management industry, the intent of Froese et al. (2003) is rather to present them to the asset management domain through a standardised and formalised structure as in the flow scheme below.

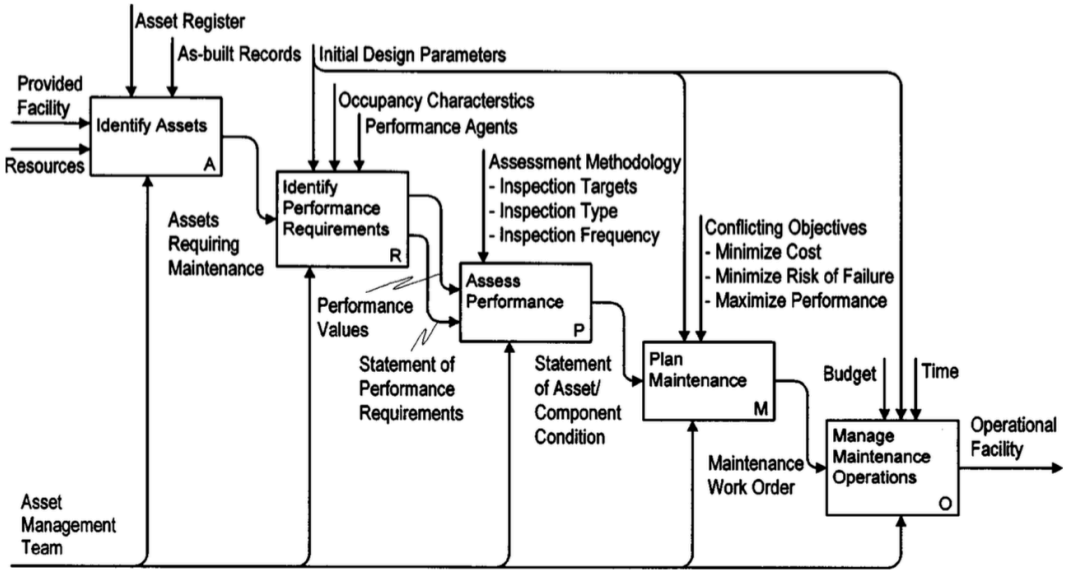

Figure 4 - Generic Asset Maintenance Management Framework Model by Froese et al. (2003)

2.6 Summary of the theoretical framework

A process is in this report defined as "A set of inputs converted into outputs to serve some kind of interest". A process strongly depends on its context, which some address as the business environmental factors that have to be considered in order to achieve a successful process. One way of achieving a successful process is the concept Business Process Management, which is based on a cultural change, optimising the process through mapping and a problem solving attitude.

A way of evaluating success is the project management triangle, developed for project work, where the balance among time, cost and quality based on the client's objectives is evaluated. The micro and macro perspectives is a way to understand why different groups of actors tend to make different priorities. Contractors and consultants tend to take the micro perspective and the client often takes the long term macro perspective.

Standards are commonly used tools to provide guidelines in order to coordinate the work that should be done and ensure the consistency over time and space. A standardisation, on the other hand, is the diffusion and adoption of a standard, where process documentation is a way of achieving consistency of a standard within a process, i.e. a process standardisation. Process standardisation are made for different reasons. Four highlighted advantages are improved process performance, improved customer confidence, enhanced readiness, and simplified and increased communication, in order to create a more transparent process. By making the process more transparent, sources of delays and other kinds of waste can be identified.

The international standard organisation ISO has high influence in many organisations today and valued as one of the most important mechanisms in the subject of standards. Despite that their standards are optional, some of them have become more or less mandatory in certain areas. The well-known standards have however got criticised, not mainly on their content, but more of the purpose of why they are adapted. The ISO standards have a symbolic value and a strong signalling function for many companies, which explain the reason on why many implement the standards not particularly to improve their business, but rather to satisfy their customers. ISO 55000 is a standard series developed for asset management, aiming to develop, coordinate and monitor actions the organisation take for their assets through a structured model. The ISO standards give the organisation a high level of freedom on how to implement it, by setting minimum requirements that should be met, but it does not steer the implementation process regarding how to get there.

Information management is another area related to process standardisation, by helping companies organise the huge amount of documents accompanying a business process. A good information management can, through helping organisations to make the documentation more available, improve the productivity on recurrent issues and avoid misunderstandings by setting a standard for the documentation. Thereby, the business of the organisation becomes more efficient, since all information provided is available. However, caution has to be had toward an unorganised and poorly managed standardisation process. Since this could, in difference of mentioned benefits, instead result in a more expensive and drawn-out process.

The asset management can be more efficient through making the whole processes more visible and transparent, which can be done through an efficient register. A technical understanding of the assets within the organisation is also recommended to achieve a robust asset management system. Attempts to standardise asset management

is made, where two models are presented in Section 2.5.1. One of them is valuing the decisions related to the impact they will have on the organisations performance, the other is further focusing on presenting the activities to create a formalised structure.

3 Methodology

This chapter presents the methodology of which this thesis is built upon. The thesis is based on a case study, supported by a theoretical literature review, following a qualitative research method. The case studied is the main inspection process at a pier, operating crude oil tankers at the Port of Gothenburg. The method used in order to collect the data for the thesis is explained, divided into literature study and case study. Furthermore, the selected research method is discussed.

3.1 Development of the theoretical framework

Before the collection of results, a theoretical literature study on existing research in the subject area was made, to be able to generalise from the case to the theory. Important to remember, though, is according to Yin (2009) that the case studied is not a sample unit from a population as in quantitative studies. Thereby, a statistical generalisation cannot be made, but should be an analytic generalisation, where the developed theory is used as a template to compare the empirical results to.

The literature study started as a broad search on different theories and narrowed down into process standardisation and standards. Useful search words were process, standard, standardisation, asset management, efficiency, bridge maintenance, infrastructure maintenance, and information management. When finding a useful source, the literature citing the source as well as the references of the source were studied in order to, through a snowball effect, find additional useful sources within the selected topic. Using a method like this, where there is logic and strategy behind the research conducted, showed to be very efficient and thus also the main technique of how material was collected for this master's thesis.

The references used are mostly academic journal articles, but also a few books. To collect scientific information to the literature study, the database Google Scholar and the search tool Summon provided by the Chalmers Library were mainly used. The country of origin as well as the journal the article was published in was taken into consideration when evaluating the articles, and its usefulness for this study. Website sources were used regarding information about the companies Port of Gothenburg and the Swedish Transport Administration, BaTMan (Bridge and Tunnel Management) system were used for information regarding the BaTMan inspection methodology and system.

In the theoretical framework, different researcher's view on standardisations are reviewed. This is done to be able to support and understand the results from interviews and consequently develop a fruitful discussion. Parallel with, and after the collection of the results, additional literature research was made to supplement the research in line with the results found. When talking to people in the studied organisation about the scope of research, suggestions on literature and topics of research came up, which were then followed up.

3.2 Case study

A case study can, according to Yin (2009) study one single or a set of multiple events. A case study of a single event generally studies a case over time (Gerring, 2004). Yin (2009) does through Schramm (1971) define a case study as a study trying to illuminate a decision or set of decisions, and the background and aftermaths of the decision. Further, Yin (2009) emphasises that the study does not necessarily have to focus on a decision, but can nevertheless be an organisation, event or process. An advantage of a case study is that it studies a phenomenon in its context, as a contrast to an experiment for instance, where the phenomenon is divorced from its context (Yin, 2009).

Yin (2009) express the question whether it is possible to make generalisations from a single case. Case studies are according to Yin (2009) not generalizable to populations, but to theoretical propositions, which should be kept in mind. Case studies have been criticised of being too situation-specific and thereby provide an insufficient basis for scientific generalisation (Dubois & Gadde, 2002). However, the general perception of case studies tends to be more positive, building on the insight that findings are unstable over time. A case study contains six sources of evidence: documentation, archival records, interviews, direct observation, participant observation and physical artefacts (Yin, 2009). The various sources complement each other, and the usage of as many sources as possible will therefore benefit the case study (Yin, 2009).

For case study research, Dubois & Gadde (2002) suggests a method called systematic combining, close to abductive method, as a way to work with the data, a method used in this study. Systematic combining is a non-linear process building upon a continuous movement between the empirical and modelled sphere, see Figure 5. Through using a systematic combining method, the trap of trying to adjust the collected data to fit into the existing theory during the matching process can be avoided since the theoretical and empirical work are made in parallel. Further, unpredicted discoveries are allowed to shape the research through the non-linear process, where theory and empirical work are conducted in parallel (Dubois & Gadde, 2002).

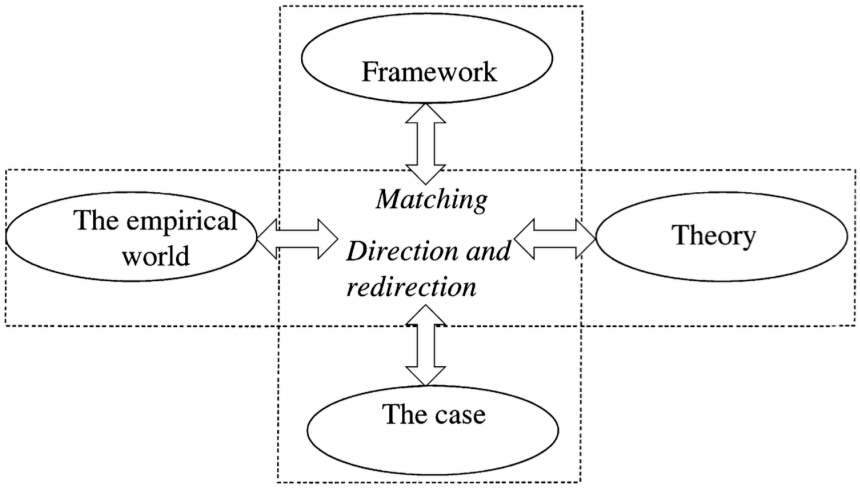

Figure 5 - Systematic combining (Dubois & Gadde, 2002)

Collected data can, according to Dubois & Gadde (2002), be divided into passive and active data. The passive data is the data the researcher aims to find through searching for it, while the active data is the unpredicted data found, associated with discovery. The systematic combining approach allows both of these kind of findings, giving the study an extra dimension (Dubois & Gadde, 2002). In this study, the active data is collected through observations during meetings, inspections, and small talk with people in the organisation, while the passive data was collected through interviews, literature search and documents regarding the case. By combining active and passive data search, both kinds of data can be collected (Dubois & Gadde, 2002).

A qualitative research method is characterised by a closeness to the object of research item (Holme, et al., 1997). The closeness to the object of research is in this study conducted through a case study containing a set of interviews and every-day observations of the organisation. More arranged observations during meetings as well as field studies were conducted as a way to observe the daily work of the process today.

In this study, the process is followed from start to end and a standardisation proposal for the process is produced in parallel. The standardisation is developed through the study of the inspection process on one single pier with the aim to subsequently being applied across all the dozens of piers currently owned by the Port of Gothenburg.

3.2.1 Interviews

A set of ten interviews was conducted to get a deeper understanding of different angles of the case. The interviewees were 3 asset managers, 2 structural engineers, 3 inspectors, 1 document controller, and 1 asset manager from the Port of Rotterdam. The interviews were conducted with a qualitative methodology. A qualitative interview methodology is characterised by a closeness to the object of research (Holme, et al., 1997). When using a qualitative method, the interviewer is only setting the frames for the interview and lets the interviewee influence the interview's progression. The strength is that it is similar to an everyday conversation, where the interviewee is given the possibility to feel relaxed and comfortable (Holme, et al., 1997). Questions were prepared beforehand as a guidance for the interviewer. The interview then proceeded as a conversation, with the prepared questions acting as guidance for the direction of the conversation. The interview questions prepared can be found in Appendix I. Interviews were recorded and parts of them were afterwards transcribed to be able to pick out correct cites and analyse the information given. Additional interviews were conducted with two of the interviewees, to follow up particular topics and questions raised during the case study.

Interviewees having a direct or indirect role in the main inspection process were strategically chosen out of their position and involvement in the process. During the interviews, suggestions of additional interviewees were often made by the interviewees, which was noted and the list was extended. According to Yin (2009), stakeholders having a more overall control over the process should be included, to achieve a more holistic approach and broader perspective, therefore, the asset managers were added to the list of interviewees. Consultants from different companies were selected, aiming to achieve an as nuanced view as possible. For instance, diver inspectors from two different diving companies, and structural engineers from two different consulting firms were selected.

3.2.2 Field studies and observations

Different kind of observation studies was conducted, such as passive participation on meetings at the Port of Gothenburg and during the inspections at the pier.

Observations are producing the environmental conditions of the case, providing additional information about the topic being studied (Yin, 2009). According to Travers (2001), one can learn a lot regarding different occupational groups and content of discussions made, through spending time in the social setting studied. During the observations, it can according to Travers (2001) be interpreted what takes place in a content form a particular theoretical point of view.

Observations were made during the inspections to get a grip on how the inspection itself was conducted as a means to easier get a complete picture of the whole process from start to finish. The diving inspectors' as well as the above water inspectors' work was followed during a normal workday, to get an overview of the area of investigation and to understand the different difficulties facing the inspectors when conducting the main inspection. Simultaneously, questions were made, to get a better understanding of the work conducted.

The authors of this thesis were located at the head office of the Port of Gothenburg, which offered the possibility to make observations in the daily work of their processes and to ask questions regarding the organisation and processes when analysing the results. Small talk with employees at the office opened up for new input and areas of research. As many meetings as possible regarding the main inspection were participated, such as a planning meeting, question meeting, start meeting and follow up meeting. A port asset management conference, "Benchmarking Quays and Roads", with asset managers from Germany, Belgium and Netherlands, was participated in order to achieve a holistic view of their challenges, and how the long term strategical work is conducted.

3.3 Data processing

During the data collection, the material was sorted into categories, forming the headings of the results section. Through this, the interviewees' answers from similar questions could be compared to allow an overview analysis.

Continuously during the research process, a mind map was created by sticky notes, in order to map the process. Every activity was given its own sticky note, which was placed on a wall to visualise the process and making it possible to rearrange it. The result of this mind map is presented under the result and discussion chapters. The discussion was developed through a brainstorm session, trying to summarise the results in relation to the theoretical framework. Through brainstorming, some main themes were identified, and with the research questions as a guideline the discussion was formed.

The names of the interviewees were in the report anonymised, but renamed after their title or position. When there were several interviewees with the same position, they were separated through numbers in no particular order, e.g. Inspector 1, Inspector 2, etc.

3.4 Discussion of the selected methodology

Inquiries whether the methodology used is the most appropriate one can be raised. For example, a multiple case study could make the research even deeper, through evaluating the differences between the different methods of conducting the pier inspections between different harbours and countries. Because of the time frames of this thesis, this was not feasible.

A qualitative research does have its downsides, for example the answer received from one interviewee does probably not give the whole picture of a situation or a problem, thus the information received might not be agreed upon if asking someone else. Further, there is a risk that the researcher's biases are influencing the answers received from the interviews, and consequently the result of the study. Since the interviews were made during an ongoing main inspection, the answers received may be impacted by how the work and cooperation have functioned at the day of the interview. On the other hand, an advantage is that the process of the main inspection is fresh in mind, however another result may have been achieved if the interviews would have been made in retrospect.

The number of interviews conducted does impact the results, as well as the selection of interviewees. Despite the number of interviews were limited, they were strategically selected to represent the case. However, the researcher's interpretations of the case do thereby impact the results. These issues were with best of efforts handled by the authors through conducting interviews with employees having similar positions within the Port of Gothenburg and the consulting firms.

Regarding trustworthiness of a qualitative study, Bryman (2004) stress that there can be more than one interpretation of social reality. In a qualitative study, it is important for the researchers to remember that the interpretation which they arrive at is the one which will determine the acceptability to others. It is therefore important that the research is conducted in a way which ensures good practice through for example submitting findings to others, in order to confirm that they are correctly understood. The authors have as a means to ensure what Bryman states above, sent the research findings to supervisors and other actors involved in the process in order to receive valuable feedback and adjust possible misunderstandings.

Worth mentioning is that this study is not only valuable for the Port, but in general for companies dealing with physical asset management. Although the standardisation is based on a specific case, parallels can be drawn when standardising other similar asset management processes.

4 Background to the empirical results

In this chapter the background for the case study is presented, in order to communicate a better understanding when reading the results chapter. Information has been collected through various state owned websites, meetings attended during the case study and also to some extent through interviews. In Figure 6 below, the hierarchy of the interviewed actors is presented. The General asset manager appoints the Asset manager to be in charge of the main inspection. In this specific inspection a consulting asset manager was procured to be the manager. The consulting asset manager (henceforth Asset manager) procure a structural engineer and inspectors that will perform the main inspection. When the main inspection is finished, the findings are handed back over to the Asset manager who will decide how to proceed. If any repairs on the pier are necessary, the Asset manager will appoint a Project manager for that specific task.

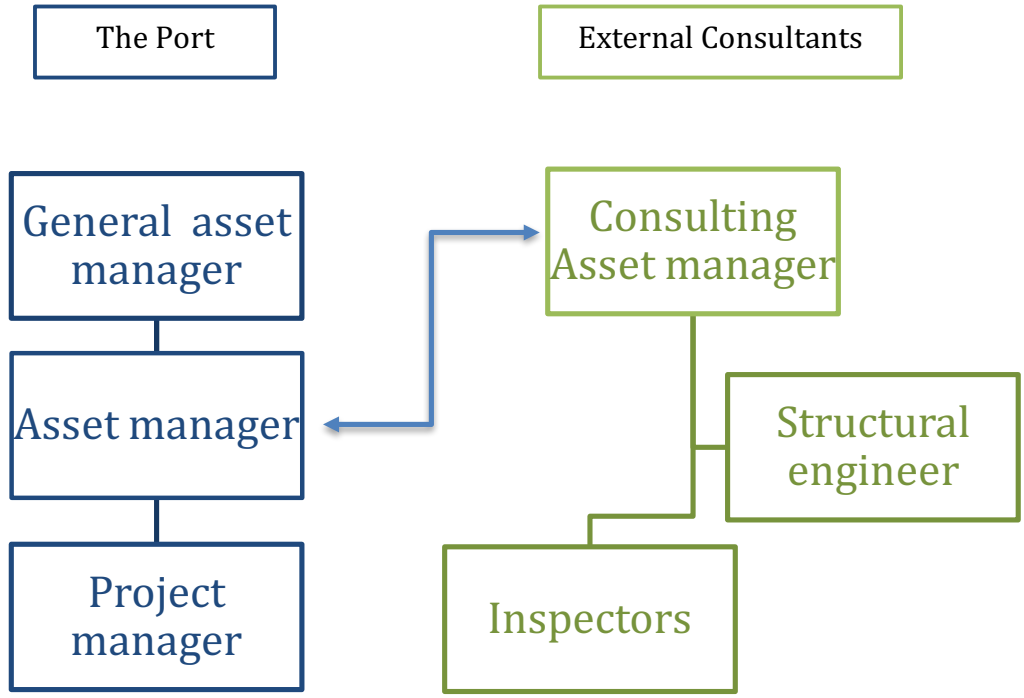

Figure 6 - Organisation chart of the main inspection. The left side represents employees at the Port, while the right side are consultants working for the Port. (Own compilation)

4.1 Maintenance responsibilities

The Port is responsible to maintain the pier structures from a safety perspective, but also from their business perspective. The safety perspective is regulated by the Swedish law, as described below, and the business perspective is regulated through contracts with the customers of the Port, e.g. the pier operators and shipping companies. The Port does not perform any operations on the piers they own, but rent them out to different customers such as oil and cargo companies as well as cruise ships. The Port is therefore only responsible for the maintenance of the harbour and pier structures, which means making sure that the piers are functioning the way they are intended to and that they are safe to operate on, given certain specifications. A map of the Port can be seen in **Fel! Det går inrte att hitta någon referenskälla.**, here Torshamnen is located furthest to the west.

There are no clear regulations in the Swedish law regarding how piers should be maintained or inspected. An applicable regulation is in the eight chapter of the Swedish Plan and Building Act: *Requirements for constructions, building products, sites and public*, which states that:

4 § A structure shall have the technical characteristics that are essential in terms of:

- *load capacity, stability and durability,*
- *safety in case of fire,*
- *protection with regard to hygiene, health and the environment,*
- *safety during usage,*
- *protection against noise,*
- *energy economies and heat retention,*
- *suitability for the intended purpose,*
- *accessibility and usability for people with reduced mobility or orientation and,*
- *management of water and waste.*

When making a brief comparison to other European harbours, it is found that the maintenance regulations differs to a large extent. In Germany for instance, all structures have to be inspected every 3rd year, independent of their age. This is in high contrast to Sweden's inspection requirements that allows a large degree of freedom during execution.

This means, that the asset management of the Port is set relatively free on how to maintain and inspect the piers, as long as the law requirements above are satisfied. According to Asset manager 1, the major reason on retaining the piers in a good standard is to keep them attractive for their customers, e.g. the oil companies operating the piers. The customers do not want to risk that the accessibility and operation of the piers is disturbed due to maintenance work or bad conditions, which could make them choose another port for their operations. Further, it is of high importance to keep the piers in a good shape to prevent high costs due to neglected maintenance. The worst case scenario is, according to Asset manager 1, an unknown status of the the piers, resulting in that sudden measures has to be taken, which have not been planned for.

4.2 Maintenance strategy decided by the Port

The law requirements described above are seen as relatively loose by the asset management at the Port, and through purely following them, a safe and predictable pier cannot be guaranteed, according to Asset manager 1. The asset management department has therefore made a decision to align their inspection strategies with the framework of the Swedish Transport Administration (henceforth called STA) regarding their maintenance system of bridges and tunnels (henceforth called BaTMan (Bridge and Tunnel Management)). This decision is taken because bridges and piers are similar in many ways, such as in structure and design. By using the same standard as such a large organisation as the STA, the quality and safety of the maintenance of the piers can be regarded as assured. Additionally, it is by the Port valued as advantageous to use the same data system as STA, enabling the possibility to have access to the same services such as support tools and educations.

The Port does however not strictly follow the standard prescribed in BaTMan, since they do not find it fully compatible to pier maintenance and inspections. For example, every part of the structure is not inspected as prescribed in BaTMan, but samples of 20% of the poles are inspected due to the high costs when inspecting below water. A more in depth presentation of BaTMan will be held in next section.

According to the STA's recommendations regarding bridge maintenance, a main inspection aims to detect and assess defects that can impact the function or safety of the construction within the next ten years. Also defects which without action can lead to increased maintenance costs should be detected. Furthermore, damages classified as leading to malfunction of the structure within three years on elements with a bearing function should be followed up before they reach an insufficient functionality. (Rutgersson, 2014)

According to the guidelines given by STA, the main inspection is to be made on each pier in an interval of maximum six years. All elements of the construction should be inspected in an "arm's length distance. Equivalent methods with help from different techniques are also allowed (Rutgersson, 2014)**.** The Port has followed this advice through taking a decision of using 2D and 3D Sonar during their main inspections, in order to create as accurate pictures as possible of the columns and sea bottom.

4.2.1 BaTMan – the Swedish Transport Administration's data system

In order to compile the information collected about the pier after the main inspection, all observed damages that are found by the inspectors are put into the data system BaTMan. Here, the damages are classified and sorted according to their location on the pier. The current licence agreement in BaTMan only allows the Port of Gothenburg to insert damages found on the piers, and unmark them when they are repaired. It is currently not possible to make notations regarding details such as which method was used for the repair or if only parts of the damage were taken into consideration. The solved damages are separately reported into another database, the internal server at the Port.

In BaTMan, the damages are classified on a scale from 0 to 3, this classification is called status classification (tillståndsklass), henceforth called TK. The classification TK3 means a malfunction at the time of the inspection. TK2 means malfunction within 3 years, TK1 is malfunction within 10 years and TK0 beyond 10 years i.e. free from damages at the time of the inspection.

Some of the features of piers differs from bridges. Therefore, the applicability of BaTMan for pier inspections is sometimes limited. This makes it complicated to directly apply the methods in BaTMan on pier maintenance. The standard length of an average pier is longer than a bridge which makes it hard to get an overview of the piers. In addition, pipes, electricity and other utilities are frequent on piers, while they are nearly non existing on bridges. Documenting a damage on one of these features into BaTMan is therefore complicated.

5 Empirical results

In this chapter, the findings from the case study are presented. First, the main inspection process is described, framed by comments received through interviews and observational studies. Secondly, suggestions of improvements of the process are presented, followed by an evaluation of the contribution BaTMan has on the process. The ongoing work of standardisation at the Port is described, followed by driving forces influencing the main inspection. The final parts of the chapter bring up BaTMan's contribution to the main inspection as well as ongoing standardisation work at the Port.

5.1 The main inspection process

In this section, findings from the interviews regarding the main inspection process are presented. The authors have decided to look at the main inspection as a process divided into three parts; *Preparations, Execution and Closure*. The General asset manager highlights the importance to clarify the border between the preparation and execution phase. Because of the close and long relations among the Port and the consultants, the borders have become a bit fluent. The borders are however important from a contract aspect, why this section attempts to untangle the distinctions. These borders are subsequently an important aspect to keep in mind when developing the standardisation.

5.1.1 Preparations

As partly described in Chapter 4, the General asset manager starts the main inspection process by taking a decision that a main inspection should be done, and appointing an asset manager. The main inspection process is then initiated by the asset manager in cooperation with a structural engineer, evaluating the current pier with the latest executed main inspection as starting point, to investigate what was done the last main inspection (which samples and tests etc.). Based on what is found there, documentation for the main inspection such as specifications on range, budget and a time frame are set up as a base for the procurement of consultants. The time span of a main inspection varies, depending on factors such as the properties of the pier. The studied main inspection of Torshamnen span over about four months, but there have been main inspections that have spanned nearly a year.

Finding material from previous inspections have sometimes been problematic, something that is highlighted by both the General asset manager as well as the structural engineers. The information in BaTMan is sometimes believed insufficient, and the information stored at other places is hard to find, according to General asset manager 1. Since the consultants do not have access to the internal database at the Port, they have to request the information from the document controller at the Port. Structural engineer 2 describes the difficulties requesting the correct information, when not knowing what is available.

> *"You have to know the supply when asking for something. It is hard to ask the document controller "give me everything you have"". - Structural engineer 2*

Also employees at the Port are expressing a hesitancy to search for material regarding the main inspection on the internal server despite they have access. With numerous

places to look, and without insurance to find what is sought, it is too time consuming to browse the internal server, compared to asking someone that might know the answer by experience, according to General asset manager 1.

When the material from previous inspections is collected, it is compiled to a compendium, which constitutes the basis for the quantity description used when procuring inspectors. The quantity description describes the extent of the inspection, such as which parts of the structure that should be inspected, and the amount of Sonar images desired (Sonar = SOund Navigation And Ranging). Areas that need extra inspection are marked on the blueprints handed out to the inspectors, as well as the areas where samples are to be collected. The blueprints also give the inspectors a hint of the extent of the inspection. After the procurement, a more in depth description of the scope is made in fluent text, to give the inspectors some background information of the pier, and the conditions of the project.

Furthermore, the inspectors usually receive one or two reports from previous inspections. The information the Port provides the Inspectors with is generally very good, according to Inspector 1. Inspector 1 would however appreciate to get all information at once, to fully be able to assess the current state of the pier, and means that the need of asking for additional material numerous times causes delays in their work, and complicates planning and time estimations.

Inspector 2, on the other hand, finds the material satisfying, and means that it usually contains what they need to undertake the inspection, and does, however, not see the supply of blueprints as such big problem.

> *"If something is missing in the material I receive, I just ask for it" – Inspector 2*

However, Inspector 2 thinks that the focus sometimes is put on the wrong things during the main inspection, as the asset manager is not fully informed of everything going on. Inspector 1 has a similar view, meaning that the cause of this is that the asset managers preparing the material are not always fully familiar with the work that should be done, and therefore suggests more site visits by the asset managers.

When the procurement is made, the inspectors, asset manager and sometimes also the structural engineer, undertake a site visit at the pier. This site visit enables, according to Inspector 3, to rise questions and get an overview of the project which can be hard to achieve only through looking at blueprints. Questions appeared after the site visit are then collected and discussed during a question meeting. However, many of the inspectors think that it is a bit too late to undertake this site visit after the procurement, when the budget for the inspection is already decided. Today, the site visit is held too late in the process and lack a dialogue between the parties, or as Inspector 2 puts it:

> *"There is not so much give and take in the current site visit, the Port is mainly telling us how they have decided that we are supposed to do things (...). It is more like something that is supposed to be checked off on a checklist" – Inspector 2*

Inspector 2 suggests a site visit before the procurement is signed, which the inspector believes partially could solve the issue and make the site visit more valuable for the inspectors. Asset manager 1 believes that the site visit is by high value for both inspectors and project management in order to assure that they know what they agree upon, and that the inspectors knows the extent of the inspection.

Finally, before the execution phase is started, permissions to the site for the inspectors has to be solved. Additionally, a risk meeting has to be conducted, where all involved parties are participating.

5.1.2 Execution

When the procurement and permissions are finished, the inspections can begin. The underwater inspection is conducted by a diving inspection team consisting of one captain, one diver and one diver attendant, serving the diver with oxygen cables, tools, and keeping the contact underwater. To undertake a main inspection, the responsible diver must complete a course about the database BaTMan, and be practically trained by an experienced diver. It is also preferred that the diver has been hired for several years to conduct inspections for the Port, including previous main inspections. Inspector 1 means that experience is of high importance, since the knowledge about the old damages on the pier helps evaluating the new ones during the inspection.

In addition to the diving below water inspectors, there is an above-water inspection team, consisting of two inspectors. The demarcation of below and above-water is made at the top of the poles, making the above water inspectors in need of a scow in order to access the underside of the pier.

During the interviews, it was realised that there is a feeling amongst the inspectors that the decision of which poles and areas that are going to be inspected is not always well-reasoned. Due to this reason, Inspector 2 suggests the conduction a Pre-Inspection with room for a shorter sonar scanning of the pier, to evaluate where focus is supposed to be put. This would, according to Inspector 2, result in a better overview of the pier, thus eliminate the risk of making unnecessary samples or other tests on parts of the construction not in need of being inspected. This would take some additional time in the start-up phase and would be more expensive, but according to Inspector 2 it would enhance the final result. Structural engineer 2 is on the same opinion, meaning that a pre-inspection followed by a revaluation should be a more suitable way to conduct the inspection than the current, sometimes too static, strategy.

One thing highlighted by Inspector 1 is the lack of access to site. Since a diving team cannot work if they lack a person, stand-in divers are not uncommon. When that is the case, the stand-in's do not have the right permissions to the Port which result in a downtime while solving the issues. Therefore, Inspector 1 suggests that the permissions are prepared before the inspections for the stand in's as well as for the permanent inspectors. On the same note, Inspector 1 also requests increased authority for the Asset manager, to make the Asset manager able to take more decisions, which for example could solve the issues with lack of permissions. According to the General asset manager, the reason for this is that the Asset manager presently is a consultant, complicating the permission issue.

Inspector 3 raises a similar problem, where the necessary tools and materials needed for a special part of the inspection are not provided by the Port, with delays as a result. Structural engineer 1 confirms this, emphasising the need of a check-list for practical arrangements and material that should be prepared for the inspectors before a main inspection.

An example of a misunderstanding was observed during a meeting participated. A specific inspection was desired by the structural engineer, who asked the inspector

how long time extra it would take. The answer was one day extra, but the inspector meant one pole, while the structural engineer had the whole pier in mind, which would then imply weeks of extra work. This kind of misunderstanding could according to Inspector 1 be avoided if the asset manager and structural engineer were more on site, achieving a better understanding of the work. Inspector 3 agrees that the asset management have not been out visiting them on site very much. However, Inspector 3 believes that if the need would arise, the asset manager would after a quick phone call come out, a system that the inspector finds suitable.

The reason of why the number of site visits are limited is mainly the cost, according to Structural engineer 2, but further perceives that the asset management lately have realised that costs are saved through being more involved in the inspection process.

> *"That we're not more on site is a matter of costs, even though the Port hasn't explicitly said that we're not allowed to be present more (...). However, we've realised that this is not to cut costs, because to being more on site will actually lower the costs (...)" – Structural engineer 2*

The amount of site visits by the asset managers and structural engineers have increased lately, which is very much appreciated by all inspectors interviewed. Structural engineer 2 experiences the communication with the inspectors as very good, but believes that the structural engineers should be present more on site. Especially the first day of the inspections, Structural engineer 2 finds it valuable to be present, believing that the possibilities to adjust the planning to the findings and work more through "active design" would increase.

Structural engineer 2 describes ordinary bridge inspections, where the structural engineers often carry out the specific inspections themselves and not outsource the work to inspection firms. During pier inspections on the other hand, they can by practical reasons not execute the inspection by themselves since they are not taught how to dive. According to Structural engineer 2, this clearly indicates that the structural engineer should be present more during the specific inspections on the piers.

> *"We wouldn't let an entrepreneur, a construction worker, go out and take photographs (...) and then communicate back, while we're staying at our office, continuing working on it (the results)." - Structural Engineer 2*

Asset manager 2 emphasises that clear meetings and that the structural engineer as well as the General asset manager are active throughout the whole process, being on site, promote the communication and prevent misunderstandings. Further, Asset manager 2 believes that many misunderstandings derives from that they are not "speaking the same language", in terms of an agreed nomenclature. The above water inspectors highlight the outside conditions as the biggest challenge with the main inspection. Since the weather, as well as the ship arrivals are unpredictable (because of oil price fluctuations), the execution of the inspection is hard to schedule. Compared to a normal bridge inspection, which they are used to, the weather is complicating the inspection a lot when going by boat under the structure. However, thanks to a generous schedule with room for this kind of disturbances, the weather has in this case not caused too much problems.

5.1.3 Closure

When the inspection is completed, the inspectors transfer the results into BaTMan. This enables the structural engineer to assess the current status of the pier and make suggestions on maintenance measures. The assessment from the structural engineer are sent over to the Maintenance project manager who is deciding upon a maintenance plan and formulates maintenance projects for the pier.

Additional information regarding the main inspection, except the damage reporting into BaTMan, is not compiled after the inspection, something that is raised by several interviewees. Both structural engineers and asset managers state that there is a lot of information on the internal server but they do not know how to find it, or as commented earlier, that it takes too long time to make an effort to find it. This has resulted in that the old information and experience is not utilised, but reinvented for every new project, which was emphasised by Asset manager 1.

> *"We have to stop reinventing the wheel!" – Asset manager 1*

Asset manager 2 agrees, thinking that the documentation of the main inspection is presently insufficient managed. Since many meetings lack a written protocol, the decisions made, and the background of them, are not documented for the future. Structural engineer 1 suggests to have a feedback meeting subsequent of every main inspection to tackle this issue, evaluating what should be changed until next time, and which new solutions have been invented to save for future inspections. Further, Structural Engineer 1 emphasises that this kind of meetings must be documented in a proper way, making other persons able to take advantage of the information collected.

However, Inspector 2 claims that feedback meetings are already held today, where the inspectors in a structured way discuss the inspection with the structural engineers, and further claims that several issues are captured through a feedback meeting. Conversely Inspector 1 states that, since they are consultants competing with other companies, they are not too eager to share their knowledge with their competitors, and do not gain on participate on the improvement of the documentation at the Port. Inspector 1 believes such a meeting would be too time consuming, and is not motivated enough for them to participate. However, Inspector 1 understands the benefits in sharing experiences and knowledge if there is a new company that should be introduced to the work, but that the companies having a framework agreement with the Port have the knowledge enough to undertake a main inspection.

Another thing suggested by several of the structural engineers, is to document information, like time, place, and methods used for the reparations made on the piers. Structural engineer 1 rises an example of an area of the pier where the concrete of a repaired area has crackled, i.e. the reparation was unsuccessful. Because of that, the structural engineer is keen on not repeating the inappropriate method for other similar damages, however the method is unknown since the person responsible has left the company. Also the purpose of the reparation should be documented, in order to go back to the reasoning behind it. An example was highlighted by Structural engineer 2, describing a reparation made to extend the life length of a pier by another five years. If the strategy changes, and it is decided that the pier should be in operation for longer than five years, the information regarding the previous maintenance works is highly valued.

"If the reason and background of the reparation is not stored, one can hardly not know if the pier was repaired as new or just extended by a few years, information that is necessary in order to keep the pier in operation." – Structural engineer 2

This view is shared by Asset manager 2, who believes there is a need to document the history and information regarding how the damages are repaired, to be able to work with the asset planning in an efficient way.

Relating to this subject, there is no agreed way of working regarding who is supposed to document when damages are repaired into BaTMan. Consequently, this leads to unawareness whether a damage has been repaired or not, highlighted by both Inspector 1 and Inspector 3. Additionally, Structural engineer 1 emphasises that at the start of each main inspection, a mapping of which damages are repaired and which are not now must be conducted, causing extra work. Further, damages not correctly reported have to be traced, which consumes time from the inspection process.

5.2 Driving forces influencing a main inspection process standardisation

When branding the Port, the reliability and level of service of the piers is by high value for the shipping companies. Because of that, the General asset manager has discussed whether an implementation of the standard ISO 55000 could strengthen the brand of the Port in relation to the shipping companies. The Standard *ISO 55000 – standards for asset management* is not required by the customers in the current situation, but the General asset manager predicts a future where it could be relevant.

Currently, the quality is by the General asset manager ranked as most important in the process. Money is by lower priority, mainly because the cost of the main investigation is quite low in relation to the high cost of maintaining a neglected pier structure that suddenly has to be totally renovated or rebuilt.

The General asset manager states that due to the limited amount of time available for the main inspections, they must also have a large time focus. Having the inspection done in time is necessary since the structural engineers need time to evaluate the pier status that the asset managers need. The infrastructure department at the Port has to follow the Port's budget year when planning their future actions and projects for the pier structures. This makes the time aspect even more relevant in the main inspection process, in order to make it possible for the General asset manager to prepare a budget in time for the upcoming budget year.

Structural engineer 1 experiences the time as highest prioritised by the Port. There is much focus on setting a time plan with tight deadlines, but they are poorly respected, according to Structural engineer 1. Further, the cost aspect seems to be low-prioritised. Structural engineer 1 experiences that the price is trivial for the Port, as long as the time schedule is followed and a good quality of the result is produced. Further, Structural engineer 2 finds quality and cost as higher prioritised:

"The inspection doesn't feel like a rush job, but the inspections are very expensive to make, resulting in that the money governs how many elements are inspected. - Structural Engineer 2

Inspector 1 experience a high time pressure from the Port, which is seen as a bit unjustifiable, since the main inspections can be prepared for a long time beforehand thanks to their recurrent nature. Also Inspector 3 perceives that the time has got the

highest priority, which has been stressed from the start. Even though the quality has been expected to be good, Inspector 3 perceives that the time aspect has been given the highest priority. Inspector 1 perceives that the hard time pressure in combination with insufficient instructions could jeopardise the quality.

Inspector 2 perceives that the cost is steering the process in terms of the number of samples made, and which equipment chosen for the inspection. Inspector 2 do not feel a direct pressure from the Port, but rather derive the time pressure from the procurement, where the costs (and thereby time) have to be limited in order to win. Since the price is relatively fixed after the procurement, Inspector 2 admit that some parts of the structure which are very inaccessible sometimes are deselected, due to the time pressure.

> *"Occasionally, very complicated poles are deselected during the inspection. (...) the quality is suffering because of the time pressure" – Inspector 2*

This can result in that the structural engineer does not get the desired poles inspected, risking that the quality of the main inspection is suffering. Because of this, Inspector 2 suggest that the inspections should not be run through fixed price, in order to not deselect poles that might be important. Furthermore, Inspector 2 experience that the quality is the thing most important when running the main inspection, and that it is the consulting firms themselves that are pressure the time, not the Port.

5.3 Improvements through standardisation

In general, the current main inspection process is performing well, according to the General asset manager. With today's high competence of the employees, the quality of the result is not considered as endangered. However, concerns regarding the future are expressed. Since employees tend to change employer more often today, there is a risk for loss of competence if the knowledge regarding the processes are not transferred and stored in a proper way. Ensuring a high quality within the processes could therefore be a hard task to solve, and according to the General asset manager, introducing a more standardised way of working is a step in the right direction.

Through a standardisation of the main inspection at the Port, the General asset manager believes that the achievement of good quality could be ensured through the assurance that the right methods are used regardless the experience of the person in charge of the project. The General asset manager addresses problems in the main inspection regarding the knowledge transferring. The process would benefit from having a proper documentation to enable personnel with less experience from the main inspection to conduct the planning for the inspection, according to the General asset manager.

When questioning what a successful standard implies to the different interviewees, different answers are received. In general, two kind of interpretations regarding a standard are highlighted. One is about to agree on a nomenclature and how to value damages, i.e. more on a detailed level. The other rather cover the overall process and to assure a stable quality of the inspection over time.

> *"A standard implies a common nomenclature, to call things common names. It also means a common way of working. A standard should set up several minimum levels and requirements, for example that one should inspect ten or twenty percent of the poles" - Structural engineer 2*

"Generally, the lack of an agreed nomenclature often leads to misunderstandings at the Port. I think that one should decide upon what different words really imply." – Asset manager 2

Structural Engineer 1 on the other hand, further relates to a more structured documentation when talking about a process standardisation. The aim with a presumptive standardisation would be to make it possible for a less experienced person to run the main inspection process. The documentation could be made as a check-list, containing what should be prepared, which permissions that are needed, which meetings that should be conducted, and what purpose the meetings should have. A risk-analysis and safety- and health plan, as well as a contact list of the people involved in the process to promote communication.

One risk with working according to a standard is expressed by Structural engineer 2. A presumptive standard or check-list for the main inspection could result in relying too much in a check-list, causing that the users stop thinking on their own. The purpose with a check-list should therefore be clearly communicated, securing that it functions as a support which everyone should feel confident enough to oppose when needed.

The General asset manager requests a standard to assure that the main inspection is performed correctly. A successful standardisation would assure the quality of the main inspection and the piers in the present situation, despite the high staff turnover. To achieve a successful standard, and thereby an efficient process, the General asset manager believes that a clear course of action described is the key. Further, the General asset manager does not believe that *how* the exact execution of a main inspection can be standardised but rather *what* should be done. This belief is confirmed by the inspectors:

"Tell us what you want, and we solve the method"- Inspector 1

"The optimal scenario is a mutual trust between the client and the inspectors" – Inspector 2

"The expectations from the Port are clear, thanks to the usage of the BaTMan methodology" – Inspector 3

"The cooperation with the Port is working very well, (...) we prefer the down-up type of governance that is currently used." - Inspector 1

The General asset manager strongly believes that the inspectors and structural engineers involved in the main inspection have a high competence, however the procedure to restart the process every year due to the lack of documentation is problematic. This way of working is too time consuming, and also risk that vital parts in the process are forgotten. Another aspect raised by the General asset manager is that even though the competence and experience of the inspectors are high, the Port cannot rely on them to report their suggestions of inspections the Port might have forgotten in the agreement. This is thereby another reason on why a mapping of the inspection process is requested. However, Structural engineer 2 means that it is a duty of a structural engineer to report to the client if the methods chosen are clearly not suitable for the purpose, and to report if something found requires further investigation.

"It is not OK to take a given solution from a client which is not suitable but not say anything" – Structural engineer 2

Finally, Structural engineer 2 emphasises that the climate from the client has to be open-minded for such suggestions, and that the technical responsibility for the specific knowledges should be handed over to the structural engineer.

An example expressed by Inspector 2, is that the Port interferes in working methods they not fully handle. Regarding sonar, the Port sometimes ask for 3D sonar and sometimes for 2D sonar, which occasionally make the Inspectors wonder if the Port always knows what is really sought, as was expressed during an interview:

> *"The Port initiate a process and decides working methods, without being sure of what methods are the most benefitting to reach the desired result" – Inspector 2*

To solve this, Inspector 2 suggests that the Port should focus on setting up desired goals and let the inspectors work out the best suited methods for the inspection. Inspector 1 agrees with this, stating that because of the various number of more or less specific factors to take into consideration, they prefer to be relatively free in their work methods. Asset manager 1 thinks the reason is that the Port has not stated the intention of the inspection clear enough, but only that it should function as a base for the future to develop a ten-year plan.

> "*The Port hasn't clarified what the main inspection should result in." – Asset manager 1*

The inspectors have a bit different view of a main inspection standardisation than the asset managers and structural engineers. Inspector 3 refers to BaTMan as a standard for the main inspection. The methodology described in BaTMan is by both Inspector 2 and Inspector 3 referred to as a standard, however not fully followed. Inspector 2 means that the methods in BaTMan cannot be followed within pier inspections - it would not be economically feasible, since every part of the structure then should be inspected. On a pier this would imply that all under water parts should be first cleaned from barnacles and seagrass, and then inspected closely, which would take enormous time. Inspector 2 believes that the Port has chosen to work according to BaTMan to minimise deviations when different inspectors are executing the main inspections, to achieve a uniform result. On the same note, Inspector 3 finds BaTMan very useful since it provides a uniformity in the inspections and the results, making the results comparable over the years, in terms of how the damages are estimated by the inspector as well as the structural engineer. Further, the inspectors value BaTMan as a well-functioning program, and request an extended use of it from the Port. Inspector 2 suggests that additional documents and blueprints necessary for the inspectors should be added into BaTMan, where they are easier accessed for the consultants.

5.4 BaTMan's contribution to main inspections

As mentioned earlier, BaTMan is developed for bridge maintenance, and thereby not fully compatible to pier maintenance. According to Asset manager 2, some structural parts cannot be inserted, such as pipes and other structural parts that are specific for piers and do not exist on bridges. These have due to that reason not been implemented by STA into the system, which cause problems when the inspectors document damages on these parts. However, even though some activities are not compatible, the General asset manager states that BaTMan still could function as a forum between the inspectors, structural engineers, and asset management, if more information such as documents and drawings was stored in BaTMan. Structural engineer 1 agrees, stating that the usefulness of BaTMan is huge, but is dependent on being up-to-date and

correctly and regularly used. By collecting the damages into BaTMan, they can easily be found when preparing maintenance work for the next inspection.

Although there is a lot of information available in BaTMan, Inspector 2 comments that this benefit is not fully utilised, claiming that despite time is spent uploading information regarding the status of the pier into BaTMan, this advantage is not capitalised by other actors:

> *"I get phone calls at start-up processes of inspections from different actors. They ask me to send information which is already available on BaTMan. It usually ends up with me sending them the material via email" - Inspector 2*

Inspector 2 believes this is due to the fact that some actors are unfamiliar, thus hesitate to use BaTMan. In their desire to fast get accurate information they doubt to use BaTMan where the information might not be valid, and instead call colleagues who they know can solve their issues.

The consultants executing the inspection of the pier are trained to classify the damages found, and are responsible to transfer them to the database BaTMan. It is according to Structural engineer 1 important that the inspectors correctly report into BaTMan, in order to make the information easy to adapt and work with. Complications can occur due to the way the damages are reported, when for example many small damages are lumped together. Structural engineer 1 describes scenarios when some of the damages are repaired but not all of them. If the damages are lumped together in BaTMan, they cannot mutually be classified as repaired. This leads to that following inspection will have partially wrong information as it is being planned.

Structural engineer 1 is in general positive to BaTMan, underlining that its high reputation results in a common feeling of familiarity to the methodology within the industry. Structural engineer 2 agrees, and requests an extended use of its features by the Port. Structural engineer 1 claims that the way of using the TK-system for damage classification is widely accepted in the industry and that this classification is important to make sure that the damages are prioritised correctly. Through using the BaTMan methodology for inspection and classification, it has the function as a standard within the industry.

However, the function of using BaTMan as an information collector is only partly used, since there is another program (Hypedoc) used by the Port handling blueprints. In addition, despite the possibility for everyone to request access to BaTMan, the opportunity is not used by all asset managers. On the same note, Asset manager 2 states that a drawback with the current system is that repaired damages currently not always are being reported into BaTMan, but into the internal server at the Port. Lack of updates into BaTMan and several sources of information has resulted in difficulties to know if damages from earlier inspections have been repaired or not. According to Structural engineer 2, the decision to use an internal server to store information on is a strategical mistake, since the documents now are inaccessible for the consultants. The General asset manager agrees that it would be a good idea to store the blueprints on a place accessible for all consultants and inspectors, and further believes that it would save a lot of work if the they have access to the material needed. The General asset manager further claims that it also is possible to give the consultants access to Hypedoc, where all information they need is available.

5.5 Ongoing standardisation at the Port

Over the last years, the strategy of the main inspection has changed. According to Structural Engineer 2, the structural engineers are now involved earlier in the process, giving them a bigger knowledge thus influence of the inspection. Structural engineer 2, believes that this strategy both saves money when saving unnecessary inspections, and increases the quality. Structural engineer 2 perceives an open mind towards the Port, eager to make improvements in the main inspection process in order to achieve as good quality as possible. Nowadays a lot of focus is put on the communication and structure, as a contrast to the past.

> *"Wrong decisions were made due to the lack of communication." – Structural engineer 2*

When asking the General asset manager of what is currently being done regarding standardising their main inspection process it was shown that a process chart is currently being developed by the General asset manager and a structural engineer, the chart is found in Appendix II. This chart is intended to in the future be compatible with a software (called API) which is currently used within other processes at the Port. By clicking on a field in this interactive program, the user will receive additional information, such as necessary documents regarding that specific part of the process. This interactive field does however not exist for the main inspection today. Based on the interviews conducted for this thesis, there is a present need at the Port to map and structure the process to make it as understandable as possible. This would as mentioned earlier also decrease the uncertainty for new and less experienced asset managers. A well elaborated process chart would enable an asset manager to quickly find what is to be done at a particular moment as well as upcoming activities, each activity also comes with a set of attached documents needed in order to complete the activity.

The process under development is more iterative than a straight line of activities, but also agile to the findings during the process, able to change the inspection strategy in order to achieve the best inspection result possible. The structural engineers are also involved earlier in the process, which has helped the asset manager to put focus on the right things from a structural perspective when planning the inspection. One thing highlighted is the selection of inspected poles, which for an external can appear to be randomly selected, which Structural engineer 1 stresses they should not be. Through involving the structural engineer earlier in the process, the structural engineer can support the asset manager in the preparations, for instance in the selection of poles to inspect. This obviously results in bigger expenses, but the quality of the inspection will be improved.

Structural engineer 2 finds this new strategy very good. Through being involved during the whole process, the structural engineer now participates when the inspectors are presenting their results for the General asset manager and asset managers, open up the availability for supplementary questions, which was previously not possible. The iterative way of working is suitable when unexpected damages are found during the inspection. If it is found that parts of the structure are totally out of order and have to be demolished, some material lab tests can be unnecessary and that money can therefore be saved. Structural engineer 2 therefore suggest that the inspection should run for a couple of days, thereafter a reconciliation should be made to check if the preliminary finding were the expected and how the inspection should continue.

The communication, or the lack of it, within the process is another issue, addressed by several persons in the process. The communication related to the main inspection can be divided into two categories: internal communication during the process execution among the project participants, and communication through documentation in order to store knowledge and experience for the future. Regarding the internal communication some improvements have already been introduced. Structural engineer 2 describes the former process as a sequence of different activities, without linkage and lack of dialogue. To overcome this, intents have been made to open up a dialogue between the consultants in the process. Structural engineer 2 suggests that the General asset manager should promote and assure that the consultants to talk to each other, to achieve a context of their findings and decisions.

6 Discussion

In this section, the findings in the case study are evaluated in relation to the theoretical framework, in order to find the reasons of the desires to standardise the process, the current issues, and the desired outcomes, to find a suggestion of a way to standardise the main inspection process.

6.1 Why a standard?

Through the case study, it is shown that a standardisation of the main inspection process at the Port is requested by many of the actors. Complaints such as "We keep reinventing the wheel", "BaTMan is not working as we would like to", and "Finding documents requires a lot of time and resources" is recurrent. At the same time, the current process is according to many of the interviewee's ok. During the studied main inspection, there has not been any bigger issues regarding time, cost or quality, rather it has been quite successful. This gives rise to the question why a standardisation still is requested by almost everyone involved. Following section will investigate this question in an attempt to delineate its cause.

6.1.1 Why is a new standard requested?

When developing and implementing a standard, there has to exist a mutual agreement of what is sought. In this studied case for example, the interviews showed that there exist several different perceptions of a standard amongst the actors. Some refer to the need of just establishing a set of common terminological principles, while others rather refer to it as a set of guides and rules which describes the ideal way of working.

Generally, inspectors and other parties only involved in parts of the main inspection process requests an agreed nomenclature, while parties who are engaged during the whole process such as the managers and engineers rather ask for a checklist what the process should include. The desire to have a checklist can be linked to the concern of forgetting something, as well as easier engage new persons to the process, while the agreed nomenclature seems to be requested to avoid misunderstandings. The persons being involved in a limited part of the process do not pay attention to process thinking to the same extent, since they do not see their tasks as a part of a process in the same way as the persons being involved in the whole process, which can explain this difference. The theory shows that continuous end user training, cooperation and structured work promotes a more successful process, which means that the process could gain if all parties were better informed of their activities as a part of a process and that the suggestions of how the process could be improved are relevant in relation to the theory.

The consultants request, in addition to a common nomenclature, a more stable process and clearer directives from the Port. The desire communicated through the interviews was that the consultants would like the standard to contain properly structured documentation concerning what the Port is expecting from the inspection. It should for example clearly be stated that the structural engineer is responsible for the pole selection, and also regarding practical matters, such as regulations regarding access to the working sites, etc.

The interviews conducted does to some extent answer the question on why inspectors experience the main inspection as unstable and without clear directives. Today, the General asset manager has to rely on past experiences when conducting a main inspection, or if that is not enough, contact persons which have performed the inspection in the past, in order to receive needed information. If a structured documentation, available for everyone in the process, did exist the problem of giving unclear directives to the inspectors could be minimised. Additionally, it would stop the asset managers' problem of constantly reinventing the wheel, since concerned parties would constantly be understood with what was needed from them at each specific moment.

The aim of implementing a standard to secure a minimum level for the result of the process is further requested, mainly from parties with more responsibility within the business. The asset management is worried that the quality is unreliable and wants to assure the quality of the main inspection process, since it is one of the most important measures to assure the quality of the piers at the Port. Therefore, the asset management requests a standardisation of the process flow. It is said that standards have grown so much in power as they sometimes tend to reimburse legislation, or sometimes is incorporated in it, which seems to be the case here. The legislation is weak in the area of port maintenance, which makes the asset manager seek for another framework to steer the work and assure the quality. Additionally, the main inspection process is consuming regarding both money and time, making the asset manager in need of savings. Through standardising the process, the expectation is to streamline the process and by that identify waste, making the process more cost efficient, which is one of the well-known benefits of process standardisation as described in Section 2.3.1.

BaTMan has many positive effects, in line with what is said regarding well known standards by de Vries in Section 2.3 and further in Section 2.4, its familiarity within the infrastructure asset management industry in Sweden, makes the inspectors as well as the structural engineers familiar to the BaTMan standard, and often already educated in line with the standard, saving the Port from education costs. Since BaTMan classifies the damages through the usage of a decided system, the results are comparable over the years.

However, not everyone identifies BaTMan as a standard, or is even in need of BaTMan as a standard. Inspectors, for example, use it on a daily basis resulting in it becoming similar to a standard for them. Managers on the other hand rarely use it, since it does not help them in their daily work, as it for them is functioning more as an information database. This discrepancy leads the authors to the conclusion that it is beneficial to develop BaTMan in a way more suitable for the inspectors, including increased compatibility with pier inspections as well as an increased amount of drawings and similar documents within BaTMan. An extended and more customised usage of BaTMan will help setting guides and rules for how to conduct the technical parts of the inspection, but also a common nomenclature for the involved actors.

The managers who at this date do not see BaTMan as a useful standard for them, would rather see a flow scheme similar to the one presented in Section 5.5. This flow scheme is, as described earlier, already being developed by the General asset manager and a structural engineer at the Port, and a further development of this scheme is recommended in order to satisfy the request described by the management. The flow

scheme provides guides and rules regarding the more managerial parts of the main inspection process.

The General asset manager highlights the symbolic value of being part of a big organisation such as STA in a branding strategy point of view. Using the same inspection methodology (BaTMan), functions as a quality approval for external customers. This perception is in line with what is stated in Section 2.4 regarding using standards used as a way to differentiate a company from its competitors. The way BaTMan is used today does however not seem to be enough. The General asset manager is investigating the possibilities to implement the new ISO 55000 series, in order to assure the quality both internal and external for the customers. The asset manager predicts a future where the customers requires an ISO standard by their suppliers. This confirms what is said in the literature about standards; standards are fundamentally optional, but many of them have become more or less mandatory because of a standards establishment in current society. It is however seen that companies sometimes only formally comply to well-known standards without changing their processes, in order to use it as a marketing method. The decision to use BaTMan is traced to the same reason though, as a seal of approval to use the same asset management system as the large, established organisation STA. When studying the usage of BaTMan closer, it is shown that the standardisation is not completely followed, making the standard as an approval in lack of edge, which might be the reason on why a standard still is requested, even though one already is in use. However, it is claimed that standards are costly to implement and should therefore be avoided if required by the customers. Furthermore, studies have shown that standards sometimes tend to shape the organisation rather than its practices. Therefore, it is important to be sure regarding the purpose of implementing a new standard into a process, and if it is the practices or the organisation that is ought to be changed.

As a complement to BaTMan, the feasibility of ISO 55000 has been investigated. BaTMan is criticised to be too non-specific for pier maintenance. This makes the applicability of ISO 55000 questionable if the purpose is only for external approval, and not really to make the maintenance management easier. However, the asset management is concerned of securing the quality of the inspections and thereby the pier's status, not only for marketing purposes, but mainly for internal purposes. Conclusively, ISO 55000 is suitable if the asset management seeks a standard mainly for external approval. If the internal purpose to secure the process' quality is the main purpose of the standard, ISO 55000 should be fully implemented and thoroughly considered to be useful and worth its expenses.

6.2 Key factors for a successful implementation

As mentioned in previous section, one must first know what is desired by a standard to identify what a successful standard implies. With that said, the success of a standard is quite process-specific and must respond to what a successful process implies. Through studying why the standard is requested, the sought results of the standard can be traced. Further, a standard need special features in order to actually be used and not stay as a paper-product not leaving the desktop. By using de Vries (2006) criteria for a successful standardisation, it should *be there*, *be known and available*, and *be used*.

When implementing a standard, it is important to create a social acceptance connected to the implementation of a standardisation. To promote this, a cluster of creators, containing both managers and consultants as well as inspectors and other concerned consultants is recommended. An accepted standard is a standard compatible within all fields involved in the process, which then will result in a more complete and used standard.

Through studying the main inspection process, containing many participants temporary and partly involved, knowledge transferring and a proper mapping of the decisions made is necessary. This to make it possible to understand the process for a person recently introduced and to store the knowledge of a person no longer within the process. Furthermore, clear directives are necessary to make the inspections repeatable and comparable over years. However, the process is quite specific on different piers, making the use of a detailed standard nearly impossible.

As a complement to BaTMan, the feasibility of ISO 55000 has been investigated. BaTMan is criticised to be too non-specific for pier maintenance. This makes the applicability of ISO 55000 questionable if the purpose is only for external approval, and not really to make the asset management easier. However, the asset management is concerned with securing the quality of the inspections and thereby the pier's status, not only for marketing purposes, but mainly for internal purposes. Conclusively, ISO 55000 is suitable if the asset management seeks a standard mainly for external approval. If the internal purpose to secure the process' quality is the main purpose of the standard, ISO 55000 should be fully implemented and thoroughly considered to be useful and worth its expenses.

6.3 A suggestion of an improved main inspection process

Through studying the main inspection process as a case, some suggestions of improvements have been identified by the authors. First, a flow scheme similar to Figure 8 below is suggested, to clarify the aim of the main inspection, both internally but also externally. Through using this, the actors will achieve a greater knowledge what is to be conducted during the inspection, thus they will be able to give suggestions for how to better perform the inspection. Included in the suggested flow scheme is a pre inspection with the Sonar scanning in 3D, before the main inspection is conducted. This pre inspection can help planning the main inspection, and the brief knowledge about the pier and its status can help prioritise the inspection. However, there is a risk to use the pre inspection as a foundation for the subsequent main inspection, since things might be missed because the pre inspection is more an overview. However, the alternative to do nothing at all is by the authors considered worse and can be way costlier, risking to conduct main inspections on elements that are in perfect shape, and missing elements that would need a thorough inspection.

Secondly, an extension of BaTMan is suggested. BaTMan has great potential due to its familiarity amongst inspectors and structural engineers within the asset management industry. Making it more compatible with the harbour industry, as well as inserting more drawing and blueprints will make it easier to use, resulting in both time and cost savings for the Port. Further discussion regarding these subjects will be held below.

6.3.1 Flow scheme

The flow scheme suggested aims to support the asset manager in the main inspection, through mapping all activities in relation to each other. The program should be built as a checklist, helping remembering all activities and permissions that a main inspection contains, in order to make it feasible for any asset manager to execute it. Further, the process can be more fluent when the sequence of activities is better planned, and the Asset manager gets an overview of the activities that should be conducted. When forgetting elements in the process, a lot of time and money is spent, such as people waiting for things to be fixed and permissions to be solved; a source of waste that can be prevented through usage of the suggested flow scheme.

Furthermore, the new flow scheme also aims to add to the already existing chart which is under development by the management at the Port. It further aims to collect additional standard documents like templates and agendas needed in the main inspection process. It is not intended to collect results from the inspections, which is aimed to be done in BaTMan. Instead, the flow scheme is recommended to be used by the asset manager and asset management, while BaTMan is to be used by the inspectors and the structural engineers. When implementing the new standard, it is important to communicate its purpose and intended way of usage in a proper way. As one of the structural engineers expressed a concern about, a risk with checklists is that people just do and stop think, which can harm innovation and hinder unexpected things to be observed. The structure of the flow scheme is presented in Figure 7 below.

The flow scheme consists of three main phases identified during the case study: preparations, execution and closure. During the preparations phase, the main inspection is planned, in order to make the execution phase run as smooth as possible. Since the execution phase is engaging the most people, the cost can be cut through shorten the time. Therefore, there is a lot to benefit from a thorough preparation. The flow scheme is intended to be extended and transferred into the data system of the port. When standard templates are needed, such as agendas and forms, they should be easily accessed through clicking on a link inserted in the program. When making agendas easy to access, they are hopefully to a larger extent used, which makes the process better documented.

The flow-scheme is intended for internal use, making the external, temporary consultants unable to access it. On the other hand, with the suggested new, improved way of using BaTMan, they do not need to access the flow-scheme to take advantage of it, since it particularly is intended to be used by the asset managers. In Section 6.3, suggestions for how this standard could look like are presented. The usage of two separate software flow scheme and BaTMan should also be questioned. Flow scheme is more agile to the business and is already in use in other parts of the organisations, why it is decided as the most favourable decision to retain the usage of both flow scheme and BaTMan in parallel.

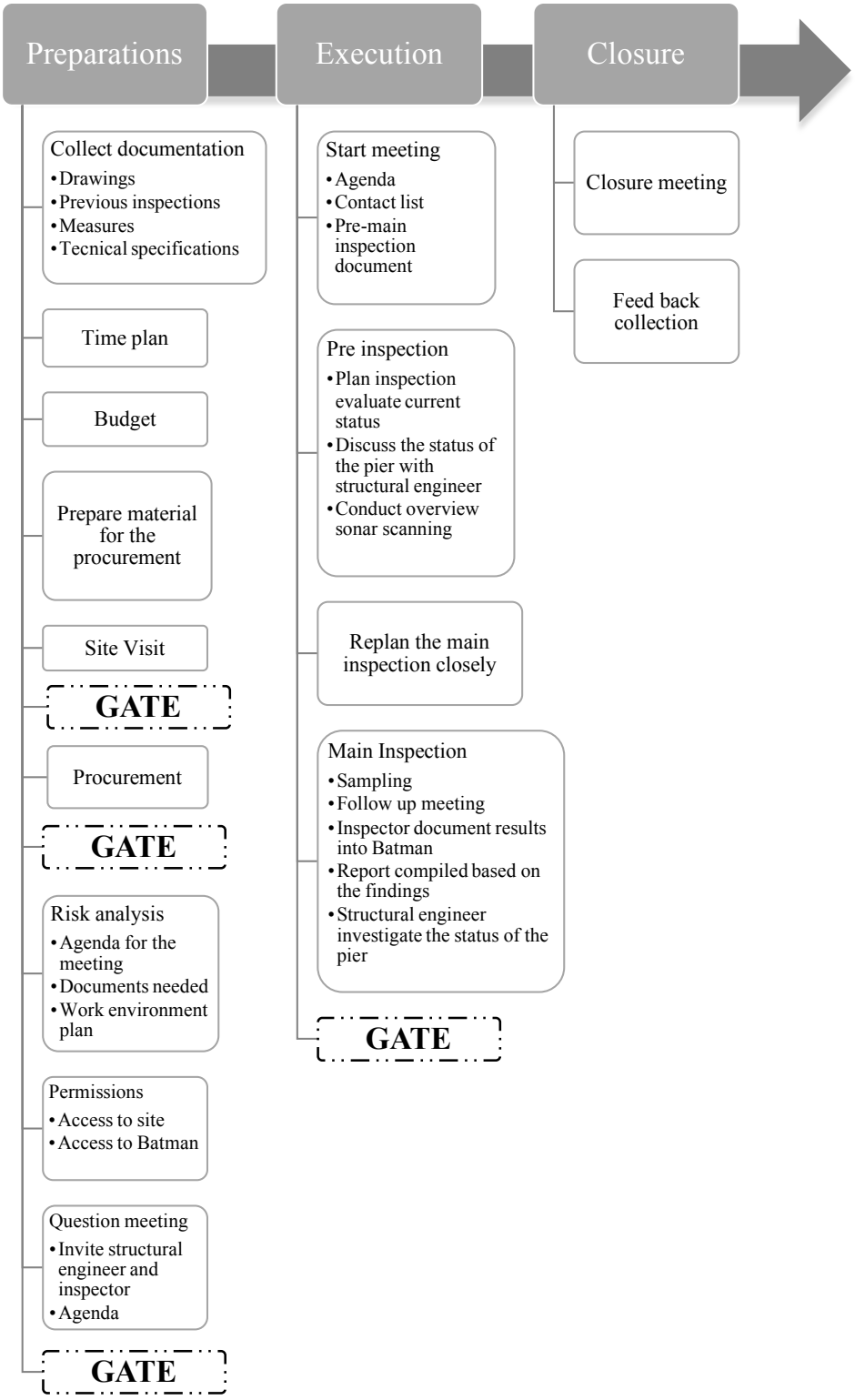

Figure 7 - Suggestion of a Flow Scheme chart for the main inspection process

Worth highlighting in the preparations phase is the permissions. Through preparing the permissions beforehand, they will not be an issue when they are forgotten and the inspectors cannot access the site in the execution phase. Since these kind of permissions sometimes can be time consuming they can preferably be prepared beforehand.

The “Gate” activities are milestones, which indicates that all activities listed above it must be finished in order to proceed. Due to the fact that there is today such close relationship between client and inspectors, the borders between activities are, as described earlier, perceived as fluent and they tend to overlap with each other. The Gates will help preventing this through being an activity where, in order to pass, the steps above have to be completed. This will further ensure that nothing is forgotten during the course of the process.

Through the use of Gates, it can be clarified which information should be prepared before the procurement, to limit the amount of additional information added after the procurement, something that is fluent today. In addition, present issues expressed by the Inspectors, such as permissions, can be prevented through the usage of gates within the flow scheme. It will guarantee that the Execution phase is not initiated before all questions regarding permissions are solved, and actors in need of access to the site got one. This will probably lower the amount of downtime experienced by the Inspectors.

In the execution phase, a pre inspection is suggested, in order to put correct focus during the inspection. The pre inspection should be made in close collaboration with the structural engineer and inspector, to get a picture of what is known and what is unknown and therefore needed to be investigated during the main inspection. In the pre inspection, Sonar pictures in 3D are made to achieve an overview of the pier below water, and thereafter analyzed. This procedure is expensive, but the expectation is that it will gain the quality as well as the focus of the further process. When having a better focus, unnecessary parts can be peeled off and money is saved. Since it is found that the money is not the highest priority, rather the quality, this seems to be a good trade-off.

A feedback collection meeting is added in the closure phase, in order to gather all parties involved in the process, to enable them rise suggestions of improvements and report issues that made the process flow function badly. Today, the main inspection process lacks this meeting, but this kind of experience sharing can create an organisational memory useful for the future, making the process dynamic. Further, it can collect the knowledge and experiences produced during the main inspection to make it available for future inspections.

A meeting like this is consuming in terms that many persons must be gathered at the same time to fulfil the purpose, but is recommended in a project like this with a high staff turnover. The meeting is preferably planned a long time beforehand, and should be included in the contract with the consultants. Resistance against spending time on sharing experiences have in the case been expressed by the consultants, which can be traced to the difference of perspectives described in Section 2.1.2, where consultants often have the micro viewpoint, not striving to long-term goals. To overcome this, the purpose of the meeting should be closely communicated in order to make the participants understand how they can contribute and what the gains are, which will prevent misunderstandings regarding the reason for the meeting as explained in Section 0.

The feedback collection should be mandatory and contains both a meeting where the process is discussed and possible improvements are suggested, and the regularly documentation of the process and decisions constitutes the second part. As described

is Section 2.3, an active user of a standard, including feedback to developers as well as users is necessary for a standard to make it being of value for a company.

However, in order to harness the benefits of this improved mapping of the process, it is important to have some guidelines in mind. Based on what is mentioned in Section 2, the presented major activities should be properly mapped, documented and promoted in a way which makes it known and available to anyone who is in need of it. Further note that the current scheme is based on interviews, site visits and theory conducted during the progression of this thesis. To make a more comprehensive and accepted scheme, it is important to have a cluster of creators to receive multiple angles from all actors within the process. Further, the standard should be simple and easy to use, why an already existing software is chosen, which also promotes the acceptance in the organisation. Finally, the final standardisation should not include any project specific variants, which could hamper the schemes' compatibility when performing other activities. Instead, groups of operations should be linked to the process, as described in Section 2.3.

6.3.2 Extended use of BaTMan

In addition to the flow scheme, an extended use of BaTMan is recommended in order to collect information regarding the main inspection in one place, accessible for the external consultants engaged in the main inspection. BaTMan is currently mostly used by inspectors and structural engineers, while the asset managers at the port rather use another software for blueprints and store their documents on the internal server. The suggestion includes that the blueprints and other documents describing the pier are collected, but also that BaTMan is used more continuous when maintaining the piers, i.e. not only during the main inspection. This would include that the asset managers report their measures on the piers into BaTMan, collecting everything made on the pier in one place. Through collecting all information needed regarding the piers, the structural engineers and inspectors can access the information they need easier, eliminating the problems of providing information in time prior to the inspections. Thereby, both resources and money can be saved.

To make this feasible, some adjustments should be made in BaTMan to make it more customised for the Port. This includes the possibility to insert pier-specific elements that not exist on normal bridges and therefore is lacking in BaTMan. Further, extensions in the licence might have to be adjusted, to allow all actors involved in pier maintenance to document their information, in order to make it available to other parties.

The structural engineers' and the inspectors' positive attitude regarding BaTMan could be because they are actually using the standard, i.e. all three criteria of de Vries (2006) are fulfilled. Furthermore, the inspectors and structural engineers are consultants often hired by the STA, used to work with BaTMan, which implies that the standard is more known and available for them as for the asset management. This seems to be a big advantage, as the risk of misunderstandings decrease when the project participants know how to structure and communicate the information they generate. Additionally, the use of standardised documents on recurrent elements in the main inspection process provided by BaTMan can increase the productivity and decrease confusion.

However, seeing as the Port has recently implemented the system Hypedoc which manages their drawings and blueprints, resistance might appear towards changing program again and use BaTMan instead to manage the data. Further, BaTMan is by many seen as a bit complicated to work with, and requires its users to undertake a course in order to achieve a licence, something that can further lead to resistance of new users. Since the discussions regarding the document management strategy is ongoing within the organisation and has been for a while, a unite and long term decision is probably well received.

6.4 How the new standardisation will influence the main inspection process

When implementing the flow scheme, a more thorough and carefully prepared process can be achieved. Through the usage of the scheme, less time has to be spent on non-value adding activities which eventually will result in an increased efficiency and improved quality. This is due to the fact that all involved actors will know what is to be done at each specific step of the process, and consequently what should be done at the following activities. Through having all issues regarding access and other permissions for the inspectors solved at the early phases, a smoother process will be achieved.

Another advantage with the new standard is that the problem of reinventing the wheel, expressed by for example the Asset manager 1 will be limited. Through better routines for documentation on meetings and with activities properly structured and visible, important activities will be prevented from being forgotten. Additionally, new employees will through a well-documented and standardised process be smoother taught regarding what is expected from them. The extended experience collection meeting suggested is intended to making it easier to introduce new members to the process. However, the value of experience of the process should not be underestimated, and that the experience of being on site cannot be replaced by a written description of the project.

Through the suggestion to collect all blueprints and other documents in BaTMan, a more comprehensive view of the pier can easier be achieved. This is useful when evaluating the need of maintenance and inspections, as well as preventing employees perceiving that finding right documents is hard and a waste of time. Directly accessing needed documents from BaTMan results in that the external consultants will not need to ask the information manager at the port, to obtain requested documents. Additionally, when inspectors, structural engineers and managers are all receiving the information from the same place they will be encouraged to start "talking the same language", thus making it easier to understand each other. Furthermore, the inspectors can report their findings regularly during their inspections, making the structural engineer able to start evaluating them as they are reported. This allowing the inspectors and structural engineer to work in parallel, making the process shorter and more efficient.

Further, the suggestion to make the inspection process more iterative, and re-plan the inspection after the initial pre inspection with 3D Sonar, will both improve the quality of the inspection, but can also save money for both avoiding making unnecessary inspections, but also through not missing inspections that would have been necessary

to be supplemented afterward, something that is very costly to conduct after finished inspection, when the inspectors are no longer located on site.

However, implementing a standard similar to what is described above does not necessarily only bring gains to an organisation. In order to successfully implement a standard, hard and strenuous work is required, in order to prevent the standardisation not being used, which for obvious reasons should be avoided. Additionally, awareness has to be raised regarding the fact that a too literally followed standard might result in a loss of agile behaviour and independent thinking amongst the employees.

The progress of developing a flow scheme to support the main inspection will ensure a proper mapping of the process. This will result in that the Port will be able to identify waste in the current process and through that improve the efficiency. In addition, it could simplify communication and make the process more transparent, allowing benchmarking through the usage of common Key Performance Indicators. Since the programme as a standard can be customised to the operations, it is suitable for the main inspection and clarifying many of the complaints regarding BaTMan not being compatible enough. Further, the implementation cost is low since the software already is in use. Since the organisation now can develop their own standard, there is no external organisation influencing the process. When using standards such as ISO 55000 or BaTMan which are owned by external organisations, there are always requirements and requests that the standard must be adjusted, influencing the standard in different directions. This results in a standard not being fully compatible with, in this case, the Port's business. Furthermore, these kind of standards often contain a control element, where the organisation controls that the standard is followed. This is generally very costly, a cost that can be saved through developing a standard within the organisation. Furthermore, the flow-scheme is quite simple and user friendly, due to that it is developed for the business. Through developing the scheme in cooperation with asset managers and asset management, the key actors of the process are participating during its development, which promotes its implementation and helps it being accepted within the organisation.

7 Conclusions

A successful standardisation of the main inspection process at the Port will result in a process where things are not forgotten, and less misunderstandings. It was found that a standardisation implies different things for different actors, where the period during which a certain actor is involved in the process seem to be a critical factor.

Generally, actors involved during a longer period of the process, such as managers and structural engineers, requests the standard to facilitate a stable process with guides and rules where everyone knows what should be done and where the quality of the results is assured. Actors involved during a shorter period, such as an inspector, requests a common nomenclature to avoid misunderstandings. These different perspectives are important to keep in mind when developing the standardisation.

The results from the main inspection is important for the Port's strategical work and how maintenance investments in the piers are made. Therefore, an incorrect result due to a bad quality inspection can have big implications. Hence, the quality of the inspection is highest valued, and money and time aspects due to this are of inferior character. This should be kept in mind when standardising the main inspection process. Furthermore, it is shown that the importance of the quality should be clearly communicated to all parties involved in the process, to prevent an overhasty performed inspection due to a false perception of a too high time pressure.

A successful process standardisation will increase the efficiency and improve the quality through a better prepared main inspection process, and a better structure in the documents through improved information management. The standardisation is further expected to decrease the risk of misunderstandings through an agreed nomenclature, with better structure and thorough documentation of meetings throughout the process. Furthermore, the standardisation will facilitate that the documentation is done, since it will clarify when and by whom the documentation is required. This will result in a standardisation providing a more comprehensive basis of the piers for the future, where the information regarding the inspections are collected at one place.

If not managed properly, the standardisation will however not lead to these results, and the increased productivity related to the standardisation will be lost. The risk in following a check-list too literally should be discussed, and the importance in communicate how to relate to the check-list. It should be emphasised that the asset manager must be confident enough to make decisions deviating from the check-list when needed. A new standard requires considerable resources to develop, it is therefore necessary that the standard is well received and fully adopted by the organisation, to prevent it being useless and costly. Therefore, the standard should be very thorough considered and developed in line with the recommendations in this report. As there is a wide range of actors involved in the process, it is recommended that a cluster of creators with different positions and perspectives is present when developing a successful standardisation of the main inspection process.

7.1 Recommendations for further research

For further research, it is recommended that the suggested flow scheme is developed in a deeper and more technical approach. The usefulness of the different methods performed by the inspectors could advantageously be investigated, to evaluate which are the most suitable ones for the main inspection. Furthermore, it is recommended to conduct a similar case study on a comparable business, for instance during another main inspection process at another pier or port. Additionally, a study on how the BaTMan framework could be better aligned to port maintenance would be valuable.

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Appendix I

Interview questions Structural engineer

- Vad arbetar du med?
- Vad har du för yrkesbakgrund?
- Vad är din relation till huvudinspektionen?
    - Kan du i korthet berätta om din del i huvudinspektionen?
- Vad tycker du om dagens sätt att utföra huvudinspektion, för dig som konstruktör?
    - Vad tror du skulle kunna göras för att göra processen smidigare?
    - Vad upplever du saknas?
- Vad har du för tidigare erfarenhet från Huvudinspektionen?
    - Hur gjorde man då?
- Vad tycker du om Batman?
    - Dess användarvänlighet?
    - Dess kompatibilitet till kajer jämfört med broar?
    - Hur tror du man kan förbättra användandet av Batman?
- Vi skulle vilja veta lite mer om förberedelserna inför en huvudinspektion. Är du involverad i det? Vilken typ av material tas fram, etc.
- Hur ser materialet/underlaget ut ni får inför inspektionen?
    - Är det tillräckligt?
    - (kommer det i tid?)
    - vilken del av materialet är du med och tar fram?
- Hur fungerar det att söka information bakåt i tiden?
- Vi jobbar med standardisering av huvudinspektionen, vad har du för förhållande till standardiseringar. Tror du att det hade varit en bra ide för huvudinspektionen? Varför/Varför inte?
- Vad innebär en lyckad standardisering för dig?
- Hur tror du huvudinspektionen skulle påverkas genom en standardisering?
- Vi har tittat på prioriteringar gällande tid, kvalitet och pengar. Hur skulle du gradera dessa i huvudinspektionen?
- Hur fungerar samarbetet mellan konsulter, inspektörer och infrastruktur på hamnen?
    - Hur fungerar informationsflödet?
- Hur mycket är du ute och besöker piren under en inspektion? Anser du att du är ute så mycket som du finner nödvändigt?
- Om en standard skulle införas, vilka punkter på en “to-do” list hade varit viktiga att ha med?
- Har du någonting du skulle vilja tillägga?

Interview questions Inspector

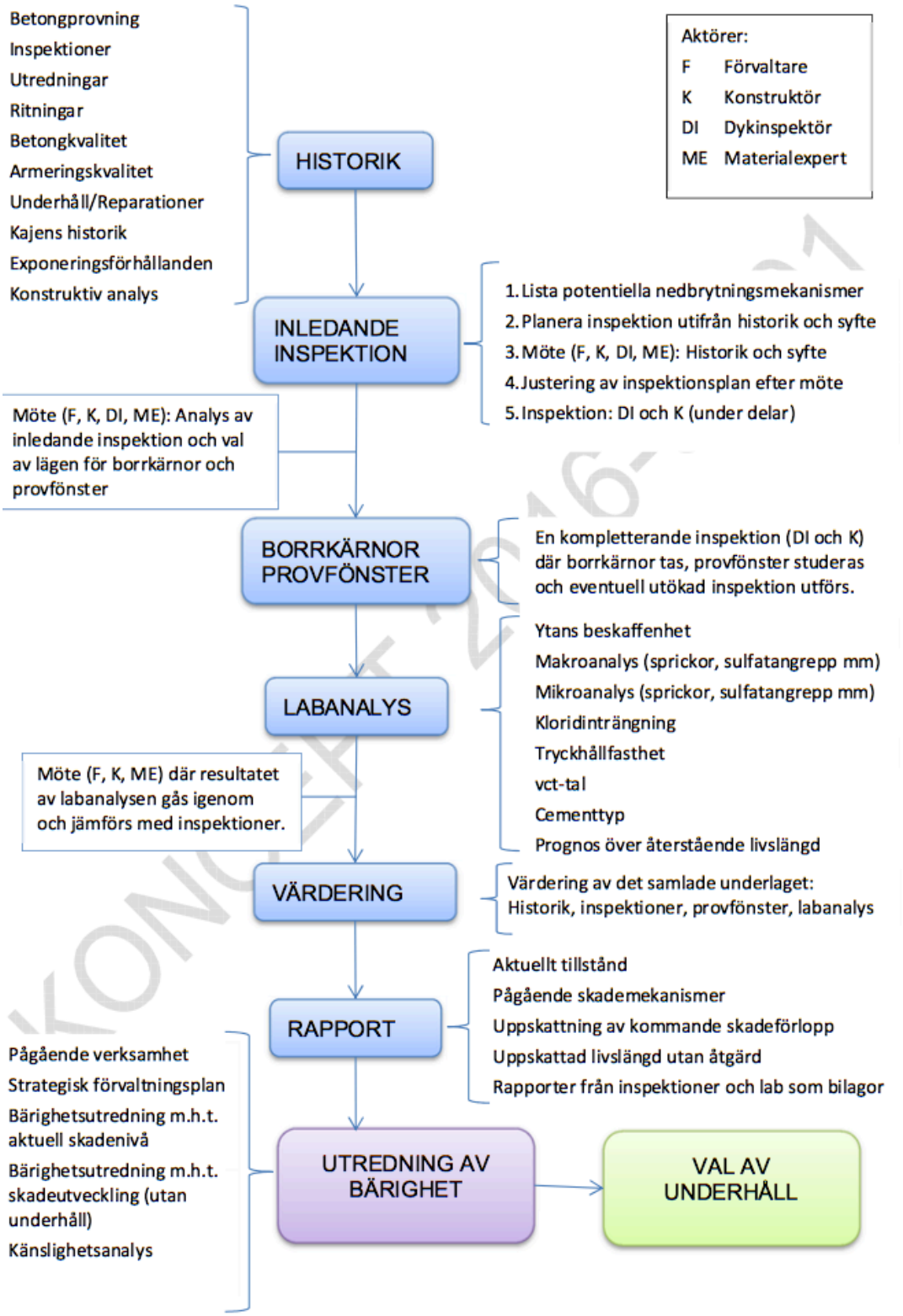
- Vad arbetar du med?
- Vad har du för yrkesbakgrund?
- Vilken är din roll i huvudinspektionen?
- Vilken är er största utmaning i huvudinspektionen?
- Hur upplever du samarbetet med GHAB?
- Hur utförligt och omfattande är materialet ni får inför huvudinspektionen?
    - Ritningar
    - Mängdförteckning
    - Tidigare skador, information från tidigare inspektioner
    - Är informationen tydlig?
    - Saknar ni någonting?
- Har ni fått tillgång till material från tidigare inspektion?
- Finns det tydliga anvisningar på vad som förväntas av er och ert arbete?
    - Vad gäller inspektionen?
    - Vad gäller resultatet?
    - Vad gäller föra in resultatet i BaTMan?
    - Hur fungerar Batman?
- Hur upplever ni de möten som hålls under processen?
    - Frågemöte
    - Startmöte
    - Uppföljningsmöte
    - Slutmöte/erfarenhetsåterföring?
- Upplever ni att GHAB är tillräckligt insatta i ert arbete?
    - Hur skulle detta kunna förändras?
- Vad tycker du om att ha erfarenhetsåterföringsmöte efter arbetet är avslutat?
- Använder ni dokumentation från tidigare huvudinspektioner?
- Finns det någon del i huvudinspektionen och arbetet kring den som ni önskar/ser skulle förbättras?
- Vad upplever ni som högst prioriterat från GHABs sida i fråga om tid, pengar eller kvalitet vad gäller huvudinspektionen?
- Till vilken grad skulle du säga att ditt arbete är standardiserat?
    - Hur ser du på att arbeta efter standardiserade dokument?

Interview questions Asset manager

- Vad var anledningen till att ni bad oss titta på huvudinspektionen?
- Hur upplever du processen i dagens huvudinspektion?
- Hur har huvudinspektionen förändrats över tid?
- Hur påverkas resultatet av att GHAB sätter nivån för inspektionen?
- På vilket sätt bör en standard utformas enligt dig?
    - Ska den fokusera på processen eller resultatet?
- Varför efterfrågas en standard? (från din/GHABs/kundernas sida)
- Har du tidigare erfarenhet av implementering av ISO-standards (eller annan standard)?
- Till hur stor grad tror du generellt på standardisering av processer?
- Hur hanterar ni lagring av information i dagsläget?
- Hur ser du på standardisering av informationshantering?
- Vad tror du om en utökad användning av BaTMan?

Appendix II

Betongkonstruktioner i havsvatten – strategi för underhåll.



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