LUND UNIVERSITY
School of Economics and Management

Processes in Public Sector Organisations – Like Flowing Water

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Master thesis in Accounting and Finance
Lund University

Abstract

Seminar date: June 3, 2021

Course: BUSN 79

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Five key words: Efficiency, Effectiveness, TDABC, Stakeholder and Public Value

Purpose: The purpose of this thesis is to investigate and analyse how processes of public sector organisations can become more efficient and effective.

Methodology: This thesis is conducted with an action research approach and is part of a R&D project in the public water sector. The thesis focuses in particular on a single case. Material is gathered from within the R&D project in forms of documents and meetings with the project members. Empirical findings are gathered by conducting semi-structured interviews.

Theoretical perspectives: The starting point of the theoretical background is the stakeholder theory, which identifies the relevant stakeholders to the case study. The concept of public value is presented. Thereafter, the principles of Activity Based Costing (ABC) are explained in order to set the stage for the more refined version of the ABC, namely Time Driven Activity Based Costing (TDABC). TDABC is applied to the process of pipe installation works in order to achieve a cost perception of the process and to highlight potential cost savings.

Empirical foundation: The empirical data is collected from several data sources, namely interviews, documents and meetings in order to acquire an in-depth understanding of the organisations involved and the case that is being investigated.

Conclusions: We believe that the TDABC-model can be used to a larger extent in public sector organisations performing robust processes in order to solve practical problems and make processes more efficient. To benefit from the full potential of the model more detailed and comprehensive information needs to be acquired. Our analysis shows the importance of taking the perspective of stakeholders, and the creation of public value, into account in order to make the processes of public sector organisations more efficient and effective.

Acknowledgements

We would like to take the opportunity to thank our supervisor Anna Glenngård for her much appreciated inputs, guidance and valuable insights in the process of writing this master thesis. We would also like to thank the participants in the R&D project and the interviewees for giving us insight into the public water sector.

Lund, Sweden

May 28, 2021

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1. Introduction

This chapter sets that stage for the entire thesis. An introduction and problematisation regarding the research topic are presented together with the three theoretical perspectives used, which then unfolds into a purpose and research questions. The following section explains the research context and the R&D project in which this thesis is a part of. The chapter ends with research delimitations and an outline of the thesis.

1.1 Background & Problematisation

Public services are ordered and mainly financed by public sector organisations and delivered to society (Leisink, Andersen, Brewer, Jacobsen, Knies & Vandenabeele, 2021). Consequently, many different actors have a stake in public sector organisations and the delivery of public services including, for example, citizens in their roles as customers and payers of taxes and user fees. Many other "stakeholders", which refers to "any group or individual who can affect or is affected by the achievement of the organisation's objectives" (Freeman 1984, p.46), to public sector organisations can be identified including employees, suppliers, and environmentalists. Accordingly, public sector organisations within sectors such as healthcare, electricity distribution and water distribution have a broad array of stakeholders in society.

The recovery phase after the economic crisis in 2008 revived the public debate on the quality of the services of public sector organisations and on how they are adding value to the public (Leisink et al. 2021). Several approaches of improving management in public sector organisations exist, one being new public management which is characterised by incentives and market mechanisms (Hood, 1991). For improving performance of public sector organisations in sectors that are not exposed to competition, however, we argue that focus must be on other aspects than incentives and market mechanisms. Such an approach is Moore's (1995) concept of public value, which has been given attention and been further developed in recent years (Moore, 2013; Faulkner & Kaufman, 2017; Leisink et al. 2021).

Public value is created by public sector organisations producing valued outcomes, which is why the concept of public value is closely related to how stakeholders are affected by the achievement of public sector organisations´ objectives (Moore, 1995; Leisink et al. 2021). Consequently, the stakeholder theory (Freeman, 1984) and the concept of public value (Moore, 1995) will be used alongside each other in this thesis. Public value is described as a comprehensive approach to think about public management and about continuous improvement in the services of public sector organisations (Moore, 1995). Measuring public value has been identified as of great importance (Moore, 1995), but also as difficult (Talbot & Wiggan, 2010). Although the concept has existed for several decades, no literature review of public value has focused specifically on the measurement of public value until recently (Faulkner & Kaufman, 2017).

Based on their literature review, Faulkner and Kaufman (2017) developed a framework and identified key components considered necessary for measuring the extent to which a public sector organisation is creating public value. Considering that measuring public value has been identified as difficult (Talbot & Wiggan, 2010), but important (Moore, 1995), and that key components for measuring public value recently have been compiled into a framework (Faulkner and Kaufman, 2017), we argue that the theoretical foundation for measuring public value has been strengthened. Hence, we argue that measuring public value is more manageable than it was just a few years ago and that it has become increasingly interesting measuring how improvements in the processes of public sector organisations can increase their creation of public value. Accordingly, we investigate and analyse how public sector organisations' processes can be improved to increase public value, which is something we believe can contribute to both theoretical and practical knowledge. To do so, our foundation builds on the public value framework of Faulkner and Kaufman (2017) and Moore's (2013) definitions of efficiency and effectiveness. In the context of public value Moore (2013, p.56) defines efficiency as the "use of collectively owned assets and associated costs", and effectiveness as the "achievement of collectively valued social outcomes".

The stakeholder theory and the concept of public value are useful tools for analysing how stakeholders can benefit from, respectively, how public value can be increased by public sector

organisations being more efficient and effective. Regarding this, we believe that efficiency as well as effectiveness is relevant. However, we believe that improved effectiveness to a large extent comes as a result of improved efficiency in public sector organisations. Hence, to analyse how stakeholders can benefit and how public value can be increased, the starting point in this thesis will be to analyse the efficiency of a specific process in a public sector organisation. A useful model to analyse such a process is the Time Driven Activity Based Costing-model (TDABC-model) developed by Kaplan and Anderson (2004).

The TDABC-model calculates costs of resources consumed in a process and has been used to calculate costs down to single customers, patients, and processes (Kaplan & Anderson, 2004; Kaplan & Porter, 2011). Kaplan and Porter (2011) applied the TDABC-model to processes in the healthcare sector, which we classify as *delicate* processes, which are processes in which a person, or patients in that case, is a part of the process to which the TDABC-model is applied. We adapt the theoretical foundation of the TDABC-model (Kaplan & Porter, 2011) and apply it to what we classify as a *robust* process, in which a person is not a part of the process to which the TDABC-model is applied. This is because we believe that the TDABC-model has great potential and applying it to a new process can contribute to both theoretical and practical knowledge.

For applying our arguments of how the stakeholder theory, the concept of public value, and the TDABC-model can be used we have chosen the public water sector and the process of pipe installation works of drinking water pipelines.

1.2 Purpose & Research Questions

The purpose of this thesis is to investigate and analyse how processes of public sector organisations can become more efficient and effective.

Research questions:

1. Can a TDABC-model contribute to more efficient pipe installation works?
2. How can more efficient and effective pipe installation works benefit stakeholders and increase public value?

1.3 Research Context & The Project “Safe and Smart Pipe Installation Works”

In Sweden it is the municipalities responsibility to provide drinking water, but it can be organised through different types of public sector organisations (Vattenmyndigheterna, 2021), and the activities for providing drinking water are paid for by user fees (Svenskt Vatten, 2021). Sweden has favourable conditions for producing and distributing drinking water, but in recent years the debate of drinking water usage has been intensified (Malm et al. 2019). In the summer of 2018, more than 100 municipalities restricted water usage and the losses of produced water from the pipe networks in Sweden has been identified as relatively high, about 20 percent (Malm et al. 2019). Besides this, a recent report shows that the most urgent problem municipalities are facing within the public water sector is the status of their infrastructure facilities (Svenskt Vatten, 2020a). Accordingly, as old infrastructure becomes more and more ineffective, the distribution system must be renewed and expanded. Investments in infrastructure facilities have increased to some extent during the last years, nonetheless, significantly increased investments are needed soon (Svenskt Vatten, 2020b). In this context, it has become increasingly interesting to investigate how pipe installation works within the drinking water distribution systems can be improved.

The research and development project “Safe and smart pipe installation works” (henceforth called the R&D project), which this thesis is a part of, is a collaboration between VA SYD and Sydvatten, their joint research and development company Sweden Water Research, and Lund University. The project is performed with financial support from the development unit of the public water sector organisation Svenskt Vatten (Swedish Water Research, 2020). Out of the three public water sector organisations in the R&D project, VA SYD is the one we have been mainly involved with in conducting this thesis.

The R&D project aims to describe and evaluate rapid methods for analysing water quality, which could be used to perform more efficient installation works of drinking water pipes. Since the quality of drinking water is regulated, the pipe installation works cannot be finished before the quality of the water has been approved (Swedish Food Agency, LIVSFS 2017:2). Using the

current method for water analysis, it takes about four days for VA SYD and about eight days for Sydvatten before an answer is given (VA SYD, 2020). Reducing the time spent on water analysis has been identified as an area of improvements within the organisations of the R&D project. What benefits a reduction in time would lead to is, however, not obvious and this thesis aims to contribute to that understanding.

To give the reader further understanding of the settings for this thesis, it is in order to give a further introduction to the participating organisations and their relation to this thesis. One of the organisations is Sydvatten, which is a municipal limited company jointly owned by 17 municipalities in the western part of Skåne county (Sydvatten, 2020a). Sydvatten is responsible for producing water as well as for distributing water to connection points from where each of the municipalities are independently responsible (Sydvatten, 2020b). The project "Safe and smart pipe installation works" are of interest for Sydvatten because of their large system of drinking water pipelines. In addition, Sydvatten is going through an intense investment phase including the construction of new pipelines (Sydvatten, 2021). The drinking water specialist of the R&D project is working for Sydvatten.

The project manager is working for VA SYD, which is a joint municipal authority including the municipalities of Malmö, Lund, Eslöv, Burlöv and Lomma, all situated in the south western part of Skåne County (VA SYD, 2021a). VA SYD owns the public water facilities within the owning municipalities and is responsible for providing quality assured drinking water to the inhabitants of the owning municipalities (VA SYD, 2021a; VA SYD, 2021b). Due to this responsibility, further development of safe and smart pipe installation works is of great importance for VA SYD. The incomes of the organisation are to over 90 percent based on water tariffs paid by customers, which are individually set by each of the owning municipalities (VA SYD, 2021c).

Sweden Water Research (SWR) is a research and development company working with sustainable water service solutions (Sweden Water Research, 2021). SWR is the platform for this project and the project coordinator is working for this organisation. SWR are working project-based with research and development focusing on the benefits of its owners, which are Sydvatten, VA SYD and NSVA, (Sweden Water Research, 2021). Concerning NSVA, which

acts as a reference group in this project, the organisation is operating in the north western part of Skåne county and has similar responsibilities as VA SYD.

1.4 Research Delimitations

This thesis is delimited to public sector organisations. The sector and the process that we had access to were the public water sector and the process of pipe installation works. Accordingly, our methodology is delimited to the public water sector and the process of pipe installation works. Moreover, our research is delimited to the scope of the R&D project.

1.5 Outline of the thesis

This section will as the title indicates give an outline of the rest of the thesis.

Theoretical background. This chapter gives a theoretical background that is relevant to the thesis. The stakeholder theory by Freeman (1984) institutes the chapter and the relevant stakeholders to the R&D project is identified. Next, we present the concept of public value and the framework by Faulkner and Kaufman (2017). The subsequent section explains Activity Based Costing by Kaplan and Johnson (1987), which lays the foundation for the refined version of their model, namely Time Driven Activity Based Costing introduced by Kaplan and Anderson (2004). Finally, the seven-step application of the TDABC-model by Kaplan and Porter (2011) is explained.

Method. This thesis is conducted with an action research approach and focuses in particular on a single case. Material is gathered from within the R&D project in forms of documents and meetings with the project members. Empirical findings are gathered by conducting semi-structured interviews.

Empirical Results. The chapter declares the findings and results made during this thesis regarding the case of Hällestadsvägen and general findings regarding pipe installation works.

Discussion and Analysis. In this chapter a discussion will be held that is closely related to the empirical results of this thesis. The final section broadens the discussion and applies a more critical perspective to discuss contribution and further research.

Conclusion. In this chapter the purpose and the two research questions are answered, and a well-founded conclusion is made.

2. Theoretical Background

In this section the scene for the theoretical background of the thesis will be set. By way of introduction the stakeholder theory (Freeman, 1984) will be explained, relevant stakeholders will be identified and how the stakeholder theory is relevant for this thesis will be explained. In extension of the stakeholder theory, Moore's (1995) concept of public value will be explained. We introduce the public value framework of Faulkner and Kaufman (2017) and describe the different dimensions of public value identified in the framework. The following section will explain Activity Based Costing (ABC) (Kaplan and Johnson, 1987). The final part of the theoretical background describes the theoretical approach that will be applied to the case, namely Time Driven Activity Based Costing (TDABC) by Kaplan & Andersson (2004) and the seven-step approach of the TDABC-model by Kaplan and Porter (2011).

2.1 The Stakeholder Theory

The stakeholder theory was introduced by Freeman (1984) and it describes and highlights the complexity of the environment in which a modern organisation operates in. The term "stakeholders" refers to "any group or individual who can affect or is affected by the achievement of the organisation's objectives" (Freeman 1984, p.46). This theory highlights different individuals or groups of individuals that are associated with the organisation and its objectives.

VA SYD and Sydvatten are organisations with stakeholders that could benefit from the outcome of this R&D project. It is of importance for this thesis that the stakeholders are identified and that it is investigated how they are affected by changes in the way these organisations perform pipe installation works. Freeman (1984) talks about different stakeholders and how they were important for American businesses. In this case, the same types of stakeholders can be identified to both VA SYD and Sydvatten. The following paragraph will identify the different stakeholders to VA SYD and Sydvatten that are affected by the R&D project.

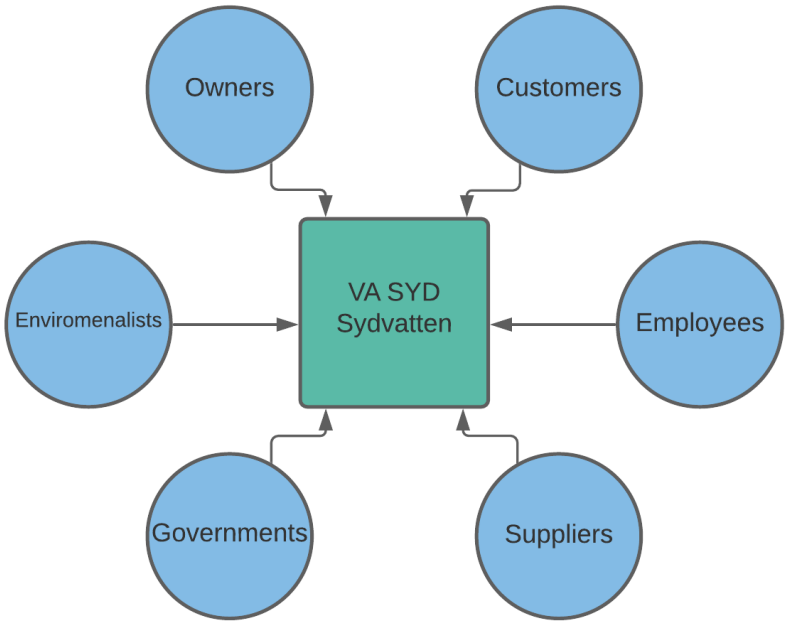

Figure 1: Identified stakeholders to VA SYD and Sydvatten in relation to the R&D project

2.1.1 Owners

Freeman (1984) argues that management cannot only assume that owners have one objective with their ownership, which traditionally is return on investment and should instead assume that they have a more complex intention with their ownership. The organisations participating in the R&D project have member municipalities that resemble owners in Freeman's (1984) stakeholder theory. The municipalities' intention with their membership in these two organisations is not monetary reimbursement, their intention is instead to provide their citizens with a public service that is crucial for a well-functioning society. Distributing clean water at a low cost ensures that everyone in society have access to clean drinking water. This is a very important aspect to the municipalities since the health of the citizens are often high on their agenda.

2.1.2 Customers

It can be devastating for an organisation to not continuously improve and innovate. Freeman (1984) argues that lagging behind competition will result in customer losses and financial constraints. Freeman (1984) reasoned about the declining dominance and reputation of U.S.

products compared to foreign alternatives. This was the result of lagging behind in innovation and improvement of technology and products (Freeman, 1984). Similar principles apply for VA SYD and Sydvatten. If they do not make efforts regarding sustainability through innovation and technological development, then customers may want to change how the supply of drinking water is organised. Customers to VA SYD may not have the same freedom of choice as customers to privately supplied products and services but since VA SYD is ultimately governed by politicians the customers have the possibility to vote for a change in a democratic election.

2.1.3 Employees

It is crucial for managers to find a successful level of the manager-employee relationship, which otherwise can lead to lower productivity (Freeman, 1984). Employees must find their work meaningful and a change in employee values, due to a younger workforce with different mindsets, calls for a more human approach to the management style. In Freeman (1984), he highlights the fact that companies that are excellent performers have a managerial style that emphasises the importance of employees to the success of the company. For VA SYD and Sydvatten to acknowledge and listen to the ideas of their employees regarding different aspects of business is important for their success in the future, especially if they aim to reach their ambitious environmental targets in the near future.

2.1.4 Suppliers

Companies have become more reliant on suppliers since the supply of resources is limited within their own region. Freeman (1984) argues that there has been a change of nature of the business - supplier relationship. The importance of well-functioning and sustainable supplier management has a crucial role in building sustainable supply chains and to achieve economic, social, and environmental advantages (Luzzini, Caniato and Spina, 2014; Zimmer, Froehling and Schultmann, 2016). Another interesting aspect that is particularly important to VA SYD since they have ambitious environmental targets is that “a company is no more sustainable than the suppliers that are selected by the company” (Krause, Vachon & Klassen, 2009, p.18). VA SYD and Sydvatten are special cases since the companies must conform to the law of public procurement (SFS 2016:1145), which regulates the procurement of goods, services, and

construction projects by assignment of contracts. However, both VA SYD and Sydvatten may have internal requirements that the supplier must live up to in order to get the contract.

2.1.5 Governments

The awareness of governments' role in enterprise businesses has increased and public officials have even been elected based on the promise of pursuing this role (Freeman, 1984). Freeman (1984) points out that governmental intervention has its critics, some argue that it is very costly that governments interfere with businesses while others argue that governmental intervention in the marketplace has actual social benefits that otherwise would not have occurred. Attributes such as lower air and water pollution, safer cars and an overall higher standard of living are partly an effect of government action (Freeman, 1984). The government's interference with the public water sector is mainly to ensure that the water delivered to customers is up to quality standards set by the Swedish Food Agency (LIVSFS 2017:2). VA SYD and Sydvatten are both governed by a political agenda, which is largely focused on environmental and sustainability objectives. The public agenda is deeply rooted in the objectives of both VA SYD and Sydvatten, which characterises the way they work and how they operate their entire organisation.

2.1.6 Environmentalists

Freeman (1984) argues that the environmental impact of corporations has attracted more attention and has become a major issue. The obsolete perception that nature is infinitely self-renewable has been changed for a more realistic and proactive attitude especially when it comes to governmental regulation and the way people think and act (Freeman, 1984). VA SYD has a strong connection to environmental questions and an agenda of being a part of the complex solution to the environmental issues that the world is facing. A phrase that can be found on their homepage translates: "VA SYD has since 2019 six tough objectives that will contribute to a sustainable social development and to help save the world" (VA SYD, 2021b). This showcases a very high ambition in the environmental area and the importance of environmental commitment to the organisation. The R&D project has a clear environmental objective where a new more rapid method of water quality analysis is expected to save large amounts of clean drinking water from being flushed down the drain, which in turn will lower the impact on the environment.

2.2 Public Value

Public value is Moore's (1995) approach to public management which is described as a comprehensive approach to think about public management and about continuous improvement of public services. Public value is created by public sector organisations producing valued outcomes, which is why the concept of public value is closely related to how stakeholders are affected by the achievement of public sector organisations´ objectives (Moore, 1995; Leisink et al. 2021). Another approach of improving management in the public sector organisations is new public management (Hood, 1991). However, while new public management is characterised by privatisation and market mechanisms, public value is about public sector organisations' responsibility of creating value to the public (Hood, 1991; Moore, 1995). Consequently, for a sector such as the public water sector, which is not exposed to competition, the concept of public value seems as a suitable approach. In Moore's (1995) approach, public sector organisations' creation of public value is compared to the private sector's aim of creating private value. Public value is created by public sector organisations producing valued outcomes and doing so with the constraints of available resources and capability, and the environment of formal and informal jurisdiction, legal frameworks, and mandate (Moore, 1995). Accordingly, public value is an extensive concept capturing a broad array of dimensions (Leisink et al. 2021). In the context of public value, efficiency has been defined as the "use of collectively owned assets and associated costs", and effectiveness has been defined as the "achievement of collectively valued social outcomes" (Moore, 2013, p.56). Measuring public value has been identified to be of great importance, although some dimensions of it could be difficult to measure accurately (Talbot & Wiggan, 2010). Measuring public value calls for explicitness of what types of public value a public sector organisation is trying to create, which can improve performance (Moore, 1995).

In a recent study, Faulkner and Kaufman (2017) reviewed peer-reviewed research on how to measure the extent to which a public sector organisation is creating public value. This resulted in a broad array of terms and a comprehensive framework that could be used for measuring public value (Faulkner & Kaufman, 2017). We adapt this framework to the public water sector and the process of pipe installation works. Based on the terms of public value, the framework identifies four themes that are considered important dimensions of measuring public value: (1) outcome achievement; (2) trust and legitimacy; (3) service delivery quality; and (4) efficiency (Figure 2).

The following four sections are based on information about the four themes of the framework (Faulkner & Kaufman, 2017).

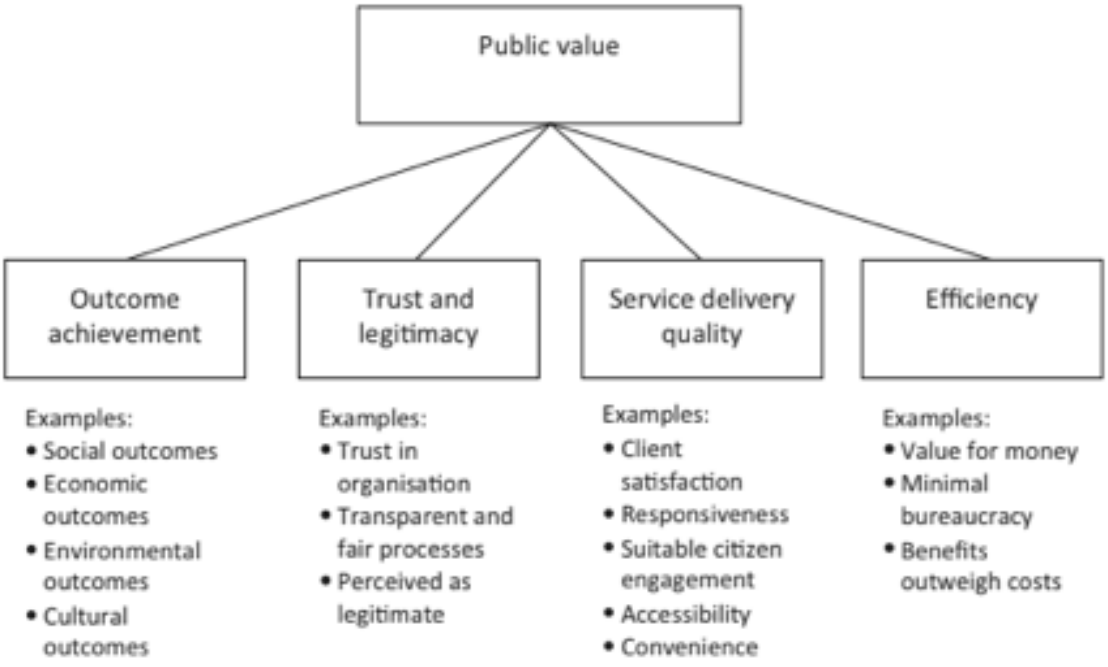

Figure 2: Public value framework (Faulkner & Kaufman, 2017)

2.2.1 Outcome Achievement

Outcome achievement refers to the extent to which a public sector organisation is improving publicly valued outcomes (Faulkner & Kaufman, 2017). This includes outcomes of economic and environmental character as well as social and cultural outcomes. To what extent public sector organisations are concerned with each type of outcome will differ. However, to create public value a public sector organisation must be contributing to improved outcomes in some way (Faulkner & Kaufman, 2017).

2.2.2 Trust and Legitimacy

Trust and legitimacy refer to the extent to which a public sector organisation and its activities are trusted and perceived as legitimate by stakeholders and the public (Faulkner & Kaufman, 2017).

Trust and legitimacy from the public are considered to be important in order for a public sector organisation to reach its objectives (Faulkner & Kaufman, 2017).

2.2.3 Service Delivery Quality

As a public value, service delivery quality refers to the extent to which the services of a public sector organisation are perceived to be delivered in high quality (Faulkner & Kaufman, 2017). It is expected to be maximised when the service delivery is accessible and convenient, and when it is satisfying the needs of the user who interacts with the service (Faulkner & Kaufman, 2017).

2.2.4 Efficiency

In the framework, efficiency refers to the extent to which a public sector organisation is achieving maximal benefits with minimal resources (Faulkner & Kaufman, 2017). This is closely related to the definition of efficiency that we use throughout the thesis, namely the "use of collectively owned assets and associated costs" (Moore, 2013, p.56). Moreover, the work of Moore (2013) is one of the contributions to the concept of public value that the framework builds on (Faulkner & Kaufman, 2017). As a public value, efficiency is expected to be high when the costs are perceived to be outweighed by the benefits and the organisation is perceived to offer value for money. In addition, efficiency is expected to be high when bureaucracy is kept to a minimal level (Faulkner & Kaufman, 2017).

2.3 Activity Based Costing (ABC)

Activity based costing was introduced by Kaplan and Johnson (1987) as a response to the need for a costing tool that considered factors that cause indirect costs and objectively expressed the relationship between products and costs. ABC is designed to correlate costs of activities to products through a two-stage methodology. The methodology is based on the assumption that production costs have originated from the implementation of activities that are performed to produce and sell products. Cooper and Kaplan (1988) argue that the overall strength of ABC is its recognition that consumption of resources in the production process is not entirely correlated to production volume, but instead to activities related to transactions that transpire within the organisation.

The ABC-model was a solution to the problem with inaccurate allocation of overhead costs by tracing the indirect costs of the business to specific orders, products, and customers based on every organisational activity performed (Kaplan & Andersson, 2004). The beneficial contribution of ABC has two dimensions. The first dimension is its consideration of a wide variety of cost drivers and its logical explanation of product costs in companies with a wide range of products and services. The other dimension is that ABC functions as a tool to guide management's decision making by highlighting relevant costs, which makes it possible to decide the real cost of a managerial decision (Moisello, 2007).

The ABC approach does not come without its deficiencies. Kaplan and Andersson (2004) pinpoint issues associated with ABC. The ABC-model is time consuming, and it causes irritation amongst employees, it is resource intensive, it fails to capture the complexity of the actual operations and is not completely accurate. These drawbacks are on a scale that creating and maintaining the ABC-model is a significant barrier to a widespread adoption amongst companies (Kaplan and Andersson, 2004). The amount of time solely spent interviewing and surveying employees to get the required data is not proportional to the benefits that the ABC-model offers. Another problem related to the interviewing part of the ABC approach is the subjective estimation by employees of their total time spent on different activities and the amount of idle time in a certain period (Kaplan and Andersson, 2004). Some companies experienced resistance from within the organisation when implementing the system since the ABC system was expensive to build, hard to modify and complex to sustain. Kaplan and Anderson (2004) concluded that the amount of time and effort the ABC-model required was unproportionable to the benefits it provided in many cases. The outcome was often a deceptive cost calculation of the company's products and services.

2.4 Time Driven Activity Based Costing (TDABC)

Time Driven Activity Based Costing is a refined version of the already widely known ABC-model and was developed by Kaplan and Anderson (2004). They introduced a model to remedy the issues related to the ABC-model. They call it Time Driven Activity Based Costing (TDABC). This refined version of ABC is not only found in the private sector, but scholars have

also applied it to public sectors such as healthcare. The authors argue that the potential for TDABC to increase awareness and understanding of cost drivers and what a certain activity costs is huge. The TDABC system uses time equations that directly and automatically allocates resource cost to the activities performed. This implies that only two parameters need to be estimated, namely the capacity cost rate of the department and the capacity usage by each process in the department (Kaplan & Andersson, 2004). Kaplan and Anderson (2004) highlight important aspects regarding a TDABC application such as obtaining detailed information regarding the processes and the resources that are used in the specific process.

To use TDABC, two parameters need to be estimated. The first estimation is practical capacity, usually calculated as a percentage of theoretical capacity (Kaplan and Anderson, 2004). Kaplan and Anderson (2004) argue that managers would assign approximately 80%, allowing 20% for breaks, training, and communication. The second parameter that needs to be estimated is the duration of time for each unit of activity, which can be obtained through interviews or direct observation (Kaplan & Anderson, 2004).

Several studies have been conducted in the American healthcare sector with TDABC as a methodology to calculate costs (Keel, Savage, Rafiq & Mazzocato, 2017). They found that with TDABC operational improvements in healthcare were achieved by reduction of resource waste, superfluous human resources and non-value adding steps in the process (Keel et al. 2017). Kaplan and Porter (2011) used TDABC to address the problematic situation in American healthcare, where costs were steadily increasing, and the reason why was not completely clear. They argued that there is a complete lack of understanding of how much it costs to deliver patient care and how little is understood about the relationship between costs and the achieved outcomes. Kaplan and Porter (2011) applied TDABC as a seven-step cost measurement process to estimate the total cost of treating patients.

This thesis will use an adapted version of the steps developed by Kaplan and Porter (2011) to make a TDABC analysis on pipe installation works. Each individual step will be explained in the following section and adjusted in order to suit the thesis.

2.4.1 Select the Condition

The first step in Kaplan and Porter's (2011) article is to select the medical condition and identify the associated complications that can affect the process and resources used to treat a patient. A clear beginning and end for the process is also defined in this step. In this thesis, the condition to define is a water pipeline that needs to be replaced or a new water pipeline that needs to be put in place to supply water to a new residential area. There is a wide variety of complications that can arise unexpectedly in a pipe installation work, which makes it a complex process.

2.4.2 Define the Delivery Value Chain

Step two in their article is to define the care delivery value chain, which shows the fundamental activities for a patient's medical treatment and where the activities are located (Kaplan & Porter, 2011). This overview of the entire process is also the starting point of mapping the activities that constitute the process. In this thesis we identify the general steps that needs to be performed in the process of performing a pipe installation work, from the shutdown of traffic to weld the pipe to the final touches before traffic can be allowed on the road section again.

2.4.3 Develop a Process Map

The third step in their process is to develop process maps of each activity in patient care delivery (Kaplan & Porter, 2011). At this step it is time to prepare a detailed process map showing each activity. A process map includes several components such as the path a patient would take through a care cycle and all the capacity-supplying resources such as personnel, equipment and facilities involved in the process. In our case a map that displays every activity, component and capacity-supplying resource associated with pipe installation works will be made.

2.4.4 Obtain Time Estimates for the Process

In the fourth step, time estimates for each process should be obtained. Here Kaplan and Porter (2011) estimates how much time a patient requires from different resources at each step in the process. When a process requires several resources, they estimate the time needed of each one. If a patient should need an additional examination or treatment as a part of the clinical visit, TDABC is well fitted to include the effect of process variation on costs caused by the additional

part (Kaplan & Porter, 2011). To incorporate this step in our thesis, interviews with key personnel that work directly and indirectly with pipe installation works will be held.

2.4.5 Estimate the Cost

In step five, Kaplan and Porter (2011) estimate the costs of supplying patient care resources, which implies that they estimate the direct costs of each resource involved in the caring process of the patients. To get the numerator in order to calculate each resource's capacity cost rate Kaplan and Porter (2011) gathered data regarding direct costs such as employee compensation and other operating expenses from the general ledger, the budgeting system and other IT systems. The cost of the investigated pipe installation work will be obtained through interviews, documents, and reports.

2.4.6 Estimate the Practical Capacity and Calculate the Capacity Cost Rate

Step six is to determine the practical capacity for employees, which will be the denominator in the capacity cost rate equation. It requires three time estimates, which are, the total number of days that each employee works each year, number of working hours per employee per day, and the average time used for breaks, training, education and administrative meetings each day (Kaplan & Porter, 2011). Just as Kaplan and Porter (2011) did, time spent on other activities than pipe installation work will be adjusted for in the equation. This step is generally applicable since the calculation is the same independently of the business.

2.4.7 Calculate the Total Cost

The final step in Kaplan's and Porter's (2011) article is to calculate the total cost of the patient care. In their article they use this step to estimate the aggregated cost of treating a patient by multiplying the capacity cost rates for every resource used in each process by the amount of time the patient spent with the resource (Kaplan & Porter, 2011). This step will in our case be used to calculate an average hourly cost of the pipe installation work.

3. Methodology

The methodological chapter presents the research design of action research, which is followed by a reflection of action research. Then, we describe in what sense this thesis is conducted as a single case study and reflects upon the alternatives. We give further information about the research context consisting of information about the R&D project, the organisations of the project and the pipe installation work of Hällestadsvägen. Next, we describe the process of the thesis and present a timeline of the data process. We provide information about how we have collected data through documents, meetings, and interviews. Finally, we reflect upon our methodology from an overall perspective.

3.1 Research Design - Action Research

This thesis is conducted with an action research approach, which is a research design that intends to contribute to both academic theory and practical action (Argyris, Putnam & Smith, 1985). Action research has been identified as a qualitative research design, but it has its differences from traditional research methods (Bryman & Bell, 2015). There is no single definition of action research, but it is characterised by the action researcher collaborating with a client in the diagnosis of a problem and in the development of a solution (Bryman & Bell, 2015). To what extent the client is involved in the process can, however, be highly varying (Grønhaug & Olson, 1999). The members of the R&D project, who are the clients in our case, have mainly been involved in the problem identification, and in providing material and interviewees. There has, however, been an ongoing dialogue between us and the project members throughout the period of the thesis.

Action research involves an iterative approach in the sense that there is a movement backwards and forwards between gathering information and theoretical reflection in the process of problem identification, planning, action, and evaluation (Argyris, Putnam & Smith, 1985; Bryman & Bell, 2015). Moreover, concerning action research, Grønhaug and Olson (1999) has developed six key characteristics that are presented below, and reveals that action research:

1. Emphasises scientific contributions as well as the solving of real-life practical problems.
2. Focuses on the common values and standards of researchers and clients.
3. Is characterised by an intensive research strategy.
4. Involves collaboration between researchers and clients.
5. Is longitudinal and that knowledge comes gradually.
6. Assumes that researchers need contact and interaction with clients to understand problems and contextual factors.

The characteristics of this thesis fits particularly well with number 1, 3, 4 and 6. The thesis aims to contribute scientifically as well as to the improvement of a practical process and the involvement in the R&D project has meant an intensive research strategy. The work of the thesis has involved collaboration with the project members as well as multiple meetings and interviews in order to understand problems and contextual factors. Concerning number 2, we have had an ongoing dialogue with the project members throughout the period of the thesis. Regarding number 5, we have been actively involved in the R&D project for approximately two months and knowledge has come gradually. As stated in the beginning of the chapter, our process will be described in a separate section.

3.2 Reflection of Action Research

On one hand, an advantage of action research is that its iterative approach and unstructured nature allows the researchers to change direction in their investigation (Bryman & Bell, 2015). This is useful for research in real-life practical situations, which is the case in this thesis.
On the other hand, the connection between theory and research could be ambiguous in action research due to its flexible settings (Bryman & Bell, 2015). This is because, generally in qualitative research methods, and perhaps, specifically in action research, theory is usually an outcome of an investigation rather than something that precedes it. In turn, this makes it more difficult to shape the research strategy as a set of stages (Bryman & Bell, 2015). Accordingly, qualitative research approaches have in general been criticised for being subjective and for presenting pieces of reality instead of making general and objective analyses (Ryen, 2004). Since action research means very specific research settings, this claim could be made for action research as well.

It should be mentioned that action research has been criticised for its lack of repeatability as well as for concentrating too much on organisational action and less on research findings (Bryman & Bell, 2015). Advocates of action research, however, claim that the research method is useful in social sciences like business research, and that the approach provides a richness of insight that cannot be gained in other ways than collaborating with practitioners (Grønhaug & Olson, 1999; Bryman & Bell, 2015). Additionally, action research is claimed to be an advantageous approach in research areas focusing on change and improvements in complex real-life practical problems (Grønhaug & Olson, 1999). Therefore, action research was selected as the most suitable approach for conducting this thesis.

3.3 Single Case Study

A single case approach is a popular and widely used research design in business research, which is characterised by the complexity and particular nature of the case in question (Stake, 1995, referred to in Bryman & Bell, 2015). The emphasis of a single case approach is usually upon intensive examination of the settings within a situation or system (Bryman & Bell, 2015). This thesis is conducted as a single case study in the sense that it is a part of the R&D project and in the sense that we focus particularly on the pipe installation work of Hällestadsvägen, which will be further outlined later in this chapter.

This thesis is well suited for the characteristics of a single case study because it requires deep insight and understanding of a particular process and its contextual factors. As action research means involvement with practitioners it would have been complicated to involve cases from outside the R&D project in our research. However, the main argument for multiple case studies is that it improves theory-building and allows for comparison (Yin, 2009). A potential disadvantage of a multiple-case study is if researchers pay less attention to the specific context and focus more on contrasting between the cases (Dyer & Wilkins, 1991). Since the context of this thesis is very specific, this would have been a potential problem in involving cases from outside the R&D project. Moreover, involving other cases has been rejected due to, to the knowledge of the thesis writers, lack of interest from other organisations performing similar processes. Another approach would have been conducting a multiple case study of pipe

installation works within the R&D project. However, in understanding with the project members we decided that focusing on one case would be the most suitable approach for our thesis considering the limited period.

3.4 Research Context

3.4.1 Safe and Smart Pipe Installation Works

This thesis is a part of the R&D project "Safe and smart pipe installation works", which is a collaboration between VA SYD, Sydvatten, Sweden Water Research and Lund University. Except for the parts of the R&D project that are being carried out by the participating public water organisations, two master theses are part of the project, one from a microbiological perspective, and this thesis, which aims to contribute mainly with a management perspective. The project aims to describe and evaluate rapid methods for monitoring and analysing water quality that are directly linked to specific interventions in establishing new drinking water pipes (Sweden Water Research, 2020). Since the quality of drinking water is regulated, the pipe installation works cannot be finished before the quality of the water has been approved (Swedish Food Agency, LIVSFS 2017:2).

In the current way the quality of the drinking water is analysed by VA SYD and Sydvatten following the legislation by Swedish Food Agency (LIVSFS 2017:2), the water samples are taken downstream from the new pipe and sent to a laboratory for an analysis of the bacteria. With the current method of analysis VA SYD takes two water samples, one sample on the first day and one sample on the second day. Since the most time-consuming analysis takes three days and since both tests have to be approved, it takes up to four days for VA SYD to receive a final result regarding the water quality. Sydvatten uses a different approach regarding the analysis of water quality. Sydvatten also takes two samples one day apart but they wait for seven days until the first samples are analysed. Consequently, in total it takes eight days for Sydvatten to receive a final result from the water analysis. By using more rapid methods and by increasing the understanding of the microbial dynamics in the new water pipes, the goal of the project is to shorten the time during which the quality of the water is uncertain (Sweden Water Research, 2020). In this way, the R&D project aims to contribute to improved pipe installation works.

3.4.2 The Case of Hällestadsvägen

The pipe installation work that was selected by the project manager and assigned to us is called Hällestadsvägen. The reader should know that different kinds of pipe installation works exist. What characterises the pipe installation works of VA SYD and Sydvatten differs because Sydvatten has larger drinking water pipelines leading to the point where VA SYD's distribution network begins. In turn, VA SYD has smaller drinking water pipelines leading out to the consumers in its member municipalities. How pipe installation works are performed within VA SYD can also differ depending on the location and magnitude of the project. Depending on such factors VA SYD can perform the pipe installation work internally or hire an entrepreneur.

The pipe installation work of Hällestadsvägen was performed on VA SYD's drinking water network in a village located in the municipality area of Lund, Skåne county. Due to the characteristics of this project VA SYD choosed to hire an entrepreneur to perform this pipe installation work. The method used to replace the old cast iron pipe was pipe cracking, which is a method that demands a small amount of excavating, which is suitable for urban areas. The pipe section that needed to be replaced was partly located in front of a school with a kitchen serving meals to other municipal activities in the area. The case of Hällestadsvägen was chosen because it was not performed in a city centre nor in a field, but in a village, which is considered as representable.

3.5 Process

The process of this thesis began in January 2021 when we were informed about the R&D project and contacted the project members. The R&D project, which is performed during a longer period than this thesis, had already begun at that point. Before the official period of the thesis began, we had two introductory meetings with the project manager and the project coordinator. In the first meeting, we were briefed about the project, the participating organisations, and the public water sector. In the second meeting, we were given further information about the project and about the process of pipe installation works. Within the R&D project, the use of rapid methods for assessing water quality had been identified as an area for improvements to perform more

efficient and effective pipe installation works. What benefits that would lead to were, however, very uncertain and this was the problem the project members wanted us to investigate.

After the two introductory meetings, we could see different theoretical ways to approach the problem of assessing the benefits of more efficient and effective pipe installation works. To find the most suitable way to approach this was complicated. This was because our previous knowledge about the public water sector was very limited, and due to the complexity of drinking water pipe installation works. In line with action research, this period of the thesis was characterised by an iterative process where we went backward and forward between gathering information and theoretical reflection (Argyris, Putnam & Smith, 1985; Bryman & Bell, 2015). During this phase, we were collecting material and had meetings with the members of the R&D project to get further understanding of the process of pipe installation works.

Eventually, we decided that a TDABC-model would be suitable for assessing the direct costs of pipe installation works, and that the use of a stakeholder model and the concept of public value would be suitable for evaluating more indirect costs and values. This was followed by an intensive phase of meetings and interviews. We had meetings with the project coordinator to get further understanding of water quality in the context of pipe installation works. In addition, we got further understanding of what impacts a reduced time for assessing water quality would have. At some meetings, the project manager from VA SYD was attending as well, and gave us further insight and answered questions. After the meetings, we were occasionally given documents with further information that were of interest to us.

As our understanding of pipe installation works increased and our questions became more and more specific the project manager assigned us with suitable interviewees to answer our questions. After our first interview, it was decided that we would use a specific pipe installation work as a starting point for our analysis and that the project manager would provide us with such a case, the case of Hällestadsvägen. As we started interviewing the analysis process began and we got further understanding of what the benefits of more efficient and effective pipe installation works would be. As action research implies, we had an intensive research strategy (Grønhaug

and Olson, 1999), and this phase was particularly intensive as we had several interviews in a short period of time and reflected upon the new information in between the interviews.

During the first five of our interviews, we were gathering information about pipe installation works from different angles. We interviewed a controller from VA SYD (Interviewee A, see table 1) who contributed with a financial perspective, and a process engineer from Sydvatten (Interviewee B, the drinking water specialist in the R&D project) who gave us further insight in the process of pipe installation works. The remaining three of our first five interviews were about the process of pipe installation works from VA SYD's perspective (Interviewee C, D and E&F). We used the interviews to further deepen our understanding of the process and asked questions in order to analyse what more efficient and effective pipe installation works would lead to.

The sixth interview and the seventh interview were more specifically focused on the case of Hällestadsvägen. In advance of the sixth interview (Interviewee G), which was with a manager from VA SYD with insight in the case of Hällestadsvägen, we had received a lot of information about the case from the project manager. Consequently, at the time of the sixth interview, we were already familiar with the case and used the interview to get further understanding of the material that we had received. Nonetheless, after the sixth interview, we still had some questions about the case and contacted the project leader of the case of Hällestadsvägen who sent us additional information about the case. The seventh interview was with the project leader of the case of Hällestadsvägen (Interviewee H). It was a short interview during which we asked questions about details of the case that we needed to confirm in order to proceed with our analysis. As stated above, the analysis phase began as we started interviewing and continued in between the interviews. After the sixth interview we focused more and more on our analysis, and after the seventh interview we were able to see the full picture of the information that we had gathered.

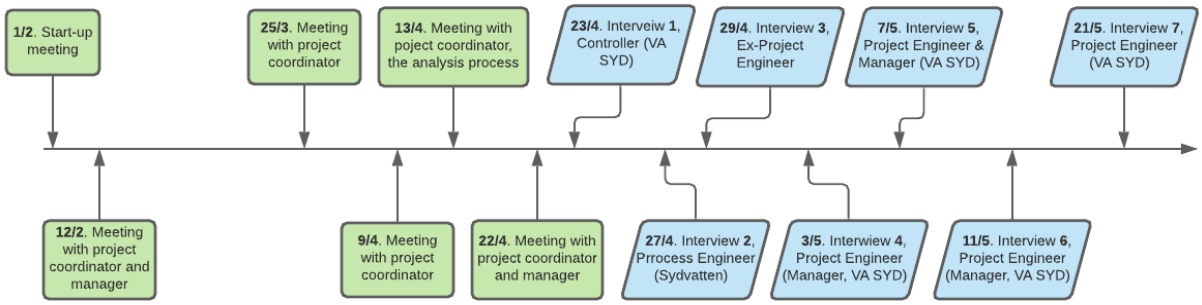

Figure 3: Timeline of the thesis regarding meetings and interviews

3.6 Data Collection

3.6.1 Interviews

To understand the complexity of pipe installation works and the benefits of performing more rapid water quality analysis, several interviews have been conducted. The selection of the interviews was based on the premise that we expressed different categories of questions, and then the project manager selected interviewees with suitable experiences and knowledge. One of the interviewees (Interviewee B) works for Sydvatten, while the other interviewees have experience from VA SYD. Out of the interviewees from VA SYD, one of them (Interviewee C) is no longer working for the organisation. She was interviewed based on her long experience of pipe installation works and on the recommendation of the R&D project manager.

Informed about each interviewee's background and position, we then formulated questions that were sent to the interviewees in advance. In this way, each interviewee was asked suitable and relevant questions, and both the thesis writers and the interviewees were well prepared. Nonetheless, we wanted to have the opportunity of following up on the interviewees' responses to go more into detail when necessary, which is why the interviews were conducted as semi-structured. Semi-structured interviews means that an interview starts with predetermined questions about a specific subject after which the conversation can be extended into further detail and follow-up questions (Bryman & Bell, 2015). The flexibility of semi-structured interviews allowed us to add or withdraw questions based on what seemed to be most important and

relevant to the thesis. Occasionally, when the interviewee was not able to answer our questions during the interview, we were sent additional information afterwards.

Because the thesis writers as well as all interviewees are from Sweden it was natural to conduct the interviews in Swedish. It is our belief that we would have gained less detailed information if the interviews would have been conducted in English. However, there is a risk that some information is lost or explained slightly differently after being translated into English. This is something that we have been aware of and tried to avoid. In addition, if the interviews would have been conducted in English there would have been an increased risk of misunderstandings during the interviews. In line with our guidelines, the interviews have not been transcribed. However, all interviews have been recorded with the approval of the interviewees.

All interviews were conducted as video calls with both thesis writers participating, of which one was taking notes as backup, while the other one focused on the questions. In addition, having both thesis writers participating in the interviews gave us better conditions for following up on the interviewees' answers that were of particular interest to us. Moreover, in some of the interviews the project manager and the project coordinator of the R&D project were participating. In those cases, they were giving the interviewees further overall understanding of the R&D project and occasionally came with valuable inputs and clarifications. There was a risk that the project manager and the project coordinator would lead the discussions of the interviews in the direction of their agenda. However, collaborating with the project members is in line with action research (Grønhaug & Olson, 1999) and the project members did not interfere to any large extent during the interviews. Also, having the project members participating was useful to focus on the most important things during the interviews, which were conducted with limited time.

Interview	Interviewee	Position	Duration	Other Participants
1	A	Controller (VA SYD)	45 Min	
2	B	Process Engineer (Sydvatten)	65 Min	
3	C	Ex-project Engineer (VA SYD)	70 Min	Project Coordinator Project Manager
4	D	Project Engineer (Manager) (VA SYD)	40 Min	
5	E & F	Project Engineer & Manager (VA SYD)	50 Min	Project Manager
6	G	Project Engineer (Manager) (VA SYD)	35 Min	
7	H	Project Engineer (VA SYD)	30 Min	

Table 1: Showing information regarding the interviews

3.6.2 Meetings and Documents

Action research involves collaboration between researchers and clients (Grønhaug, 1999). This has been the case in the process of this thesis as well, and we have had continuous contact with the project coordinator and the project manager throughout the period of the thesis. In total, it has been seven meetings and every meeting has been conducted as a video call. The two meetings that were held before the official period of the thesis began were of introductory character during which we were introduced to the project and the public water sector. We had one meeting with the project coordinator that was more specifically about the process of assessing water quality from the drinking water pipelines. The remaining four meetings functioned as opportunities for us to ask questions about complex parts of the R&D project.

Action research assumes that researchers need contact and interaction with clients in order to understand problems and contextual factors (Grønhaug & Olson, 1999). In line with this, the meetings gave us a lot of valuable insight in the beginning of the period of the thesis. As we got further understanding, however, our questions could not be answered directly from the members of the project. That is why the contact with the project members in the later part of the period of the thesis functioned more as opportunities for us to explain what we needed to know, and then we were assigned with suitable interviewees to answer our questions. Accordingly, the contact was not only important for getting direct insight, but also for accessing further information from interviewees. After some meetings, as well as interviews, we were sent documents with information of relevance in relation to the questions we had asked. In addition, we have searched for relevant documents ourselves. The types of documents were for example from organisations publishing reports about the public water sector, general documents from VA SYD and Sweden Water Research about pipe installation works respectively water quality analysis, and more specific documents about the case of Hällestadsvägen.

3.7 Overall Reflection of Methodology

Conducting a thesis with an action research approach is difficult. As Bryman & Bell (2015) describe, focus can easily be too much on organisational learning, which comes at the expense of the repeatability. Nonetheless, as reflected upon in a previous section, we believe that the benefits of action research outweighed its disadvantages when it comes to this thesis.

We took the opportunity of being part of the R&D project and we collaborated with practitioners. This required an intensive research strategy and that we had to understand the public water sector and complex real-life practical problems, which was very time consuming. This might have affected the extent to which we were able to focus on our methodology as well as theory and other aspects that are more connected to the thesis work than the R&D project. We believe that the choice of being part of the R&D project facilitated a great opportunity for us to get a richness of insight and contribute to both theory and practice that would have been very difficult to do with another methodology in the same period of time. It is our understanding that collaborating with the project members has strengthened our thesis. The project members have proofread the thesis as a whole and validated practical facts.

The fact that we did collaborate with practitioners remains, which is worth reflecting upon from an ethical perspective. Of course, the project members had an agenda with the R&D project, which might have affected our thesis in ways that we are not aware of or do not fully understand. Also, there is a potential risk that we have focused too much on the opportunities and positive aspects in the thesis to satisfy the project members and contribute to the R&D project. Much of our material and insight come from the project members and the interviewees that we were assigned. Moreover, since the project manager assigned us with most of our interviewees there is a potential risk that the interviewees were selected based on the project managers' previous perception of the interviewees' opinions on different matters. This question the reliability of our findings, but it would have been very difficult to select interviewees ourselves and still get the same richness of insight.

The ongoing pandemic has affected our methodology in the sense that we have not met with the project members or observed how a pipe installation work is performed in real life. All of this

has been discussed online. Obviously, we believe that it is possible to have an action research approach anyway since the pandemic began before the period of the thesis. We cannot say exactly how the pandemic has affected our research strategy, but we believe that the opportunities for further alignment with action research would have been possible during normal conditions.

4. Empirical Results

This chapter contains all empirical findings including the application of the seven steps on Hällestadsvägen. The findings will be tied to the different steps and presented in conjunction with each step that requires such information.

4.1 Application of Kaplan and Porter's (2011) Seven Steps

4.1.1 Step 1

This step was partly provided in the project description: "How do we create safe and smart (efficient and effective) installation works on water pipelines? [....] The target is to reduce the amount of drinking water that is lost due to flushing the pipelines and conduct more efficient and effective pipe installation works" (Sweden Water Research, 2021). Further clarification of the different aspects of pipe installation works was acquired through meetings with the project manager and the project coordinator. They both provided much insight in aspects such as which people are involved in the pipe installation works, how the current methods for water analysis works and what the alternatives for faster water analysis are.

The case that was assigned to us, the case of Hällestadsvägen, was performed in Södra Sandby in Lund municipality. The cause for this pipe installation work was due to several leaks on the water pipeline and the project was to replace the water pipeline through pipe cracking and the desired effect was to ensure water distribution to the area without leakages. The project was carried out between the 27th of December 2019 to 24th of April 2020. Associated complications with pipe installation works could for example be contaminated soil, the excavator cutting buried cables and the findings of buried artefacts (Interviewee C). A potential complication for the case of Hällestadsvägen was that the machine that cracks the pipe could get stuck in the old pipe that in this case was made of cast iron (Interviewee G). The reason why the cutting machine can get stuck in the cast iron pipe is due to the pipe consisting of ductile iron, which is tougher than ordinary cast iron (Interviewee G). Interviewee G said that this complication with a stuck cracking machine will result in more excavating and time spent on the actual replacement of the pipeline.

4.1.2 Step 2

Even though each pipe installation work is unique, there are steps that are fundamental for every pipe installation work performed. These general activities that are required to be performed at the majority of all pipe installation works are: closing and redirecting traffic; informing the public; water shut-off; excavating; demolition; pipe replacement; pipe welding; connections; pressure testing; flushing the pipeline; water sampling; water analysis; control of facility; inspection and completion (Interviewee C, E&F and G).

Shutting down and redirecting traffic is done depending on the location of the pipe installation work. Drinking water pipelines are often buried under roads, which makes this step a crucial part of the majority of pipe installation works (Interviewee C, G). Informing the public is always done to ensure minimal disturbance to affected citizens and companies whose business can be affected by the pipe installation works in different ways. Excavating is an inevitable part of every process since all water pipelines are buried in the ground. The conditions in the soil in which the water pipeline is buried determines both the time spent on excavating and the amount of soil that needs to be dug out and removed in order to easily work and install the new pipeline (Interviewee C). The old pipeline needs to be demolished to make room for the new pipe. The pipe replacement is the main act and can be done in different ways depending on the condition of the pipeline being replaced. Pipe cracking is one way of replacing an old or dysfunctional pipe. It is a method that involves excavating to a limited extent since it is only necessary to excavate in the beginning of the pipe section and in the end of the section. This only applies if there are no complications along the section or any connections to properties that need to be done (Interviewee E).

To connect the new pipe to the rest of the existing pipeline, the new pipe needs to be welded on at the start of the section and at the end. This is a process that is done independently of the conditions on the pipe installation work (Interviewee C). When the pipe is welded on the existing pipeline it needs to be pressure tested with a pressure of 13 Bar for it to withstand the pressure from the water with margin (Interviewee G). The following step is to flush the new section of the pipeline to get rid of potential dirt and filth that may accidentally have entered the pipeline during the installation work. To ensure that the water flowing in the new pipe is worthy to serve

as drinking water, two water samples are taken 24 hours apart and are sent to a laboratory where potential bacteria from the water sample is analysed. The water samples are then analysed through counting the colonies that the bacteria have formed (meeting with project coordinator). The final step is to finalise the pipe installation work and let traffic through the road section that was cordoned off. An important aspect that shall not be ignored is that the complexity within each project varies and the predictability of the amount of work that a certain project requires can be rather low.

4.1.3 Step 3

The general steps that characterise the majority of pipe installation works are displayed in the top section of the process map. The lower section displays the steps that were done in addition to the steps illustrated in the top section of the process map in the case project. This process map displays all the activities related to Hällestadsvägen. All the respondents in the interviews related to the actual realisation of the pipe installation works emphasised the variations in complexity of each individual project. VA SYD produced a quantity list where they described each step that needed to be performed by the entrepreneur in the case of Hällestadsvägen. This list together with the information acquired during the interviews constitutes the process map.

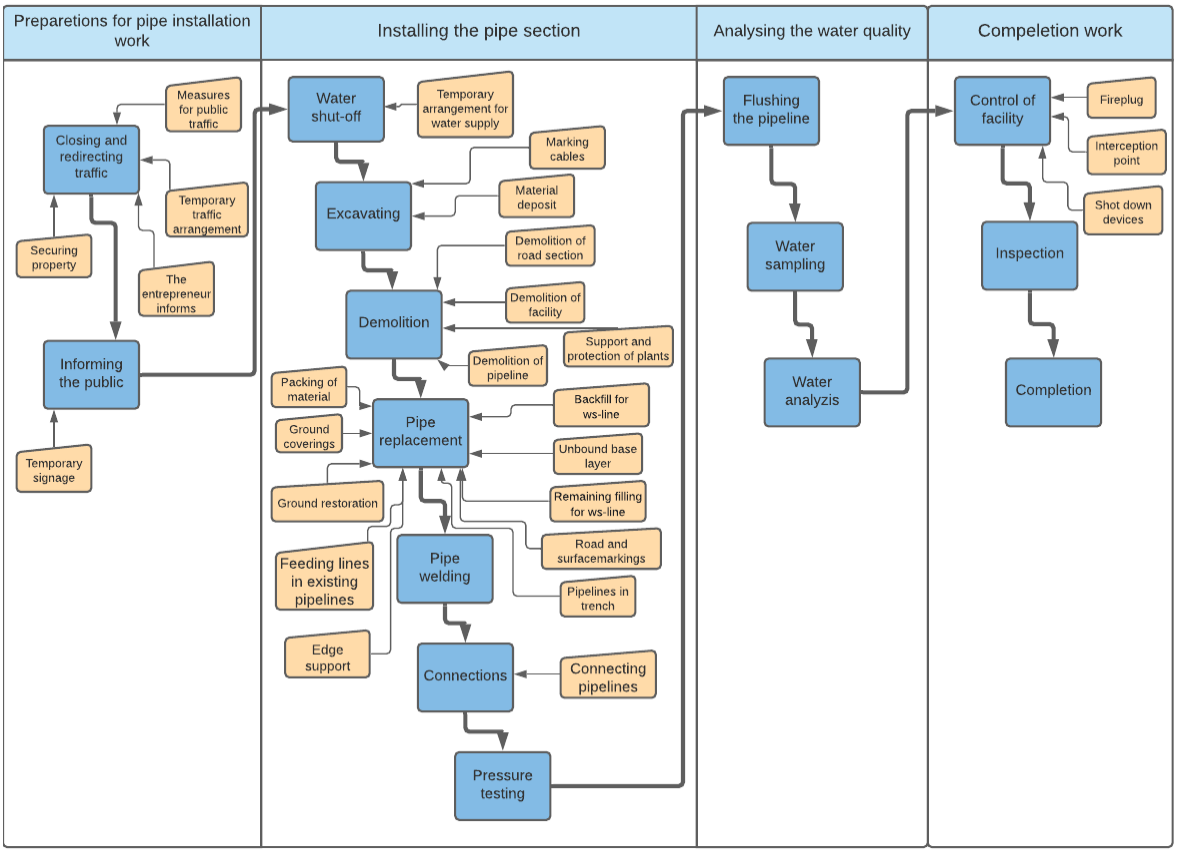

Figure 4: The process map of the case of Hällestadsvägen

Blue square = General activity in pipe installation work

Orange square = Activity typical for the case of Hällestadsvägen

4.1.4 Step 4

The fourth step is the time estimation for each step in the process. The project leader of Hällestadsvägen could unfortunately not provide us with the exact time spent on each activity in the pipe installation work. He was however able to provide the total amount of time spent on the project. This was expected and as Kaplan and Porter (2011) estimated time we did a time estimation of the distribution of the total time spent among the activities. The pipe installation work of Hällestadsvägen began on the 27 of December 2019 and ended 24 of April 2020, which is approximately 84 workdays (Interviewee H). The practical capacity is divided by the number of activities related to the pipe installation work and we assume that every sub activity takes the

same amount of time to perform. The time estimation for each step and activity in the process are illustrated in the process map (Figure 4).

4.1.5 Step 5

The data regarding the estimation of the total cost was provided by the project leader of Hällestadsvägen (Interviewee H). This provided us with the details we needed regarding the total cost for the project. The costs were distributed as follows:

Type of cost	Amount in SEK
Entrepreneurial work	3 778 027
Consulting services	123 551
Water quality analysis	29 520
Internally distributed time	265 500
Total cost	4 196 598

Table 2: A summary table over the total cost of the case of Hällestadsvägen

When a pipe installation work is planned a detailed quantity list of tasks that the entrepreneur needs to perform is provided by VA SYD. Several entrepreneurs give in turn an offer on the stated tasks on the quantity list and then the entrepreneur that fulfils all requirements regarding experience, availability, qualifications, and that gives the most favourable offer wins the contract (interviewee G).

The cost for the entrepreneur is a substantial amount of the total cost of the pipe installation work and it differs substantially from the original offer (1 735 211 SEK), which was offered by the entrepreneur before the start of the project (Interviewee H). Interviewee H explained that the large difference from the original offer and the final cost for entrepreneurial work is due to additional pipeline work and the frequent readjustment of the traffic barriers during the project. The traffic barriers needed to be frequently moved since the Hällestadsvägen project was

performed in front of a school with a kitchen that cooked meals for other municipal activities. That resulted in more work than initially planned regarding the traffic barriers since traffic needed to pass through to the school and kitchen (Interviewee H).

4.1.6 Step 6

The estimation of practical capacity of the workers on the pipe installation work requires three time estimates, which is the number of workdays during the pipe installation work, the working hours and the amount of time spent on breaks, training, education, and administrative meetings. The number of workdays is approximately 84 from the 27th of December 2019 to the 24th of April 2020. The working hours are set by VA SYD (weekdays from 7 am to 3:30 pm), which is an eight hours and 30 minutes workday and is prescribed in a document by VA SYD (VA SYD, 2020. See appendix). The amount of time spent on education and administrative meetings are approximately 16 hours during the whole pipe installation work (Interviewee H). The time spent on breaks is estimated to be 45 minutes per workday, 30 minutes are normally dedicated for lunch and the additional 15 minutes are assigned for breaks. This adds up to $84 * (8{,}5 - 0{,}75) - 16 = \mathbf{635}$ hours spent on pipe installation work during the project.

4.1.7 Step 7

This step is where we calculate the total cost of a pipe installation work. The data for this step is mainly provided by the project leader of Hällestadsvägen. However, the scope of the thesis stretches further than just the costs for VA SYD but also the costs for society that is affected by the pipe installation work and those costs should make their way into this TDABC-model as well. The capacity cost rate of the case project is $4\,196\,598/635 = 6\,609$ SEK per hour. This cost per hour reflects every activity that has been performed to complete the pipe installation work. The value of this information is to know how much money VA SYD potentially can save due to a more rapid method of analysing water quality.

4.2 The Results of the TDABC-model

The TDABC-model provides us with an average hourly cost of the entire pipe installation work. This cost can be used to illustrate the potential savings to be made if a new faster method for water analysis is implemented. An estimated calculation for the potential savings that could have been made in the case of Hällestadsvägen if a new more rapid method to analyse the water quality had been used are as follows: the current number of working hours it takes to receive the results from the water analysis is $4\ days * 7{,}75h = 31h$. The approximated cost of this water analysis in the case of Hällestadsvägen is: $31 * 6\ 609 = 204\ 879\ SEK$.The cost for the new method to analyse water samples would have been: $(1\ day * 7{,}75) * 6\ 609 = 51\ 219{,}75\ SEK$.If the new method had been used for water analysis in the case of Hällestadsvägen, VA SYD would have saved: $204\ 879\ - 51\ 219{,}75 = 153\ 659$ SEK, which in turn is 3,66% of the total costs of the Hällestadsvägen.

4.3 General Empirical Results

The main aspect of the R&D project "Safe and smart pipe installation works" was that shorter time spent on water analysis was expected to result in cost savings. For example, more pipe installation works could be done in a year since a pipe installation work with a more rapid method to analyse the water quality would make each pipe installation work take less time to complete. A question related to this conception was asked to one of the respondents and the answer was a clear "No!" (interviewee C). The interviewee argued that the amount of time that can be saved due to a more rapid method of analysing water samples is not that significant in relation to the entire time spent on a whole pipe installation work. With that said more pipe installation projects cannot be conducted in a year due to a more rapid method to analyse water quality (interviewee C).

One interesting aspect that Interviewee H mentioned is that the entrepreneur is preoccupied with different tasks regarding the finalisation of a pipe installation work when the response from the water analysis is awaited. Another interviewee (C) said that they usually took the water samples late in the week so that the bacteria could grow during the weekend and the entrepreneur did not have to stand and wait for the response from the laboratory.

All the respondents that were involved in pipe installation works said that a more rapid method would be beneficial in multiple aspects such as traffic can be allowed on the road section earlier, and in case the quality being not approved the entrepreneur can act earlier to address the cause of the water contamination. The cost of flushed water and the cost of analysing additional water samples when the water quality of the first two samples is not approved is assigned to the entrepreneur, which means it does not affect the total cost of the project for VA SYD (Interviewee G). The entrepreneur would certainly appreciate a more rapid method to analyse the water samples since it allows the entrepreneur to move onto the next project quicker and if water samples are not approved, they avoid costs related to multiple days of flushing the pipe section (Interviewee G).

5. Discussion and Analysis

In the first three sections of this chapter a discussion will be held that is closely related to the empirical results of this thesis. The final section broadens the discussion and applies a more critical perspective to discuss contribution and further research.

5.1 Application of the TDABC-model

The TDABC-model has as can be seen in Keel et al. (2017) seen its fair share of practice in the healthcare sector, which is classified in this thesis to perform delicate processes. To our knowledge it has never previously been applied to an organisation in the public water sector, which is classified in this thesis as a performer of robust processes. The TDABC-model's potential contribution to make pipe installation works more efficient and its versatility as a cost calculating tool has been tested as a result of this thesis. One might think that applying the TDABC-model to a robust sector as public water sector and pipe installation works is a far-fetched attempt to apply a model normally applied to the delicate sector of healthcare (Keel et al. 2017). Why not test and bend the boundaries of existing models and conceptions. There are undoubtedly differences between the two sectors of application, but we argue that the TDABC-model is applicable on more public sectors than just healthcare.

The result that was provided from the application of the TDABC-model is fair measurement of the average hourly cost of the pipe installation work in the case of Hällestadsvägen. The hourly cost varies during an entire pipe installation work, but our estimation gives a fair average hourly cost that can be used to estimate the potential cost savings that could be made from using a more rapid method to analyse water quality. Although there are some uncertainties regarding the accuracy of the result provided by the TDABC-model since the conditions differ in several aspects compared to the seven-step TDABC-application by Kaplan and Porter (2011). Although we feel confident that this result regarding the average hourly cost of the pipe installation work is a good indication of how much money that can be saved if a more rapid method to analyse water quality was implemented in the case of Hällestadsvägen.

There are aspects of our result regarding the amount of money that can be saved that can be questioned. One might argue that the entrepreneur does not stand idle during the time the analysis response is awaited, which implies that a more rapid method to analyse the water quality does not save any significant amount of money regarding the entrepreneurial work. But one might also argue that if the entrepreneur can plan their work for a more rapid water analysis the total amount of time spent on the pipe installation work could be shortened. The entrepreneur should then be able to plan its work according to a more rapid method for water quality analysis. Less working hours should result in a lower cost for the entrepreneur's work with the new method for water quality analysis.

Although we have tried our best to collect as reliable data as possible there are several areas of improvement in our TDABC application that could enhance the accuracy of the cost calculations. Precise data regarding the time estimation of the activities in the process is a crucial part in both Kaplan and Anderson's (2004) and Kaplan and Porter's (2011) articles. Such precise time estimations could have been obtained if we could have been present during the case of Hällestadsvägen. We were not able to measure the time of every activity in the case of Hällestadsvägen since it was completed before the start of the master thesis. It was neither possible given the time horizon to attend a pipe installation work to measure the time for each activity performed in such a project. One of the respondents suggested that a VA SYD employee could measure the time of the activities performed in an upcoming pipe installation work to provide us with the exact data. Even though it was very thoughtful and in line with the articles from Kaplan and Anderson (2004) and Kaplan and Porter (2011) it could not realistically be done, due to the time limit of the thesis.

5.2 Affected Stakeholders

We are confident to say that all stakeholders would benefit from a more rapid water quality analysis cutting the overall time for the pipe installation work. The owners or more accurately, the member municipalities of VA SYD, have an interest in providing public service at a low cost and with as little disturbance in the supply of the service as possible. The TDABC-model has shown that there are costs that can be saved due to a more rapid method of analysing the water quality. A new more rapid method would also reduce the overall downtime for society in the specific location caused by the pipe installation work. These attributes of a more rapid method would be of interest to the member municipalities of VA SYD.

The stakeholders that fall in the owner category, which are the member municipalities, have a close link to the government. The government's interference with the public water sector is mainly to ensure that the water delivered to customers is up to quality standards set by the government. They also have an interest to ensure that citizens that are customers to VA SYD and Sydvatten get access to affordable drinking water that is sustainably supplied. The objectives of the R&D project are much in line with the political agenda that is setting the guidelines for both VA SYD and Sydvatten.

Since VA SYD is financed by user fees, it is their customers that in the end pay the bill for pipe installation works. The cost of water is of interest to keep at a low level so that everyone in society can afford clean drinking water. If a more rapid method to analyse water quality is implemented and the potential cost savings provided from the TDABC-model are correct, the new analysis would contribute to a lower or maintained water fee as VA SYD conducts more efficient pipe installation works. As Freeman (1984) emphasises, it is also important for customers to perceive the organisation and in this case VA SYD as an innovative organisation that takes advantage of the technological progress in society to deliver a better service that is sustainable and with less environmental impact.

The values of employees have, as Freeman (1984) pinpoints, changed over time and one area of greater interest to employees is sustainability. For VA SYD and Sydvatten to continue to attract desirable competencies they have to address areas of their business that are not sustainable and

where they are lagging behind. Employees need to feel that their work is meaningful and that they are a part of an organisation that is in the forefront of sustainable development. It is therefore crucial that VA SYD and Sydvatten continue to explore the possibilities to improve their business to provide a better public service. One area of improvement regarding sustainability is the quality analysis of the drinking water. The up to four-day long water analysis where clean drinking water is flushed down the drain is of particular interest. If VA SYD and Sydvatten can make such an improvement where clean drinking water and money can be saved, then they would be a more attractive employer to future employees.

As Freeman (1984) argues, the environmental impact of organisations has attracted increased attention and become a major issue. The environmental aspect of sustainability is deeply rooted in VA SYD's objectives. But how do stakeholders such as customers and environmentalists perceive VA SYD when large amounts of clean drinking water is flushed out for example in the heat and drought of summer when there is an irrigation prohibition. A more rapid method to analyse the water quality will help VA SYD to protect their reputation as a sustainable organisation that acts for a more sustainable society. Another benefit from a more rapid analysis is that suppliers to VA SYD and Sydvatten, mainly the entrepreneur that works on the pipe installation can charge less for a pipe installation work since the whole installation process takes a shorter amount of time. This is at least a possible outcome since we have not in reality observed what exactly goes on during the time that the water quality analysis is conducted. One thing worth mentioning is that several of the interviewees said that the entrepreneur would appreciate it if the pipe installation work took a shorter amount of time so that they can move on to a new project quicker. As Krause et al. (2009, p. 18) expressed the environmental aspect of the business-supplier relationship, "a company is no more sustainable than the suppliers that are selected by the company". Therefore, it is important that VA SYD and Sydvatten come to the conclusion that a more rapid method to analyse water quality is beneficial to both organisations, since Sydvatten is the supplier of drinking water to VA SYD.

To conclude the discussion from a stakeholder perspective, the stakeholders from Freeman (1984) that are identified in this thesis would benefit from a more rapid method to analyse the water quality when conducting pipe installation works. The new method is more sustainable and

efficient in the sense that it saves water, money, and time, which are all valued by the stakeholders identified in this thesis.

5.3 Public Value

Based on our empirical findings, and the general knowledge and understanding that we have gained during the period of the thesis, this section discusses how efficient and effective pipe installation works can increase public value. In order to answer our second research question, we use Moore's (1995) definitions of efficiency and effectiveness, and the four dimensions of public value identified by Faulkner and Kaufman (2017).

5.3.1 Outcome Achievement

For the public value of outcome achievement (Faulkner and Kaufman, 2017), we identify the social-, economic- and environmental outcomes as relevant aspects where more efficient and effective pipe installation works can increase public value.

The social outcomes (Faulkner and Kaufman, 2017) are concerned with the efficiency and effectiveness of pipe installation works in some ways. In the case of Hällestadsvägen, the pipe installation work required the road to be closed and the traffic to be redirected. This meant that everyone who wanted to access the school, its kitchen, or anything else on the road affected by the pipe installation work, had to take another route. Although this did not lead to any big delays in the case of Hällestadsvägen, the public should value if the road section could have been opened a few days earlier. It is our understanding that a more rapid method for analysing drinking water in some cases would mean a slightly shorter period of redirected traffic. The time, extent and consequences of redirected traffic varies depending on the pipe installation work. Consequently, to what extent the public will value this social outcome will vary too. Except for traffic, people living nearby the pipe installation work would value it if it could be finished slightly faster.

Similar to the social outcomes, there would be economic outcomes of more efficient and effective pipe installation works (Faulkner and Kaufman, 2017). In the case of Hällestadsvägen, the consequences of redirected traffic were just a disturbance and did not have any known

economic impacts on the public. However, for a pipe installation work in for example a city centre the economic impacts would be of significance. Of course, this is difficult to measure, but we can identify some economic aspects that would be expected to affect the public. Closed roads in a city centre could lead to delays of public communications as well as for individuals. Such delays could have an impact on productivity for individuals as well as for companies, which would have economic consequences. In addition, limited access due to pipe installation works could lead to reduced incomes for different types of businesses such as stores and clinics. In such cases, there would be an economically valued outcome to the public of more efficient and effective pipe installation works.

The main environmental outcome that can be improved and which is relevant for all pipe installation works has to do with the flushing of drinking water (Faulkner and Kaufman, 2017). Not only is the produced drinking water flushed out, but it also has to be replaced, which means that more water has to be produced for consumption. A more rapid method for analysing the water would mean a reduced time of water flushing, which would result in a reduction of wasted drinking water. Of course, this improved outcome would not only be environmentally valued, but also economically valued. This is because the drinking water has an economic value and is paid for through user fees, which is why the public would value it if less water were being wasted. Moreover, produced drinking water that is flushed out cannot be used by a consumer. Water restrictions are rare but occurring in Sweden, and if water is flushed out during such conditions it would affect the availability of drinking water for the consumer to some extent. This is not likely of any significance, but it could have some impact in an extreme scenario or in a future where water scarcity becomes a larger issue in Skåne. Another aspect is that if traffic is redirected to a longer route during a slightly shorter period, there might be some reduction of emissions by vehicles, which should be environmentally valued by the public.

5.3.2 Trust and Legitimacy

Compared to outcome achievement, the public value of trust and legitimacy is less relevant for the process of pipe installation works (Faulkner and Kaufman, 2017). Of course, trust and legitimacy in public sector organisations are important, but it is more difficult to see how more efficient and effective pipe installation works would increase this public value. However, one

aspect could be that if less drinking water is flushed out due to more rapid methods of analysing the quality of the water, individuals of the public might feel less disturbed that clean drinking water is flushed down the drain. This could have some impact on the perceived legitimacy of the activities of organisations such as VA SYD and Sydvatten, and consequently to some extent improve the public value of trust and legitimacy.

5.3.3 Service Delivery Quality

More efficient and effective pipe installation works will not improve the public value of service delivery quality in any direct way (Faulkner and Kaufman, 2017). This is because the quality of the product, the drinking water, is regulated by the Swedish Food Agency (LIVSFS 2017:2) and if the water does not meet certain requirements, it should never reach the consumer. Consequently, more efficient and effective pipe installation works will not improve the quality of the drinking water that reaches the consumer. Taking a broader view of service delivery quality, other aspects can be considered. Then service delivery is closely related to social and economic outcomes meaning that the consumer must accept that pipe installation works come with some disturbance in order for the service of drinking water to be delivered in the long run. In this sense, the service delivery quality can be improved by more efficient and effective pipe installation works.

5.3.4 Efficiency

As discussed in the previous sections, more efficient and effective pipe installation works can improve public value in different ways (Faulkner and Kaufman, 2017). That is why this section focuses solely on efficiency and takes a narrower perspective of efficiency related to pipe installation works. Because the public sector organisations that provide drinking water are financed by user fees the consumers of drinking water should be concerned with the efficiency of pipe installation works. To what extent more rapid methods of analysing drinking water quality would lead to more efficient pipe installation works did not become clear during our interviews. This is a very complex question, but our understanding is that, depending on the conditions, some pipe installation works would need less resources with a more rapid analysis method. Furthermore, our understanding is that this is very difficult to measure in advance due to the complexity of pipe installation works. Hence, the efficiency of pipe installation works is likely to

increase with a more rapid analysis method, but to what extent remains to be seen after its implementation. If pipe installation works can be performed with less resources, it would be an argument for lowering the user fee for drinking water. In that way, more efficient pipe installation works would create public value because the public sector organisations providing drinking water would be able to perform the same service with the use of less resources.

5.4 Contribution, Reflection and Further Research

Throughout the period of the thesis, we have learned a lot about the public water sector and pipe installation works. Also, we have learned that pipe installation works are very complex processes which is why our TDABC-model is not as precise as we thought it would be. Exact time measurements for every activity from multiple different pipe installation works would be obtained in an ideal setting. Due to the time limit of the thesis this was not possible and Hällestadsvägen was the case most suitable for our thesis.

With this thesis we have contributed to the existing literature by testing the versatility of the TDABC-model that hopefully will inspire others to apply it on organisations in different sectors and branches that are at the moment not typically associated with TDABC. An aspect that would have made our results more generalisable, not only to other pipe installation works but also to other public sector organisations, is if we had conducted a TDABC application on multiple pipe installation works. Then the results would have been more reliable since it better reflects the complexity of different pipe installation work and the approach can be used for processes in other public sector organisations with a more reliable result.

Although the generalisability of our result regarding the amount of money that potentially could have been saved is very low for other pipe installation works and public services organisations, the course of action and the application of the TDABC-model is to a high extent generalisable. We argue that the TDABC-model is applicable to multiple other public sector organisations both robust and delicate that have any degree of complexity in their processes. Kaplan and Porter (2011) clearly showed that a TDABC-model is applicable to delicate sectors such as healthcare and we argue that our thesis shows that an application of the TDABC-model is also applicable to robust processes such as pipe installation works.

We recognise that the TDABC-model has great potential to make public sector organisations more efficient, especially organisations in the public water sector conducting pipe installation works. For further research we advise researchers to get good access to the organisation that is investigated and above all get very good access to the process that the TDABC-model is to be applied to. Another useful advice for future researchers should be to choose a process that corresponds to their time limit so that every step in the article by Kaplan and Porter (2011) can be done as precisely as possible.

Regarding public value, we add practical knowledge to the public water sector by identifying several dimensions of public value that have the potential of being increased by more efficient and effective pipe installation works (Faulkner and Kaufman, 2017). We believe that more efficient and effective pipe installation works have the potential of increasing different aspects of public value, but there are limitations that make it difficult to measure the value based on existing frameworks and measurements. Accordingly, we find it difficult to be explicit about to what extent more efficient and effective pipe installation works can increase public value. Furthermore, as this thesis was conducted with an action research approach, we investigated a real-life practical situation and analysed the potential of improving the process. Consequently, the effects remain to be seen and one of our limitations is that we can only give suggestions on how we believe that more efficient and effective pipe installation works would increase public value.

In relation to existing literature and research of public value, we give a contribution from the public water sector and the process of pipe installation works that supports existing knowledge of public value (Moore, 1995; Talbot & Wiggan, 2010). Based on the several dimensions of public value that we identified as concerned with pipe installation works (Faulkner and Kaufman, 2017), our thesis contributes to the understanding that focusing on public value is relevant in the public water sector. Our thesis contributes to Moore's (1995) argument that measuring public value has great potential, and to Talbot and Wiggan's (2010) argument that it is difficult to measure accurately. We agree with Moore (1995) that trying to measure public value can help a public sector organisation in focusing on what public value it wants to create, which has the

potential of improving performance. Accordingly, we believe that focus on increasing public value has a role to play in measuring the performance of public sector organisations on a broader level.

Because our findings suggest that measuring public value is difficult but of great potential, we believe that public sector organisations would benefit from somehow implementing focus on public value in their organisations. To analyse how public value can be increased, we used the framework of Faulkner and Kaufman (2017), which we believe was the most suitable framework for answering our research question. As discussed, some of its characteristics were not that applicable to the process of pipe installation works and it rather supplied dimensions of public value than concrete measurement tools. Our findings do not contradict existing theory, but we believe that further theoretical development of the concept of public value would make it more concrete and adaptable. This is something we believe would increase the potential benefits of the concept in public sector organisations. To make public value more adaptable, we agree with Faulkner and Kaufman (2017), and believe that further development of frameworks and measurements are needed. Also, since public value is a broad concept, we believe that it would be interesting for future researchers to develop frameworks and measurements that are more specifically created to fit with the characteristics of the public water sector or other public sectors. In addition, an interesting topic for further research would be to investigate how focusing on public value can be implemented in public sector organisations.

6. Conclusion

To fulfil the purpose of this thesis, the three theoretical perspectives, TDABC, the stakeholder theory and public value have been our foundation to investigate and analyse how the processes of public sector organisations can become more efficient and effective.

1: Can a TDABC-model contribute to more efficient pipe installation works?
Our investigation and analysis of the pipe installation works indicate that TDABC can contribute to make pipe installation works more efficient. We believe that the TDABC-model is a suitable tool to make pipe installation works more efficient since it highlights both the total cost and the capacity cost rate of the process. This type of information will hopefully make VA SYD and Sydvatten more aware of where costs can be saved such as reducing the time spent on water analysis.

2: How can more efficient and effective pipe installation works benefit stakeholders and increase public value?
On one hand, more efficient and effective pipe installation works have the potential to benefit stakeholders and increase several dimensions of public value. On the other hand, the benefits are difficult to measure, and the effects of more efficient and effective pipe installation works remain to be seen.

In conclusion, we believe that the TDABC-model can be used to a larger extent in public sector organisations performing robust processes to solve practical problems and make processes more efficient. However, to benefit from the full potential of the model more detailed and comprehensive information needs to be acquired. Finally, we believe that our analysis shows the importance of taking the perspective of stakeholders, and the creation of public value, into account to make the processes of public sector organisations more efficient and effective.

References

Argyris, C., Putnam, R., & Smith, D. M. (1985). Action Science: Concepts, Methods and Skills for Research and Intervention, San Francisco, Jossey-Bass

Bryman, A., & Bell, E. (2015). Business Research Methods, 4th edn, Oxford: Oxford University Press

Cooper, R. and Kaplan, R.S. (1988). Measure Costs Right: Make the Right Decision, *Harvard Business Review*, vol. 66, 96-103. Available online: https://hbr.org/1988/09/measure-costs-right-make-the-right-decisions [Accessed 23 April 2021]

Dyer, W. G., & Wilkins, A. (1991). Better Stories, Not Better Constructs, to Generate Better Theory: A Rejoinder to Eisenhardt, *The Academy of Management Review*, [e-journal] vol. 16, no. 3, Available through: LUSEM Library website http://www.lusem.lu.se/library [Accessed 20 April 2021]

Faulkner, N., & Kaufman, S. (2017). Avoiding Theoretical Stagnation: A Systematic Review and Framework for Measuring Public Value, *Australian Journal of Public Administration*, [e-journal] vol. 77, no. 1, Available through: LUSEM Library website http://www.lusem.lu.se/library [Accessed 9 May 2021]

Freeman, R. E. (1984). Strategic Management: A Stakeholder Approach, Cambridge: Cambridge University Press 2010

Grønhaug, K., & Olson, O. (1999). Action Research and Knowledge Creation: Merits and Challenges, *Qualitative Market Research: An International Journal*, [e-journal] vol. 2, no. 1, Available through: LUSEM Library website http://www.lusem.lu.se/library [Accessed 13 April 2021]

Hood, C. (1991). A public management for all seasons? *Public Administration*, [e-journal] vol. 69, no. 1, Available through: LUSEM Library website http://www.lusem.lu.se/library [Accessed 12 May 2021]

Kaplan, R. S., & Anderson, S. R. (2004). Time-Driven Activity-Based Costing, *Harvard Business Review*, vol. 82, Issue 11, pp. 131-138, Available through: LUSEM Library website http://www.lusem.lu.se/library [Accessed 16 April 2021]

Kaplan, R.S., & Johnson, H. T. (1987). Relevance Lost: The Rise and Fall of Management Accounting, Boston: Harvard Business School Press, Available through: LUSEM Library website http://www.lusem.lu.se/library [Accessed 16 April 2021]

Kaplan, R. S., & Porter, M. E. (2011). The Big Idea: How to Solve the Cost Crisis in Health Care, *Harvard Business Review*, vol. 89, Issue 9, pp. 46-64, Available through: LUSEM Library website http://www.lusem.lu.se/library [Accessed 18 April 2021]

Keel, G., Savage, C., Rafiq, M., & Mazzocato, P. (2017). Time-driven activity based costing in healthcare: a systematic review of the literature, *Health Policy*, 121(7), pp. 755-763, Available through: LUSEM Library website http://www.lusem.lu.se/library [Accessed 20 April 2021]

Krause, D. R., Vachon, S., & Klassen, R. D. (2009). Special topic forum on sustainable supply chain management: Introduction and reflection on the role of purchasing management, *Journal of Supply Chain Management*, vol. 45, pp. 18-25, Available through: LUSEM Library website http://www.lusem.lu.se/library [Accessed 23 April 2021]

Leisink, P., Andersen, L. B., Brewer, G. A., Jacobsen, C. B., Knies, E. & Vandenabeele, W. (2021). Managing for Public Service Performance: How People and Values Make a Difference, [e-book] Oxford: Oxford University Press. Available through: https://oxford-universitypressscholarship-com.ludwig.lub.lu.se/view/10.1093/oso/9780192893420.001.0001/oso-9780192893420-chapter-2 [Accessed 10 May 2021]

Luzzini, D., Caniato, F., & Spina, G. (2014). Designing vendor evaluation systems: An empirical analysis, *Journal of Purchasing and Supply Management*, vol. 20, pp. 113-129, Available through: LUSEM Library website http://www.lusem.lu.se/library [Accessed 23 April 2021]

Malm, A., Axell, L., Svensson, G. & Röstum, J. (2019). Vattenförluster från ledningsnätet - beräkningsverktyg för en hållbar nivå [pdf] Publisher: Svenskt Vatten, Available at: https://www.svensktvatten.se/contentassets/98c701a70b044894b3a43f4c9cece908/svurt-19-17a.pdf [Accessed 20 April 2021]

Moisello A. M. (2007). ABC and EVA for decision making, *The International Journal of Knowledge, Culture and Change Management*, vol. 7, No 4, pp. 51–58, Available online: https://www.researchgate.net/publication/307763895_ABC_and_EVA_for_Decision_Making [Accessed 23 April 2021]

Moore, M. H. (1995). Creating Public Value: Strategic Management in Government, Cambridge, Mass.: Harvard University Press

Moore, M. H. (2013). Recognizing Public value, Cambridge, Mass.: Harvard University Press

Ryen, A. (2004). Kvalitativ intervju: Från vetenskapsteori till fältstudier, Malmö: Liber AB

Svenskt Vatten. (2020a). Hållbarhetsindex för kommunernas VA-verksamhet [pdf], Available at: https://www.svensktvatten.se/globalassets/organisation-och-juridik/vass/hallbarhetsindex/hallbarhetsindex_beskrivning_verktyget_2020.pdf [Accessed 28 April 2021]

Svenskt Vatten. (2020b). Resultatrapport för VASS-drift 2019 [pdf], Available at: https://www.svensktvatten.se/globalassets/organisation-och-juridik/vass/drift/2020-03-sv-resultatrapport-vass-drift2019.pdf [Accessed 10 May 2021]

Svenskt Vatten. (2021). VA-taxa. Available online: https://www.svensktvatten.se/vattentjanster/organisation-och-juridik/va-taxa/ [Accessed 10 May 2021]

Sweden Water Research (2020). Safe and smart pipe installation works, Available Online: https://www.swedenwaterresearch.se/en/projekt/safe-and-smart-pipe-installation-works/ [Accessed 10 April 2021]

Sweden Water Research. (2021). About Sweden Water Research, Available Online: http://www.swedenwaterresearch.se/en/about-sweden-water-research-2/ [Accessed 25 April 2021]

Swedish Food Agency. (LIVSFS 2017:2). Livsmedelsverkets föreskrifter om ändring i Livsmedelsverkets föreskrifter (SLVFS 2001:30) om dricksvatten. Uppsala: Swedish Food Agency

Sydvatten. (2020a). Delägarkommuner, Available Online: https://sydvatten.se/om-sydvatten/delagarkommuner/ [Accessed 25 April 2021]

Sydvatten. (2020b). Uppdrag, Available Online: https://sydvatten.se/om-sydvatten/vart-uppdrag/ [Accessed 25 April 2021]

Sydvatten (2021). Årsredovisning 2020 [pdf], Available at: https://sydvatten.se/app/uploads/2021/04/Arsredovisning_2020_Sydvatten.pdf [Accessed 25 April 2021]

Talbot, C. & Wiggan, J. (2010). The public value of the National Audit Office, *International Journal of Public Sector Management*, [e-journal] vol. 23, no. 1, Available through: LUSEM Library website http://www.lusem.lu.se/library [Accessed 12 May 2021]

VA SYD (2020). Utvärdering av ny rutin för nyanläggningar [pdf]. [Accessed 27 April 2021]

VA SYD. (2021a). Politisk organisation, Available Online: https://www.vasyd.se/Artiklar/Om-oss/Politisk-organisation [Accessed 25 April 2021]

VA SYD. (2021b). Om oss, Available Online: https://www.vasyd.se/Artiklar/Om-oss?utm_campaign=Branding&utm_source=google&utm_medium=ppc&utm_term=va%20syd&utm_content=3198740xCj0KCQjw4cOEBhDMARIsAA3XDRj50xjs-myrW6-O7oZ88smu9dndi1Tgkgh2X3qsviGEc0GsCACyvjMaAh9lEALw_wcB [Accessed 25 April 2021]

VA SYD (2021c). Års- och hållbarhetsredovisning 2020 [pdf], Available at: https://www.vasyd.se/-/media/Dokument_ny_webb/Protokoll-och-anslag/Fullmaktige/71-HR-2020--till-FF.pdf [Accessed 25 April 2021]

Vattenmyndigheterna. (2021). Kommunernas roll. Available online: https://www.vattenmyndigheterna.se/vattenforvaltning/vattenforvaltning-i-sverige/kommunernas-roll.html [Accessed 10 May 2021]

Yin, R. K. (2009). Case Study Research: Design and Methods, 4th edn, London: SAGE

Zimmer, K., Froehling, M., & Schultmann, F. (2016). Sustainable supplier management: A review of models supporting sustainable supplier selection, monitoring and development, *International Journal of Production Research*, vol. 54, pp. 1412-1442

Appendix

VA SYD. 2019. Mängdförteckning – Hällestadsvägen

VA SYD. 2020a. ADMINISTRATIVA FÖRESKRIFTER för 7007 - Hällestadsvägen Dnr 18/01904.

VA SYD. 2020b. Utvärdering och förslag till framtida arbete, provtagning och analys på nyanläggningar