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Improving a Fault Handling Process in Public Property Management

A Case Study Using a
Business Process Management Approach
Master's Thesis in Quality and Operations Management

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SUMMARY
This master's thesis investigates the fault handling process within a public property management organisation in Sweden, a process critical to maintaining service reliability and safety in hospitals. The study also examines the applicability of the Business Process Management (BPM) framework in a public sector context and aims to provide concrete, actionable recommendations for process improvement based on its application. The study used the first four phases of the BPM framework, identification, discovery, analysis and redesign.

A qualitative case study approach was used with data collected through ten interviews and five workplace observations in both the case organisation and in three reference organisations. Process mapping served as the overarching method to document and visualise the fault handling process. Thematic analysis was used as the first level of analysis to structure insights from interviews and observations, while the process analysis leveraged tools from the BPM framework, such as root cause analysis and impact assessment.

The analysis revealed that many subsequent issues in the process originated from poor information in the maintenance request descriptions. To address this, the implementation of a chatbot is recommended to guide users in submitting structured and complete reports. Additional recommendations include improving work routines and process standards, as well as improving KPI quality by ensuring feedback forms are routed directly to end users. It can be concluded that while BPM provides a valuable structure for the initial phases of process improvement, its successful implementation and long term impact depend on careful adaptation to the specific public organisational context.

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Keywords: Business process management, fault handling process, property management, public sector, process improvement

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1 Introduction

This chapter introduces the master's thesis by presenting the background and relevance of the study. It outlines the aim and research questions that guide the thesis. Finally, the chapter concludes with delimitations stated.

1.1 Background

Everything in life can be understood as a process, including life itself. It has a defined beginning, develops through a series of stages, and eventually comes to an end. This sequence of change and progression is true for all living organisms. A process is in the dictionary defined as a series of actions taken in order to achieve a specific result (Cambridge Dictionary, 2019). In company settings, some processes are carefully designed and structured, for example a hospital treating a patient for stage two brain tumor. Other processes emerge informally over time, shaped by habits, trial and error, or necessity. These unstructured processes often evolve organically, not unlike random mutations that, by chance, turn out to work well and become part of the system.

Whether delivering cancer treatment, manufacturing thin plastic lids for takeaway coffee cups or handling service requests in property management, the flow of activities, the process, matters. When processes are well designed, organisations run smoothly and customers are satisfied. However, when the processes are outdated or misaligned with goals, inefficiencies build up, putting performance and service quality at risk. "As Michael Hammer once put it: '*every good process eventually becomes a bad process',* unless continuously adapted and improved to keep up with the ever changing landscape of customer needs, technology and competition." (Dumas et al., 2013, p21). This highlights that process improvement is not a matter of fine tuning details. It is a fundamental organisational challenge.

Building on this, there is an important difference between doing the right things and doing the things right, that is, between doing things effectively and efficiently. Peter Drucker (1963) once said that "*There is nothing so useless as doing efficiently that which should not be done at all*." Emphasising that doing the right thing is more important than a perfect execution of something that does not add value. In the 1980s, Ford noticed that Mazda operated a comparable department with significantly fewer employees, yet achieved similar or even greater efficiency (Dumas et al., 2013). Upon closer examination, Ford discovered that its own purchasing process was designed around identifying and resolving errors after they occurred. Essentially treating errors as a separate activity at the end of the process. In contrast, Mazda had structured their process to prevent errors from arising in the first place, leading to a far more efficient operation. This case demonstrates the importance of doing the right things.

As organisations and their processes grow more complex and competition between companies intensifies, the need for structured approaches to process improvement becomes increasingly critical. The origins of structured approaches to process improvement can be traced back to Scientific Management, which introduced the idea of standardising work routines and laid the groundwork for later improvement methodologies (Taylor, 1911). Since then, numerous approaches have emerged, each varying in success and impact. Among the most well known are Total Quality Management (TQM), Lean and Business Process Reengineering (BPR). Building on

the foundation of TQM, Lean and BPR, Business Process Management (BPM) has developed as a comprehensive framework providing a systematic approach for analysing, improving, and managing business processes (Harmon, 2010). Through clearly defined phases BPM can help organisations structure improvement efforts. Its systematic and methodical approach makes it particularly useful for navigating complexity, a common characteristic of large organisations.

Although BPM has been widely adopted in the private sector, its documented use in public organisations, particularly in terms of successful implementations, remains limited (Syed et al., 2018). Public sector faces unique challenges compared to the private sector, largely due to differing goals and accountability structures (Alford & Greve, 2017). While private sector companies are driven by profit, the public sector must balance social, legal and political goals with their economic goal. Another key feature of the public sector is a high level of public accountability where organisations are expected to be transparent in their decisions toward politicians, media and citizens. This accountability combined with multiple stakeholder interests in decisions from citizens, politicians, internal departments and others often lead to public sector organisations prioritising stability over speed. Another factor contributing to the slow pace in public organisations is the presence of strong bureaucracy (Boyne, 2002).

Among the many functions of the public sector, one is public property management. Public property management involves overseeing properties owned by public organisations, such as schools, hospitals, and transport facilities, which are essential for delivering public services. Unlike private property management, which focuses on profit, public property management aims to meet critical societal needs which creates societal value and supports long term community needs (Vermiglio, 2011). A core function within any property management organisation is the fault handling process. That is, the sequence of activities from identifying a fault to resolving it. In a public organisation this process can be vital. For instance, failures in hospital infrastructure may result in delayed medical response or malfunctioning operating rooms. Such issues can lead to deteriorated healthcare delivery and, in the worst case scenario, loss of life. This highlights the importance of a reliable and efficient fault handling process in public property management.

Given the complexity of public property management, characterised by multiple stakeholders, bureaucratic structures and high accountability, BPM is a relevant framework. It provides a structured, systematic approach that can help organisations map their current processes, identify bottlenecks, clarify responsibilities, and improve coordination across departments. In doing so, it has the potential to enhance transparency, accountability, and ultimately the quality and efficiency of service delivery. Despite the strong potential of using BPM for process improvement in public sector organisations, the research in this area remains limited. Only a small number of studies have examined the application and particularly success of BPM in public sector contexts (Syed et al., 2018). When narrowing the focus further to property maintenance, there appears to be a complete lack of research, highlighting a clear gap and a need to explore how BPM can be applied to map and improve processes within public property management organisations.

1.2 Aim and Research Question

The aim of the report is to examine the fault handling process within public property management by mapping its current structure and exploring inefficiencies, both within individual activities and across the overall workflow. Using the Business Process Management (BPM) framework, the study aims to analyse the process internally and compare it to reference organisations in the industry, and also evaluate how the BPM framework can be applied in a public sector organisation. Ultimately, the goal is to provide recommendations on how the process could be improved, potentially through the integration of advanced technologies, based on the findings.

Research Questions
RQ1: *How is the fault handling process structured within a public property management organisation, and what are its main challenges?*
RQ2: How does the current process compare to practices observed in leading organisations within the industry?
RQ3: *What contextual factors influence the applicability and effectiveness of Business Process Management (BPM) in public sector organisations?*

1.3 Delimitations

Given the time constraints and the scope of a master's thesis, the following delimitations have been made in this report:

While the overall fault handling process in property management includes various types of cases, this study focuses exclusively on non urgent issues. The choice was made to ensure a manageable scope but also because this focus allowed for a more in depth analysis and closer examination of the specific process and the issues related to it. Furthermore, a part of the process of handling non urgent issues also involves determining whether the issue is covered by warranty. However, the warranty process is not included in this report, as it is a complex area and an own process itself.

The number of locations observed and included in the interviews has also been limited. Since the process is supposed to be uniform across the organisation, it was considered sufficient to visit two or more locations to gain a representative and holistic understanding. While the report touches on the potential for advanced technology implementations, broader issues such as legal, data privacy, and ethical considerations are acknowledged but not explored in depth.

The theoretical framework applied in this study, Business Process Management (BPM) includes six phases, with phases five and six focusing on process implementation and process monitoring and control. Due to time constraints, the report will be limited to the first four phases: process identification, process discovery, process analysis and process redesign.

2 Theoretical Framework

The following chapter presents the theoretical framework applied to the case organisation's process. The study is within the field of Quality and Operations Management, which also forms the foundation for the selection and assessment of relevant theoretical concepts. In particular, the chapter introduces the Business Process Management (BPM) framework as a central perspective for analysing and improving processes. To complement this, relevant aspects of change management are included to address the organisational challenges in implementing process improvements.

2.1 Introduction to Business Process Management

Business Process Management (BPM) is closely connected to the field of quality management. In the early stages, quality work mainly focused on inspecting the final product but over time it became clear that all parts of an organisation influence quality and customer satisfaction (Hoyle, 2006). This led to a broader understanding where quality was not only about the product itself, but also about how the organisation functions as a whole, a shift often described as moving from “little q” to “big Q”. Today, a key principle of quality management is the pursuit of continuous improvement across all organisational processes. This broader perspective laid the foundation for frameworks such as Total Quality Management (TQM), and later BPM.

BPM builds on the ideas of the quality movement by offering a structured approach for managing and improving business processes across the organisation. It is a system for handling core processes and has two main roots. One is the quality movement, which aims to improve performance through consistent work and the elimination of variation. Over time, this developed into structured approaches such as Six Sigma, where measurement and analysis were central. The other root is Business Process Reengineering (BPR), introduced in the 1990s, which focused on radical redesign of end-to-end processes to eliminate fragmentation and inefficiency (Hammer, 2014). BPM combines these two perspectives. It supports both continuous improvement and larger changes of entire processes.

At the same time, BPM is not only a framework with defined steps. It also represents a broader process perspective on how organisations function and improve. A process perspective means focusing on how work flows across departments and roles, rather than looking at tasks within individual units (Trkman, 2010). This view is central in this thesis, as it makes it possible to identify areas of improvements that are otherwise difficult to detect. The process perspective also supports a more dynamic understanding of organisations, since they are shaped by context, culture, and strategy (Trkman, 2010).

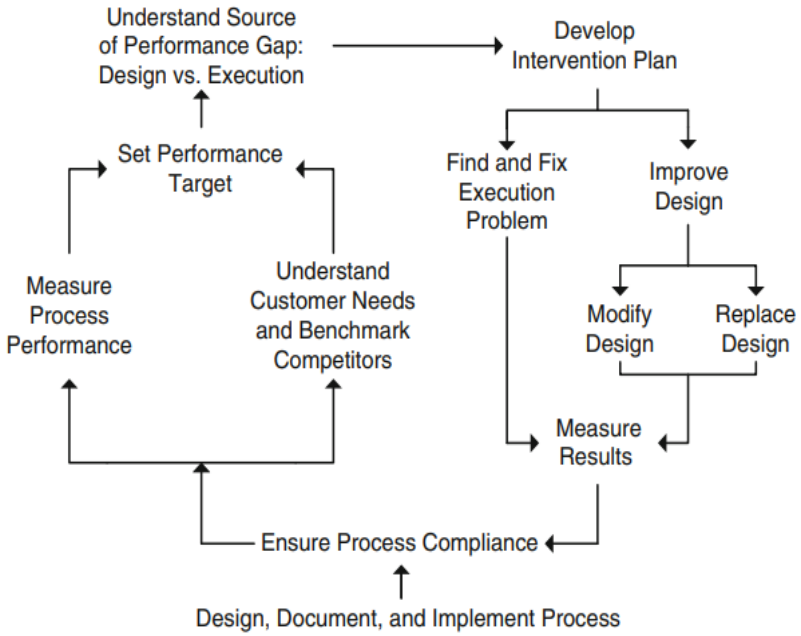

Figure 1
The essential process management cycle.
(Hammer, 2014, p. 5)

Figure 1 illustrates the process management cycle which was originally described by Hammer (2014) and follows a logic of create, assess, intervene, and evaluate. The cycle starts at the bottom where a process is created and implemented. It is then assessed to determine if it meets internal goals or customer expectations. If it doesn't, the organisation must choose an intervention and evaluate the result before starting the cycle again (Hammer, 2014). This cyclical view reflects ideas from Business Process Reengineering (BPR), where underperformance is either due to design or execution failures.

However, BPR has been widely criticised for overlooking organisational complexity and for assuming that radical redesign is always the solution (Dumas et al., 2013). This is the most frequently cited critique and is also confirmed by Harmon (2010), who further argues that BPR places too much emphasis on technology and structure, while neglecting the human and cultural aspects of change. Yet, these people related factors are often the main reason change initiatives fail, IT projects, for example, frequently fail due to poor change management rather than technical shortcomings (Legris & Collerette, 2006). However, many early BPR efforts failed because they relied heavily on immature IT systems (Harmon, 2010). Due to the combination of poor change management and reliance on immature IT systems, BPR has historically experienced a high rate of implementation failures.

To address these shortcomings, modern BPM builds on similar principles but adds more focus on continuous improvement, stakeholder involvement, and effective change management. Nevertheless, BPM has also been criticised over the years. One common concern is that BPM is often reduced to a set of tools or software, rather than being treated as a comprehensive management discipline (Harmon, 2010). The author also argues that some BPM efforts fail to achieve lasting impact because they are not aligned

with business strategy and lack a holistic approach. He further highlights that while BPM connects three approaches, quality, management and IT, many of its practitioners only come from one discipline and therefore have troubles connecting and balancing the different aspects.

Despite these critiques, BPM remains highly relevant in today's environment of increasing complexity and digitalisation. It enables organisations to control and improve complex workflows and centralise process logic. BPM techniques are also increasingly embedded within systems without always being explicitly labeled as such, underscoring the importance of understanding BPM as a discipline (van der Aalst, 2013). At the same time, it is important to recognise that BPM is not a single unified approach. It comes from disciplines such as TQM, BPR, and continuous improvement and there are also different ways of applying it depending on the context. Some versions are more top down and tool focused, while others emphasise team based work and culture change (Lee & Dale, 1998). This variety means that BPM should be seen both as a set of methods and as an overall approach to managing change.

2.2 The BPM Lifecycle Framework

While the process management cycle provides the overall logic for managing processes, the BPM lifecycle offers a more structured framework for how each phase of improvement is carried out. The lifecycle consists of six main stages: process identification, process discovery, process analysis, process redesign, process implementation and process monitoring and controlling (Dumas et al., 2013). Together, these phases guide how organisations understand, improve and manage their business processes. In the following subsections, each phase will be described in more detail.

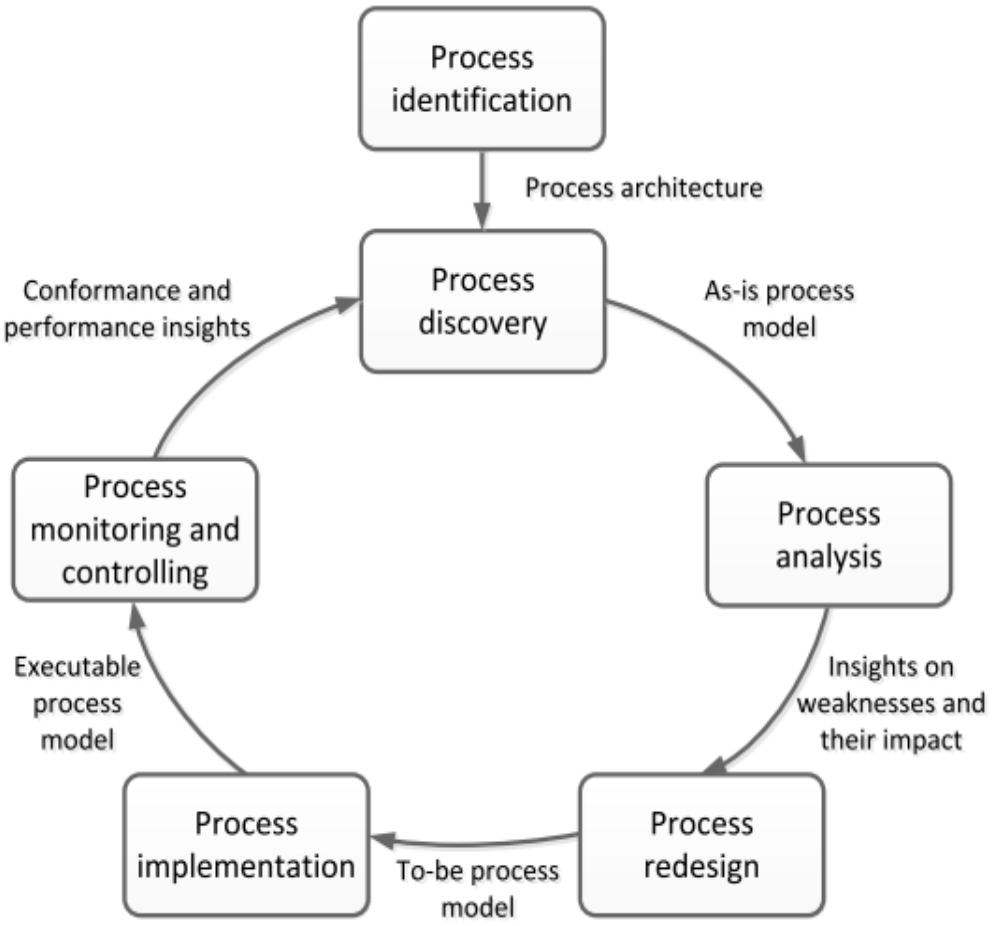

Figure 2
The BPM Lifecycle.
From Dumas et al. (2013, p. 21)

2.2.1 Process Identification and Process Discovery

In order to identify processes, there must be a clear understanding of what a process is. A widely cited definition, originally published in Bulletpoint in 1996, states that a process consists of four distinct features. First, it must have *"predictable and definable inputs"*. Second, a process is linear and follows a logical sequence or flow. Third, it includes *"clearly definable tasks or activities"*. Finally, the process has *"a predictable and desired outcome or result"* (Zairi, 2018, p. 64). When a process is defined it is important to understand how it fits within the broader structure of the organisation. Many modern organisations have moved away from traditional function based management toward a process oriented way of working where functions overlap and collaborate within processes (Zairi 2018). Adopting this approach places emphasis on understanding how processes relate to one another and on identifying which processes are most important from a customer perspective. These should ideally align with those most critical to the organisation's objectives. This structure is referred to as the process architecture (Dijkman et al., 2014).

The process architecture typically consists of three levels. Level one provides an overview of the core processes within the organisation. Level two zooms in and corresponds to a simplified process map. It typically breaks down each core process

into its main sub processes or phases, such as planning, execution, and follow-up steps. These subprocesses are still described at a high level but help illustrate the internal structure of the core processes and their logical sequence. Level three includes more detailed aspects of the processes, such as data inputs and outputs and the assignment of participants (Dumas et al., 2013). As mentioned earlier, process identification focuses on identifying relevant processes and placing them within the architecture, while process discovery aims to map the as-is processes in greater detail. With this in mind, level one aligns with the identification phase, level two spans both identification and discovery, and level three belongs to the discovery phase.

In the paper by Dijkman et al. (2014), the authors conclude that the most useful way to work with architectures is to combine a function-based and object-based approach. In the function-based structure, a hierarchy of functions is created, and processes are outlined either by looking at what happens within each function or by focusing on the flow between them. The object-based structure, on the other hand, looks at the business objects and defines processes based on how these objects flow and change throughout the organisation (Dijkman et al., 2014). Combining function- and object-based structuring allows for organisation to organise processes both in terms of what they do but also what the processes handle.

Once the relevant processes have been identified and positioned within a broader process architecture, the next step is to understand how these processes are carried out in practice. This takes place during the process discovery phase, which focuses on mapping the current as-is processes. To do this effectively, a modelling language is needed and most often Business Process Model and Notation (BPMN) is used to describe and visualise process flows in a structured and standardised way. A strength with BPMN is that it is designed to be understood by both business analyst and technical developers making it very important in bridging the gap between process design and implementation (Chinosi & Trombetta, 2012). Another important aspect of using a common process language is that it facilitates agreement and communication among people within the same organisation about what is being done.

As part of process discovery, different methods can be used to collect information about how processes are performed in practice. These include evidence-based approaches, interviews, and workshops (Dumas et al., 2013). Each method offers different strengths: document analysis provides objective data, while conversations capture informal practices and exceptions. The choice of method depends on factors such as the organisation’s digital maturity, availability of documentation, and access to key stakeholders. Often, a combination of methods is recommended to capture both formal and informal aspects of the process.

2.2.2 Qualitative Process Analysis

The third phase of the BPM framework is, as earlier described, process analysis, which aims to break down the issues with the original as-is model. This can be done either through qualitative or quantitative analysis methods. In this thesis, the focus is on qualitative tools with particular emphasis on root cause analysis and impact assessment, which are used to understand why problems occur and whether they are significant enough to address.

Understanding the root causes of issues is essential to avoid treating only the symptoms. To explore the underlying drivers of inefficiencies, Dumas et al. (2013) propose a root cause analysis. A popular tool in root cause analysis is the cause and effect diagram, also known as the fishbone diagram or the Ishikawa diagram seen in Figure 3. To use the cause and effect diagram, Ishikawa (1986) highlights the importance of clearly defining the issue at the head of the fish. Categories of potential causes are then determined and written at the end of each fishbone branch.

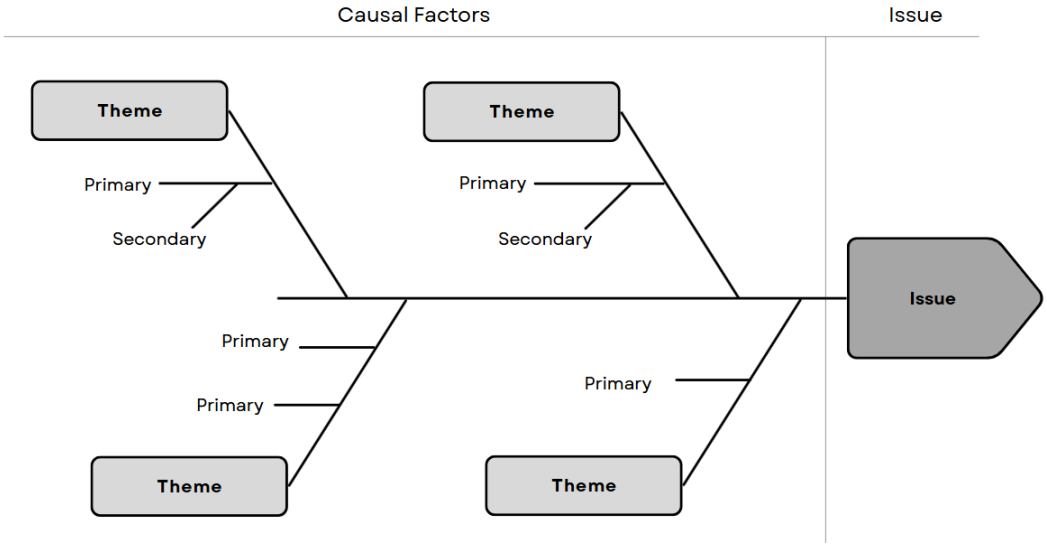

Figure 3
Ishikawa Diagram.
From Dumas et al. (2013, p. 194)

Ishikawa (1986) encourages unique categories, based on process understanding. However, a later adaption of the root cause diagram has been to use policy, procedure, people and place as cause categories for service and administration processes. After each category is defined, Ishikawa suggests brainstorming possible causes in each category. Each cause can then be divided into further sub causes so that the underlying causes are identified. It is recommended to repeatedly ask why something is happening until further sub causes can no longer be found.

Once the issues and their underlying causes have been identified, Dumas et al. (2013) recommend conducting an impact assessment to evaluate the significance of each issue. Two common methods used are Pareto analysis and the PICK chart. The core idea behind Pareto analysis is that the majority of issues can be traced back to a few key causes, often mentioned as the 80/20 rule (Juran and Godfrey, 1998). To assess the impact with the help of the Pareto analysis, the idea is therefore to use historical data and sort the causes from most to least significant to identify the issues that have the greatest overall impact.

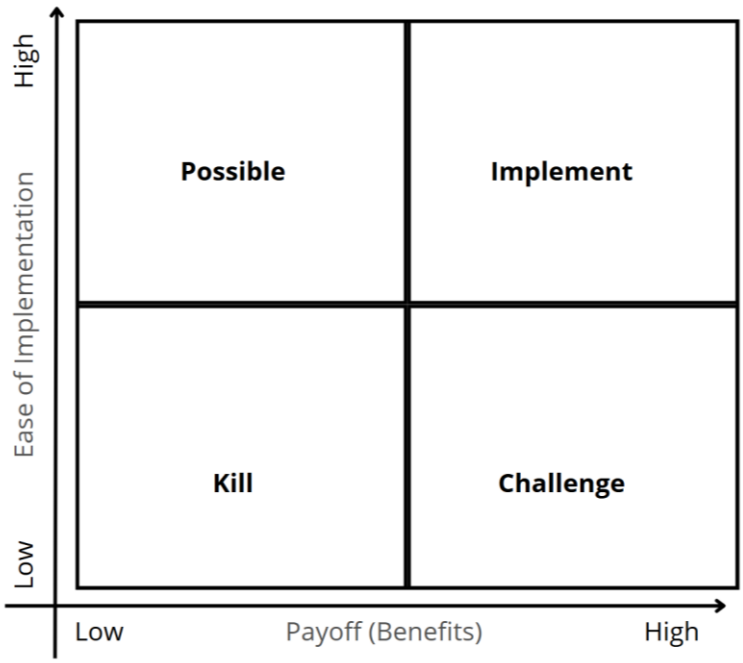

Figure 4
PICK chart.
From Dumas et al. (2013, p. 204)

Another common approach to impact assessment is to evaluate the action required to resolve the issue using the PICK chart, seen in Figure 4 (Dumas, et al. 2013). The Y-axis represents ease of implementation, while the X-axis indicates potential payoff. The purpose of the chart is to help prioritise ideas based on value and effort of implementation. Ideas that are easy to implement and offer high payoff should be implemented, while those that are difficult to implement and offer low payoff should be killed.

Together, the root cause analysis and impact assessment help provide a structured approach to analyse, understand and improve the process before moving into the redesign phase. The root cause analysis helps explore the underlying reasons for issues while the impact assessment helps understand if the issues are significant enough to improve.

2.2.3 Process Redesign

As the most central issues in the process have been identified in the previous phase, the *process redesign* aims to translate those challenges into solutions and the design of a new process, the so called to-be process.

A framework commonly used to clarify what a redesign aims to achieve is the Devil's Quadrangle seen in Figure 5. It consists of four performance criterias: time, cost, quality, and flexibility. While it is fairly intuitive that reducing time and cost while increasing quality and flexibility is desirable, the framework illustrates that these goals often conflict with one another (Dumas, et al. 2013).

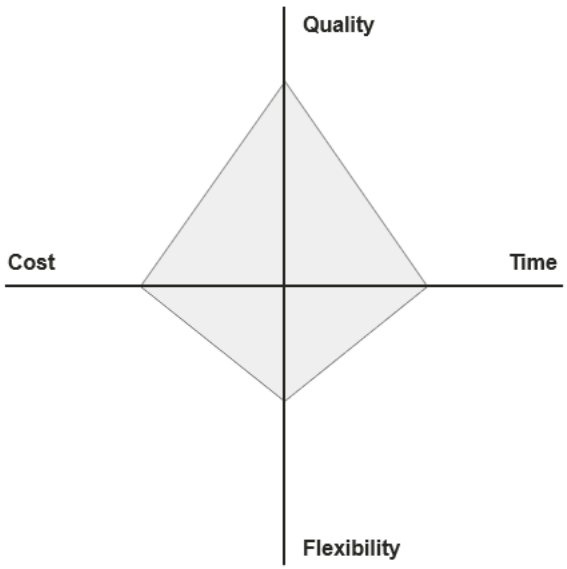

Figure 5
The Devil's Quadrangle.
Adapted from Dumas et al. (2013, p. 259)

Redesigns of processes can have very different starting points. Historically, the most common approach was to start from a clean slate and create an entirely new process. Over time, it has become more common to begin by analysing the existing process and identifying areas for improvement. A more recent development is to use a state of the art process model as a benchmark and then adapt it to the organisation's current conditions. Regardless of the starting point, there are common steps to follow when creating a new process according to heuristic process redesign (Dumas et al., 2013).

1. Initiate: Redesign project is started and an understanding of the existing situation is created as well as goals and objectives for the new process.
2. Design: Based on the goals set in the initiate phase, potential improvements are explored using redesign heuristics. These are assessed for relevance and grouped into realistic scenarios describing how the process could be changed.
3. Evaluate: The proposed redesign scenarios are assessed to determine which one best meets the performance goals. This is done through expert judgment and simulations.

There are two general ways of redesigning a process, either through Heuristic process redesign, or through product based design (Dumas et al., 2013). Heuristic process redesign is an approach that uses general guidelines, or heuristics, to find ways of improving a business process. These heuristics are based on lessons from earlier redesign projects and point to typical changes that tend to work well in practice. The aim is not to find a perfect solution, but to explore practical improvements that fit the specific goals and context of the organisation (Dumas et al., 2013). The redesign process using the Heuristic model typically starts with the current process model and aims to improve it by using the Heuristics.

Product based design on the other hand, aims to structure the process around the product or service being delivered (Dumas et al., 2013). It is a logic driven approach that starts

by analysing the final product and breaking it down into components such as data and outcomes. The next step is to identify dependencies between data and establish a logical sequence of creation, for example that component A is needed before component B. Finally, the design phase aims to find the most efficient order between steps to efficiently deliver the product. This method often leads to radically rethinking of how a process should work, while the Heuristic redesign often leads to incremental changes.

Each approach comes with its own set of risks. Heuristic redesign may overlook deeper structural issues while product based design might be hard to implement in existing organisations. Choosing the appropriate model for the redesign phase depends on the desired outcome. Heuristic redesign is well suited for capturing quick wins and addressing obvious inefficiencies, whereas product based design is better suited for challenging existing structures and driving more substantial organisational change.

2.3 BPM in Organisations

BPM is commonly used in organisations, either as a comprehensive framework or by applying specific elements to analyse or redesign processes. In the article by Venkatraman and Venkatraman (2019), the authors investigated a process involving a petrol station chain, focusing on how a centralised helpdesk team at the main office manages technical issues at individual stations.

The current as-is process begins when an issue arises at the petrol station. The issue could be anything from a broken coffee station to a broken fuel pump. The station employee, acting as the client, contacts the help desk via phone or email. A level 1 help desk staff receives the request and attempts to identify the problem. If the issue is simple or known, the level 1 agent tries to guide the employee through the solution over the phone. If the issue cannot be resolved at this stage, the problem is sent to the level 2 support which is a more experienced personnel. The level 2 support first assigns a priority level to the issue, either critical, urgent or normal. They then attempt to resolve the problem remotely, and if that is not possible, a contractor is hired to solve the issue. Key issues identified in the as-is process are too much waiting time, non value adding steps as well as communication delays, typically related to the handovers between level 1 and level 2.

Venkatraman and Venkatraman (2019) use the BPM framework much like the framework proposed by Dumas et al. (2013). The main process improvements highlighted in the article by Venkatraman and Venkatraman (2019) are the reduction of non value adding activities. By redesigning the process and implementing a more efficient system, and thus eliminating the need for Level 1 support, they significantly reduce waiting times and manual data handling. Because of the new process, the average cycle time per issue is shortened from 46.5 hours to 4.2 hours, with increased customer satisfaction and lower costs.

Beyond the petrol station case and its help desk improvements, numerous other examples demonstrate the successful application of BPM. In the article by Ammirato et al. (2024) the authors describe how the BPM framework was successfully used to improve and digitalise the Business Trip Request and Approval process at an Italian public university. The original as-is process relied on manual handling and paper based

repetitive work which led to high throughput time, frequent errors and also interfered with national digital administration laws.
The improvement initiative followed the full BPM lifecycle and led to the successful implementation of a new to-be process. The redesigned process introduced a fully digital, unified system across departments, incorporating automation and digital routing between actors. The result was a more user friendly experience and a significantly reduced cycle time. Gulledge Jr and Sommer (2002) point out that, although the BPM framework has been widely adopted in the private sector, there are few documented cases of successful implementation in the public sector. This makes the case presented by Ammirato et al. (2024) particularly valuable, as it demonstrates how BPM can be effectively applied in a public sector context.

A third case to illustrate the usefulness of BPM is the optimisation of the market analysis process within a large energy company (Teixeira et al., 2024). The original as-is process was largely manual and unstructured. Analysts relied on routine knowledge to determine analysis needs and identify the necessary data. They searched and requested data from various sources and then recorded the data in excel. This was followed by time consuming data cleaning and transformation to then be able to then manually create reports using charts and tables.

The full lifecycle of the BPM framework was utilised to redesign the process. Process discovery was conducted through structured interviews, document reviews and workshops. A BPMN model of the as-is process was developed and validated through iterative feedback from different stakeholders. The process was then analysed using value added analysis and waste analysis and redesigned using the Devil's quadrangle to balance improvement goals. The key distinction in the redesigned to-be process was the implementation of python scripts to enable automation of the process, such as scraping data from websites and standardised data transformations, improving efficiency.

Collectively, the studies made by Venkatraman and Venkatraman (2019), Ammirato et al. (2024) and Teixeira et al. (2024) demonstrate the potential and effectiveness of applying the BPM framework to non producing processes such as information- and service oriented processes. While most examples focus on private sector contexts, Ammirato et al. (2024) also provide evidence of successful BPM implementation in the public sector.

2.4 Critique of the BPM Framework

Although much of the work in the article by Venkatraman and Venkatraman (2019) is grounded in the BPM framework, the authors criticise the framework. They argue that BPM focuses too much on the process flows and too little on data and data driven change. While they acknowledge that BPM provides a solid foundation for process improvement, they believe that it is insufficient on its own for driving system level change. Especially in real world contexts involving data centric systems like Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM). To address this gap they propose to complement the BPM framework with a stronger data foundation, drawing from the more data oriented Business Object Oriented Modelling (BOOM) approach.

This limitation in the BPM framework is also recognised by Dumas et al. (2013). They note that although BPMN is great for modelling control flows as well as tasks, gateway and events, it does not provide enough support to model data lifecycles, detailed data structures and complex relationships between entities. Moreover, the authors see a weakness with the BPMN diagram, no matter how well structured it is, it cannot be directly transformed into a functioning automated system. To do so, it needs to be complemented with additional information and programming such as defining data object attributes, data types and relationships as well as adding programming logic.

The distinction between Dumas et al. (2013) and Venkatraman and Venkatraman (2019) lies in how they respond to the limitations of the BPM framework. Dumas et al. acknowledge the weakness in the BPM framework, particularly in handling data, but still suggest that the BPM framework should act as the foundation in a process improvement. They suggest that the framework can be extended through detailed programming to bridge the gap. In contrast, Venkatraman and Venkatraman (2019) believe the gap between the BPM framework and modern, data driven systems is too wide. As a result they propose moving beyond BPM toward a more data centric framework, however still using the BPM as the foundation.

Although both Ammirato et al. (2024) and Teixeira et al. (2024) present successful examples of process improvements by redesigning and automating processes, they also criticise and highlight flaws in the BPM framework. Ammirato et al. (2024) point out while the BPM framework is widely used in the private sector there have been few documented implementations in the public sector, which can lead to difficulty in public implementations. They discuss that this most likely is due to the public sector being inherently resistant to change and generally freezes the processes if there are not too many critical points. The conclusion of the discussion is that the general resistance to change in public organisations makes BPM harder to implement.

Gulledge Jr and Sommer (2002) also emphasise that implementing BPM in public organisations tends to be more challenging due to bureaucratic structures, legal constraints, and cultural barriers. Unlike private companies, public sector organisations do not face the same competitive pressures, which often results in a lower overall motivation to pursue change. In addition, they point out that many public organisations operate with outdated IT infrastructure, further complicating efforts to automate and optimise processes.

Addressing this, Ammirato et al. (2024) emphasise that BPM is not a one size fits all solution. The success of a BPM implementation depends on factors such as simplicity of the process, availability of data and the degree of stakeholder involvement. Gulledge Jr and Sommer (2002) agrees and add that successful public sector implementation requires both organisational and BPM specific adaptations. One organisational adaptation they suggest is moving from siloed departmental structures to a focus on specific end to end processes, where multiple units share responsibility for achieving a common outcome. They also emphasise the need to engage stakeholders early and foster a participation culture. In terms of BPM framework adaptations, Gulledge Jr and Sommer (2002) suggest adjusting language and simplifying how the BPM is communicated as well as gradually introducing BPM tools as the organisation often uses old and fragmented IT systems.

Teixeira et al. (2024) similarly stress that BPM cannot be treated as a plug and play model. They argue that traditional BPM assumes structured repeatable processes, whereas the original as-is process investigated in their study was far more dynamic and depended heavily on human interpretation. Because it did not follow a strict workflow, applying the BPM framework posed significant challenges. Unstructured processes are highly variable and therefore make them difficult to standardise, model and automote. Either each scenario has to be modeled or the process ends up being described in a way that lacks details. While they found the BPM framework to be a good starting foundation, it was not always practical strictly following the BPM lifecycle. Instead they suggest using BPM as base but adapting the implementation to the specific case.

While each study highlights unique challenges in their respective implementation, neither of the authors reject the framework outright. Instead they suggest extending and adapting it to fit the specific context, emphasising case specific customisation to create a successful outcome.

2.5 Change Management

While BPM provides a structured approach for improving processes, its success often depends on how well the organisation manages change. As noted earlier, many process implementation initiatives have struggled due to an overemphasis on structure and technology and too little focus on human and cultural factors (Harmon, 2010; Legris & Collerette, 2006). Even when a redesigned process is technically sound, it may fail in practice if employees do not adopt new ways of working. This is why change management is an important part of the implementation phase in the BPM lifecycle. It helps the organisation move from the current as-is process to the new to-be process. This section introduces organisational change as a perspective to better understand what influences whether process improvements succeed in practice.

Change in organisations is not only about tools and models. Change is also a social process that happens in an organisational context (Armenakis & Bedeian, 1999). People do not just follow new routines automatically, but instead they react to change based on their own experiences, values, and how the change affects their daily work. For example, in a Turkish construction company, an organisational change was resisted by employees as they felt that the implementation of a coordinator would drive them away from the center of power in the company (Danışman, 2010). This example indicates that process improvement is not only about designing better processes but also about understanding how people in the organisation respond to those changes. To make the process implementation successful, it is important to create a shared understanding of why the change is needed.

A well known model for managing organisational change is Kotter’s eight step framework (Kotter, 2009) developed from observations in a large number of organisations. The model outlines steps often needed for successful change, such as creating urgency, creating a guiding coalition, communicating a vision, removing obstacles and anchoring new behaviours in the organisational culture. Kotter (2009) argues that change is not only about structure and planning but also about leadership and communication. In the context of BPM this is relevant as many process initiatives fail because the organisation does not handle the human factors well.

The organisational challenges become even more complex in public sector organisations, such as the one examined in this thesis. These organisations often face strong external controls that can make change more difficult. Rules, political decisions and budget limits reduce the organisation's freedom to act and may hinder change (Fernandez & Rainey, 2006). Public organisations also have many different stakeholders who may want different things which makes it harder to agree on what the change should look like. While change models like Kotter's eight step model emphasise urgency, it is important to note that his work is based on change in private companies. This can make it hard to implement that model in a public organisation where the autonomy is limited. Fernandez and Rainey (2006) argue that to overcome such barriers it is important to build relations with political stakeholders and by doing so create an external support for the change as well.

A key factor in driving successful organisational change is understanding the underlying causes to why an organisation is shaped and behaves in a certain way. DiMaggio and Powell (1983) discuss that organisations in similar environments tend to be increasingly alike and describe the phenomenon as institutional isomorphism. They argue that institutional isomorphism typically is about creating legitimacy, following norms and managing uncertainty rather than creating an efficient organisation. They further explain that institutional isomorphism can take different forms depending on what influences their organisational behaviour. It could be a result from compliance with formal rules or directives by regulatory bodies, from the imitation of other organisations structures or processes in response from uncertainty, or from professional norms shaped by shared educational backgrounds among individuals working within the same industry.

3 Method

This chapter outlines the methodological approach of the study. It includes the research strategy and design, describes how data was collected and analysed, and outlines ethical considerations and the use of AI tools.

3. 1 Research Strategy

As stated earlier, the aim of this project was to examine a specific process at a regional property management organisation and provide recommendations for improvement. To achieve this, a qualitative research strategy was adopted, utilising a descriptive and exploratory case study design. This approach was best suited for the project as it allowed for a deep understanding of the process, given multiple stakeholder perspectives and the qualitative nature of the process which included few quantifiable aspects.

A core aspect of any research strategy is the underlying reasoning process, which determines how data and theory interact to form conclusions. Research can be structured using either deductive, inductive or abductive reasoning (Bell, et al., 2019). Deductive reasoning starts with theory and then tests the theory by using empirical data, usually through experiments. Inductive reasoning on the other hand builds general conclusions from observations. This study however, aligns more with abductive reasoning, mostly related to inductive reasoning but containing elements of both. Abductive reasoning starts with observations and then uses both the data and theory to develop recommendations. Often working iteratively between them. This study began with the current process, mapping the process and identifying inefficiencies. By analysing the data and going through existing theory and research, recommendations were developed.

Moreover, philosophical assumptions shape how research is conducted and how the findings are interpreted. They consist of two components, Ontology concerning the perception of reality and epistemology defining how knowledge is acquired (Bell, et al., 2019). Ontologically, research can take either an objectivist or a constructionist perspective. Objectivism is the perspective that reality is independent of people’s perceptions while Constructionism is the perspective that reality is socially constructed through people's experiences and interactions. This project adopted a constructionist perspective, as multiple stakeholders were interviewed and helped understand the process. Each interview contributed a unique perspective.

Further, from an epistemological perspective, research can be approached through either positivism or interpretivism (Bell, et al., 2019). Positivism emphasises objective facts and measurable data, seeking a universal truth. Interpretivism on the other hand, emphasises subjective experiences, context and meaning. This study followed an interpretivist approach as the goal of the data collection was to understand the process, mainly focusing on how customers and employees, in this case, hospital staff, customer support and technicians, experience and interact with the process.

3.2 Research Design

The research design of this project followed a descriptive and exploratory case study approach (Bell, et al., 2019). The descriptive phase focused on mapping the fault handling process by using observations and semi structured interviews, documenting the process structure, sequence of steps and interactions between stakeholders. This provided a clear understanding of how the process function currently. Further, the exploratory phase aimed to uncover underlying inefficiencies and different stakeholder perspectives. Semi structured interviews were conducted to understand both the specific process step, but also to understand how employees perceived dependencies and constraints between the different steps. This approach allowed the study to explore inefficiencies and bottlenecks as well as underlying issues.

Bell et al. (2019) emphasises that research often is non linear, particularly qualitative case studies. This means that different phases of the research process can inform and refine one another. In this study an iterative approach was adopted during the observations and semi structured interviews. Both the descriptive and exploratory perspective was used to understand both the current state and inefficiencies simultaneously. By combining descriptive mapping with exploratory analysis, the study provided a structured overview of the process and a deep understanding of the challenges related to the process.

The research followed the BPM framework to map and analyse the selected process. The process identification phase was mostly completed by the case organisation, while the as-is process was discovered and documented during the process discovery phase. The qualitative and comparative analysis conducted corresponds to the process analysis, and the recommendations developed can serve as a foundation for the process redesign phase. Furthermore the BPM framework also includes the phases of process implementation and process monitoring and control, these were not included within the scope of this study and are instead left to the organisation to carry out independently.

3.3 Data Collection

The purpose of the data collection was to gain an understanding of the fault handling process in property management operations. The interviews included different stakeholders to enable mapping of the full process. When possible, respondents with similar roles were also interviewed to support data saturation. However, since RQ1 focuses on a specific process involving people with different responsibilities, data saturation is difficult to achieve as each person offers a unique perspective. Despite this variation, we believe that the collected data provides a clear and well rounded understanding of the process.

The data in this study is of qualitative nature as it aimed to explore a complex real world process. Depending on the circumstance of each semi structured interview, meetings were either audio recorded and transcribed using a smart transcription tool, or detailed notes were taken during the interview. Similarly, detailed field notes were taken during the observations to capture what was seen and heard.

3.3.1 Sampling

The sampling followed a contingent purposive approach, meaning that the criteria for whom to interview became clearer as the research progressed. (Bell et al., 2019). Since the study initially aimed to map a process and describe related problem areas, in line with the first research question, this sampling method was a natural fit. As the research progressed, it became possible to change the focus and narrow it to specific parts of the process that were found to be of greater interest for the aim of the study.

The sampling for the process mapping was based on an internal process map where stakeholders and their sub processes were represented. Once the process and key problem areas became clear, a second round of interviews was conducted with representatives from companies identified by an internal resource as best in class in facility management in Sweden. With this in mind, each interview served one of two purposes. The first was to map the process and gain an understanding of its challenges and areas for improvement (RQ1). The second was to compare how leading companies within property management manage their fault handling processes, and how it compares to the case organisation (RQ2). The comparing companies were selected and pointed out by the case organisation which identified them as leaders in the field. Table 1 presents the number of interviews conducted, the purpose of each interview, and their respective durations.

#	Interviewee	Location	Connected to Research Question nr:	Duration (min)
1	Customer service	Case Organisation Location 1	1	60
2	Technician 1	Case Organisation Location 2	1	75
3	Technician 2	Case Organisation Location 2	1	75
4	Technician 3	Case Organisation Location 3	1	30
5	Coordinator	Case Organisation Location 3	1	30
6	Customer	Location 3	1	45
7	Business developer	Case Organisation (Teams)	1	90
8	Head of customer service	Company A	2	60
9	Technical specialist	Company B	2	60
10	Technical Department Manager in Property Operations	Company C	2	60

Table 1
Overview of Interviews Conducted

3.3.2 Interviews

In total, ten interviews were conducted and can be seen in Table 1. In all interviews, except for two, only one interviewee participated at a time. However, in interviews 2 and 3, two interviewees were present simultaneously. Interview 2 was the main interview, but the interviewee from interview 3 contributed so meaningfully that we chose to present it as a separate interview. Both authors of the report were present during every interview.

All interviews were done in person, except one who took place digitally via Microsoft Teams. The initial part of the interview focused on setting the stage, which included small talk as well as actively listening and showing respect to help the interviewee feel comfortable with the interviewers (Brinkman and Kvale, 2015). Interviews then followed a semi structured format. This means the interviewer used a guide as a base, while allowing the interviewee freedom in how they responded. The guide included topics and questions but the interview was also open to topics beyond the initial questions, depending on what the interviewee emphasised. This allowed the interviewer to follow up on areas that appeared important during the conversation (Bell et al., 2019). Since the first part of the study aimed not only to map the process but also to understand potential problem areas, this format was necessary. Potential problem areas for the process often emerged during the interviews and were not always possible to anticipate in advance.

Brinkman and Kvale (2015) emphasise that while research is often focused around the "*why*" something is happening, interviews should first focus on "*how*" and "*what*" is happening. The reasoning behind people's actions should be analysed by the researcher, who can move beyond the interviewee's own understanding. The authors liken this to a doctor's diagnosis. A doctor never asks why the patient is sick, but instead investigates how and what the patient is feeling. Asking why too early can lead to speculative answers with limited value. However, asking "*why*" was not excluded, it was simply reserved for after the "*how*" and "*what*" had been established.

The second round of interviews took on a more structured approach, with a focus on answering specific questions. Rather than continuing to map the overall process, the emphasis shifted towards the initial step of the process and the quality of information involved. Despite the increased structure, the interviews maintained a semi structured format, allowing to explore unexpected but interesting topics that emerged during the conversations.

3.3.3 Observations

In the study, multiple observations were conducted. The purpose of the observations was to follow an issue through the process, understand each process step and see how the different stakeholders interact with one another. It also worked as a method to validate what was said during the interviews but also as a method to refine interview questions based on observed insights. As observations were intended to complement the interviews in addressing the research questions, all steps of the process, except customer fault reporting, were observed. The initial reporting step was excluded due to feasibility constraints, as it was not possible to predict when or where the next issue would be reported.

The observation method used was shadowing as a means of understanding roles and perspectives, as described by McDonald (2005). This technique involves closely following an individual in their daily work to gain insight into their role and subjective experience within the organisation. While shadowing is often conducted over several days, our observation period was shorter, as shown in Table 2. Throughout the sessions, the observers asked frequent questions, not only about visible tasks but also about verbal interactions, including both formal and informal communication. The level of participation varied depending on the situation. At times, this involved active

engagement, such as assisting technicians with simple tasks, while in other cases, it meant observing and asking questions as administrators demonstrated their use of software. The level of participation varied, but was always influenced by what was observed. However, we were never formally embedded in the organisation and did not hold any official roles, we maintained the position of external observers.

During observations, brief notes were taken and then summarised more thoroughly afterwards to avoid interrupting the observation. Participants were encouraged to carry out their tasks as they normally would, in order to capture a process that closely reflects actual practice.

#	**Observation**	**Location**	**RQ**	**Duration (min)**
1	Customer service + Work order categorisation	Case Organisation Location 1	1	120
2	Work order selection + Work order execution + Closure	Case Organisation Location 2	1	180
3	Work order selection	Case Organisation Location 3	1	60
4	Customer service + sorting	Company A	2	45
5	Customer service + sorting	Company A	2	45

Table 2
Overview of Observations Conducted

As shown in Table 2, observations among the reference observations were conducted only at Company A, as this opportunity came up during the interview. Observations were not possible at company B or C.

3.4 Data Analysis

Two methods were used for the data analysis. First, process mapping was used to document and gain a structured understanding of the overall process. To explore the process in greater depth and identify issues and areas for improvement, thematic analysis was applied as a complementary method. After the thematic analysis was conducted, the process was analysed by utilizing the BPM tools outlined in the theory section. There were no strict selection criteria for these tools, but given their widespread use and the fact that alternative tools did not serve the purpose as effectively, they emerged as a natural choice.

3.4.1 Process Mapping

To analyse and enable improvement of the fault handling process, process mapping was used, a method for visualising workflows and identifying inefficiencies. The process

map provided a structured overview of the different steps in the process, making it easier to detect bottlenecks, delays, and unnecessary activities.

Following Heher and Chen (2017), the process proceeded with process mapping in several steps:

1. *Defining the scope*

A specific troubleshooting process was selected, and the parts to be mapped were identified with clear boundaries established.

2. *Involve stakeholders*

Key stakeholders were engaged to ensure that all perspectives were captured.

3. *Brainstorming and mapping*

A whiteboard was frequently used to brainstorm, document and map each step in the process.

4. *Validating through direct observation (Gemba Walk)*

The process in practice was observed to ensure that the map reflected reality.

5. *Analysing and identifying improvement areas*

The process map was used to highlight inefficiencies and identify opportunities for workflow improvement. To further identify issues and themes in the process, a thematic analysis was used to further explore the process in depth.

3.4.2 Thematic Analysis

To analyse these primary data sources, thematic analysis was leveraged, using an inductive analytical approach as themes emerged from the data rather than being guided by predefined theory. The thematic analysis was based on Braun & Clarke's (2006) six step method. It was chosen because of its suitability for identifying patterns in qualitative data. The six steps included:

1. *Familiarisation with the data*

The process began with transcribing and reading through the interviews as well as the notes taken to gain a holistic perspective and remembering the data. In this first step, initial notes and observations from reading through the primary data were also taken.

2. *Generating initial codes*

In the second step, systematic coding was done of relevant data features, including interesting comments and process specific bottlenecks or comments of the specific process steps. The coding originated from the initial ideas from step 1 but was developed. The purpose of the coding was to break down and organise data systematically on the micro level, compared to themes which were generated later and which worked more on the macro level.

3. *Searching for themes*

This third phase focused on a macro perspective of the codes and aimed at grouping codes into broader patterns or concepts. In the beginning of this step a whiteboard was

used to draw a mindmap, linking the different codes to each other and thereafter dividing them up into themes and sub themes. Themes were not determined just by frequency but also by relevance and significance. However, to be named a theme it had to be supported by multiple data points.

4. *Reviewing themes*

The intention of the fourth step was to refine the themes and in the end of this phase know the different themes, how they were related and what the themes say about the data. As proposed by Braun and Clarke (2006) two levels of reviewing the themes were used. The first level was used to see whether the coded data in each specific theme formed a coherent and relevant group. The second level was used to see if all themes combined accurately reflected the entire coded data.

5. *Defining and naming themes*

In this fifth step the final refinement of each theme was done. It involved analysing each theme in detail and trying to create a narrative that connected the theme to the research question. If clarifying was needed in some of the themes, it was done to increase clarity between the theme and research question. Lastly, each theme was assigned a clear and descriptive name.

6. *Producing the report.*

The final phase of the six step method focused on writing the report and connecting the themes back to the research question. It involved creating a clear and structured narrative as well as selecting illustrative quotes to support the interpretations made.

To support the coding process, a structured manual approach was used, primarily working in Excel to organise and store coded data. This enabled a consistent analysis across data types, where the observational notes added valuable contextual insights that complemented the interview material. Although Braun and Clarke's (2006) six step model is presented as a linear process, the actual coding was more iterative. Codes were continually revised and merged as new data was analysed, reflecting the evolving nature of qualitative research.

Similarly, Thematic Analysis was applied to the data from the comparative study, gathered through three interviews and two observations of the reference organisations, using the same coding approach as for the case organisation. The resulting themes were then compared to those identified in the case organisation to highlight similarities and differences.

3.6 Research Quality

The trustworthiness of qualitative research should not be judged by whether different researchers can produce the same results. In fact, different researchers, settings, and time periods are expected to yield different outcomes. With this in mind, the quantitative concept of validity is not a goal in qualitative research. Instead, qualitative studies should aim to produce trustworthy results that inspire confidence and trust in the researchers' findings (Stahl & King, 2020). Lincoln and Guba (1985) suggest that researchers should strive for credibility, transferability, dependability, and

confirmability to establish trustworthiness. The following subsections will explain and elaborate on these four terms and how they have been considered in the study.

3.6.1 Credibility

Credibility in this study refers to how believable the findings are. In a qualitative study there might potentially be several explanations for a certain result, this puts a lot of stress on the researchers to provide strong evidence for their conclusions (Bell et al., 2019). In the context of this study, it means that credible sources in interviews support the findings and that the respondents' answers were accurately interpreted. To ensure this, interviews were recorded when possible. When recording was not feasible, detailed notes were taken during both interviews and observations to enable reassessment of the answers in case of any unclarity. Furthermore, the use of follow up questions have been extensively used in cases where misunderstandings have been suspected.

3.6.2 Transferability

Transferability addresses the question on whether the findings of the study are specific to the context in which they were found or if they can be generalised to different settings and cases (Bell et al., 2019). Since this study examines a process built on a standardised IT system designated for troubleshooting in facility management, it is likely that other companies using the same system have similar processes. Additionally, as the study is conducted within a public organisation, the findings related to organisational challenges and benefits may be generalisable to a broader context such as other public sector organisations. In summary, while certain findings from this study may be applicable to other companies and processes, one should carefully consider the specific context of each case.

3.6.3 Dependability

Dependability refers to how well documented the research process is and how easily an external party can follow its progress and verify the legitimacy of the findings. This requires maintaining thorough records throughout all phases of the study, from problem formulation to data collection and the decisions made during the research process (Bell et al., 2019). To ensure dependability, the study followed a structured and well documented research process. Regular meetings with the supervisor were held throughout the project to reflect on methodological choices and ensure consistency. In the final stage, the report was peer reviewed to further enhance the reliability of the findings.

3.6.4 Confirmability

Confirmability refers to the objectivity of the study and the assurance that researchers have acted in good faith. While complete objectivity is not attainable in business research, it is essential that researchers do not allow personal beliefs to influence the research process or its findings (Bell et al., 2019). This study has addressed confirmability in data collection by using non leading questions in interviews.

Additionally, continuous discussions regarding potential biases have been conducted to maintain clarity and transparency.

3.7 Ethics

Ethical principles have been considered throughout the entire business research process. As Bell et al. (2019) emphasise, it is important to revisit ethical consideration throughout the entire work process instead of setting it aside once the planning phase is done and ethical approval has been gained. According to Bell et al. (2019), the most common ethical principles to consider in business research are whether any harm is caused to participants, whether informed consent is lacking, whether there is an invasion of privacy, or whether any form of deception is involved. These principles were carefully considered, and to ensure no ethical breaches occurred, all participation in interviews and data collection was strictly voluntary. Participants were informed that they could withdraw their participation at any time. Furthermore, transparency and research aim was clearly communicated to make sure that the participants were not deceived.

Since the case study was conducted at a case organisation, which owns and maintains hospital facilities, the most important ethical consideration was to avoid any invasion of hospital patients' privacy during observations and interviews. To address this, a discussion was held with the case organisation before visiting the hospitals, where it was agreed that no information about what or who was seen at the hospitals would be shared or disclosed in any way.

Non disclosure agreements (NDAs) were signed with the case organisation. The company name is included in the name of the report, however, is anonymised throughout the rest of the report. Before publication, the case organisation reviewed the content to ensure that no confidential information was revealed. The primary concern outlined in the NDA was to avoid disclosing any sensitive hospital related information, given its societal importance.

For Company A, Company B and Company C no formal NDAs were signed. However, there was a mutual agreement to anonymise the company names. The relevant sections of the report mentioning these companies were sent to the respective interviewees for review, ensuring that no confidential information was included.

3.8 Usage of Generative AI

In this report the generative AI tool ChatGPT has been used as language improver to enhance clarity and readability of the text in accordance with the Chalmers guidelines. To ensure full compliance, the supervisor was consulted throughout the project. However, it is important to emphasise that all original ideas, concepts, structure and content were written by the authors, AI was solely used to refine the language.

3.9 Methodological Reflection

Overall, the methods applied and the sampling strategy used in the study provided the insights that were initially desired. After conducting the thematic analysis of the case

organisation a recurring theme and analysis was that the information quality was lacking. It was identified as a problem area and that a solution to the specific issue would also be the greatest possible improvement. To support this aim, the interview questions were designed to address information quality in detail. However, during the interviews, it became apparent that focusing solely on information quality was challenging. As a result the focus therefore shifted from just focusing on the information quality to a broader analysis of the overall process. While this shift meant that it did not follow the original plan, it eventually gave valuable insights.

4 Case Description

The case organisation, a division of a Swedish region, is one of Sweden's largest property owners with more than two million square meters of property. The type of properties they own and manage are mainly hospitals, but also include public transport hubs, schools, museums and other public facilities. While the case organisation is responsible for constructing and maintaining these properties, the actual users, called clients, are separate organisations. For example, the case organisation owns and manages a hospital property, while the client in this case is the hospital organisation who operates independently in the facility.

The case organisation is divided into different operational units. One unit is, for example, responsible for building and constructing new buildings as well as rebuilding existing properties. However, this project will focus on the service and maintenance unit, which is responsible for maintaining the properties used by clients.

The maintenance of the case organisation's properties can be divided into three types of general cases.

1. Client reported issues: A problem is identified by someone in the client's organisation. These are further divided into:
    a. Urgent: Issues that pose an immediate risk of damage to assets or harm individuals, where timely intervention is critical.
    b. Non urgent: Issues that do not present an immediate threat of damage in the short term if left unaddressed.
2. Planned maintenance.
3. Customer orders of a new installation.

Among these categories there are roughly 180,000 cases annually and about 25% of these, i.e 47,000 are non urgent issues. All three categories rely heavily on manual processes. In this report the first case of maintenance, where non urgent issues are identified by someone in the client's organisation, will be investigated. It should be noted that, although this is a fairly common process, it is subject to particularly high demands in the case organisation. For instance, faults such as malfunctioning automatic doors must be addressed immediately to avoid creating bottlenecks within the hospital. The process in general terms is described below.

When a problem occurs, a staff member from the client's organisation sees the issue and either calls customer service or writes a report on what the issue seems to be. The customer service in the maintenance team then reads the report and tries to diagnose the underlying technical cause. This includes deciding from which area the specialised professional (electrician, HVAC technician, etc.) should be sent to address the fault. A complicating factor in this process is that the report writer, i.e., the person from the client's organisation, often lacks the technical understanding or does not know what the underlying cause is, leading to insufficient descriptions. The reader from the case organisation's customer service therefore has to interpret and guess the underlying issue and what profession is best suited for the problem, which sometimes leads to miscommunication. Customer support does not create a new report, but instead reviews the client's report, adds relevant information and assigns it to the responsible team.

The report is then placed in a watch list from where the service team can pick the reports. The service team reads the report and determines the necessary actions. The process for how cases are prioritised is not explicitly documented. Most of the time a team from the case organisation is sent to address the problem. However, in some cases the issue could be of a different character resulting in the need for a different team. For example, this involves issues covered by warranty which need to be handled by an external team. When the issue has been resolved, it is reported in the system. The system used in all steps is called Facilitate and consists of both a web version, WebLord, and a mobile app, PocketLord. Among these, the WebLord version is used significantly more for reporting the various steps.

Despite the presence of various sensors in the buildings, the current maintenance and troubleshooting process remains largely manual. The case organisations have expressed interest in exploring more efficient ways of working and see potential in increased use of technical solutions. Moreover, with a high volume of cases handled annually, even a small reduction in time per case could lead to significant efficiency gains overall.

5 Results

The Results chapter follows the BPM framework, beginning with a mapping of the current as-is process in the process discovery phase. This is followed by a qualitative analysis of the process. Finally, a comparative analysis is conducted between the case organisation and three leading reference organisations.

5.1 Process Discovery, Current as-is Model

An overview of the current as-is model is shown in Figure 6. As illustrated, the process begins when an issue is detected. In most cases this happens within the client's organisation, where a staff member identifies a problem and submits a maintenance request describing the issue, its location and their contact details. There are however three other possible process starts. A technician from the service organisation may discover an issue during routine work and report it directly. A cleaning staff can email the customer service with an issue. Alternatively, the client may call customer service to report a problem. While this method is intended for urgent issues, it is occasionally used for non urgent matters as well.

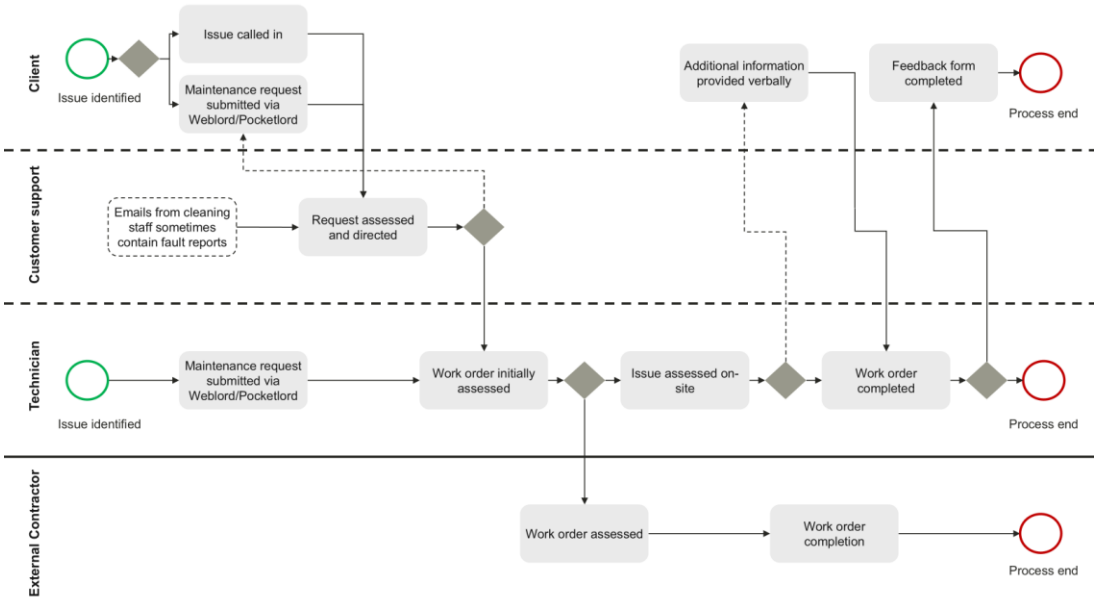

Figure 6
Current as-is model.

Once a maintenance request has been submitted, it is reviewed by the customer service team, who interpret the issues and direct the issue to a team of technicians. The work order is then placed in a watchlist queue, where the different technicians can sort the watchlist based on geographical area and competence. A technician eventually picks a work order and assesses the report. If the technician determines that the issue falls within the scope of the internal team's capabilities, it is resolved internally. If not, the order is sent to an external contractor. When the work is completed, the case is closed and an update with a feedback form is sent to the client's organisation.

5.1.1 Problem Detection and Filing a Maintenance Request

As stated earlier, the process starts in one out of the following four ways:

1. Client submits maintenance requests through either Weblord or Pocketlord.
2. Client calls customer service who then writes a report.
3. A technician from the case organisation discovers a problem during routine work and creates a work order.
4. Cleaning staff discovers an issue and reports it via email to customer support who then creates a work order.

Out of the four possible starts, the client submission through either Weblord or Pocketlord is the most common one. Calling customer service should be limited to urgent cases but occasionally happens for non-urgent cases as well. Technician- and cleaning staff-reported issues are rare but are a possible starting point.

When someone in the client's organisation reports an issue and creates a maintenance request they are required to fill in several information fields in the system. Firstly the reporter has to fill in their contact details. This information is intended to help other stakeholders follow up directly with the reporter if there are any uncertainties when resolving the request. To simplify filling in contact information there is a list of pre registered contacts that can be used to autofill the contact fields, however, if the reporter is not listed, they must enter their details manually. According to the customer service, it is common for reporters to select a random name from the autofill list instead of entering their own. This leads to problems if the request has to be completed with further information and when the customer service is unable to reach the original author. This statement is also supported by multiple technicians that confirms that it is a recurring issue, making it difficult to to track down the person who submitted the request.

The maintenance request also includes a description field where the reporter is required to explain the issue. According to customer service, the quality of these descriptions varies significantly. Customer service wants the descriptions to be as informative and descriptive as possible, while still being short and concise. The current usage however, lacks a standard template and therefore leads to either vaguely formulated descriptions or too long descriptions which makes it hard to identify the real issue. One technician estimated that around 80 percent of the descriptions are unclear enough that they require a phone call or an on site visit to fully understand the issue. However, another technician did not consider poor descriptions an issue as he typically calls the report writer anyways. A third technician pointed out that language barriers between the report writer and the technician sometimes complicate understanding the issue. "*Some people write in a way that makes the problem completely unclear, not just quirky Swedish, but downright incomprehensible*" he says.

Another mandatory field in the maintenance request is the location of issue, specified using house designation and room number. According to customer service, there has recently been a new update regarding room numbers to standardise the room number used across different organisations. Ensuring that the room numbers used by the hospital align with those used by the rescue services and maintenance teams. This has

led to recent miscommunications about which room the issue actually concerns. This was also evident during a shadowing session of a technician, where the room number in the maintenance request did not match the actual location of the problem.

Another optional field in the maintenance request is the ability to upload photos. Photos are not mandatory and the feature is rarely added. However, all technicians interviewed agreed that having a photo would support their assessment of the issue, making it easier to prepare and respond effectively. The coordinator described the helpfulness of a picture using the following example.

> "*....when a customer writes 'wall needs to be filled and painted,' I assume it means an entire wall needs to be patched and then a painter has to be called in to paint the room. But once you see a picture, it turns out it's just a drill hole that needs to be sealed and then covered by a dab of standard white paint, something anyone could do. So yeah, pictures really help.*" - Coordinator.

However, when asked why photos are included so rarely, the regional manager for customer service and development explained that the previous response has been that the client's organisation believed that technicians seldom look at the images, so they see little reason in including them. A nurse from the client's organisation mentioned that she includes pictures when asked upon, but never includes them initially. When she includes pictures, it is via email to the customer service and not through the system. Both a technician and coordinator believe the primary reason for so few pictures is a system barrier. They described the web based platform, weblord, as unintuitive and difficult to use when it comes to attaching images. The coordinator even admitted that, despite multiple tries, he still does not know how to upload photos through the system. Instead, he uses the mobile app, pocketlord, to attach pictures directly to the work order. However, Pocketlord has its own usability issues. None of the participants in this study use the app for anything other than uploading photos to work orders.

Another system related challenge highlighted by the nurse during the reporting stage is the difficulty in knowing where to direct maintenance requests. Property related issues are meant to be sent to the case organisation, while requests concerning medical or technical equipment should be forwarded to other specific suppliers. This division of responsibility creates confusion, especially in borderline cases. As the business developer explained, the maintenance of a lamp, depending on the use case, should either be sent to the case organisation or the supplier of the medical equipment. If it is a normal lamp, then it is a case for the case organisation, however, if it is a lamp used for specific cases, for example providing light during surgery, it is supposed to go to the medical equipment supplier.

To help the clients organisation avoid miscommunication or report the same issue twice, the nurse says that her department has initiated a physical cover with all the maintenance requests printed in the reception to keep track of all the issues being reported. According to her, it is not visually easy to see the already reported issues from the clients perspective in the digital system and that they use this paper based system because of its user friendliness.

To keep track of all issues reported in their department, the nurse says that it is typically the same person reporting all issues. In their case, the receptionist has unofficially taken

on this role, acting as both the reporter and a point of contact for technicians when follow up is needed. This receptionist is so confident in the role that he often attempts to diagnose and resolve minor issues himself before submitting a request. While this level of initiative is somewhat unique, the coordinator noted that they frequently see the same names appear on the systems watchlist, suggesting that several departments across the hospital have their own go to person responsible for reporting issues.

However, this structured approach is not consistent across all hospitals. Technicians at another facility reported that they do not experience the same pattern, highlighting that the example with the receptionist may be an exception rather than the norm. In general, those assigned to submit maintenance requests often lack both the technical expertise and the time required to provide clear and accurate issue descriptions. This contributes to the ongoing challenges technicians face when trying to assess and resolve problems efficiently.

5.1.2 Categorisation and Assignment by Customer Service

The next step in the process is categorising the issues which are managed by customer service. Although the unit handles a variety of tasks, the fault handling process is their primary responsibility and occupies the majority of their workday. They work within the system Facilitate, where maintenance requests submitted through the web, Weblord, and the mobile app, Pocketlord, are collected. Customer service is divided into smaller teams within the region, each division responsible for one geographic area.

When a maintenance request comes in, it follows a partly standardised format since Weblord requires certain fields to be completed by the customer. Customer service reads the description. If the information is clear enough, they add details to the request before it is converted into a work order and forwarded to a technician. If not, the request is sent back to the customer for clarification. The details that customer service adds include installation type, type of work, work group, and priority. The installation type refers to the kind of system the fault relates to, such as ventilation, plumbing, or electricity. The type of work specifies the nature of the task, whether it is corrective (fault repair), preventive maintenance, or a customer initiated request, and also determines who is responsible for payment and invoicing. The work group is added to make sure the right technician handles the issue. There are 14 different types of work groups, spanning from electricians and plumbing to energy and environment.

The priority is also set by customer service and refers to how quickly the technician should handle the work order. The three different levels of priority are emergency, urgent and ordinary and can be seen in Table 3. Emergency work orders are issues that must be handled immediately, for example, a leaking pipe. Urgent work orders are rarely assigned by customer service. *“We use it if we want to speed things up and draw attention. But not as urgent as an emergency work order,”* one operator explains. Ordinary priority is what most faults are categorised as. When asking about prioritisation in the interviews, a conflict between technicians and customer service becomes evident. As mentioned earlier, customers can report faults by phone. If the issue sounds like it would correspond to the emergency priority, it is also assigned such by customer service. However, once the technician arrives, it may turn out not to be that urgent. This can cause tension, where the technician feels customer service has chosen the wrong priority.

Level of priority	Level of urgency	Agreed Response Time from Request to Start
1	*Emergency*	One hour
2	*Urgent*	One workday
3	*Ordinary*	Five workdays

Table 3
Agreed Response Time Goals Between the Case Organisation and Its Clients

As mentioned earlier, once the requests are categorised by customer service and assigned to the right work group, they are converted into work orders and made visible to the technicians. In addition to details about the fault, the work order also specifies who is responsible for covering the repair costs, based on the type of work.

During the observation, it was clear that customer service worked in a structured and efficient way. Assessing incoming requests is their top priority. When the incoming request page was shown, the oldest request was 20 minutes old, which matched the time we arrived. When asked if this was typical, they explained, "*When we get to work, there can be a lot of issues reported during the night. But during the day, it's rarely more than 20 requests in the queue"*. It also became clear that different customer service centres within the organisation likely work in different ways. The larger the facility they are responsible for, the more important it becomes to make sure maintenance requests follow the set standard. As a result, service centres for larger facilities are stricter and send requests back more frequently to the customer if key information is missing. In contrast, service centres for smaller facilities may allow those requests to be converted into work orders anyway. According to customer service, this is because in smaller facilities, technicians often know the customer personally and the distance to the fault is usually quite short which creates more flexibility. In larger facilities, the process needs to be more structured and standardised. Otherwise, the work orders take too long to complete.

One point raised by the business developer is that customer service assesses incoming maintenance requests to the best of their ability. However, they often lack the technical competence and specific industry knowledge needed for accurate evaluation, a fact acknowledged by both the business developer and the customer service team. While the job description for customer service does not formally require technical expertise, their responsibilities often demand a basic understanding of the field. They are responsible for categorising requests and assigning them to the correct workgroup, identifying the type of installation, and type of work, all of which ultimately influence how the job is handled and who is invoiced. Without sufficient technical insight, these decisions can be challenging to accurately make.

According to the business developer, the first thing technicians typically do is verify whether the request has been correctly assessed. It is not uncommon for them to find misclassifications, a point partially supported by technicians. However, customer service states that they rarely receive feedback on whether their assessments are accurate or not. As a result, they assume that things are working smoothly. Technicians,

on the other hand, do not identify it as a major issue. They note that the written request often does not reflect the actual work required anyway. Therefore, they routinely conduct their own assessments on site and adjust both the work type and billing details when completing the order.

5.1.3 Job Selection from Watchlist and Resolving the Problem

The next step in the process is work order selection and execution. Through interviews and observations with technicians, it has become clear that many have their own way of working. While the process allows for some flexibility, especially during execution, the lack of standardisation in how jobs are selected suggests that the organisation may not have a clear view of what the best approach actually is. At the same time, many technicians value the freedom to work in their own way. By observing the process from job selection through execution and closure, and linking it to the earlier steps, it becomes clear that several issues in the process become visible here. However, some of these problems may not originate in this part of the process, but rather be consequences of earlier shortcomings.

For the technicians, the process starts with selecting a work order from the list assigned to their work group by customer service. Some technicians choose a set of issues they believe will correspond to a full day's work and then head out immediately to take photos and get a better understanding of the problems than what is possible to read from the description. Even though the descriptions might have sufficient information, there is also a lack of trust from technicians towards the customer which is another reason to inspect the issue in person before starting the job. It can also be a matter of what is convenient. If there are a lot of issues geographically close to each other there is a stronger case for working in this way compared to if the issues are far apart. Technicians may also prepare work orders that a colleague will handle later.

> One technician explains *"Or if you're already nearby, working on something else, you might as well go there, take some pictures, and update the case in the watchlist so the next person knows what needs to be done when they get there."*

When selecting work orders, technicians always make an estimate of how long each one will take. To work efficiently, they try to fill up their day so that all work orders are finished by the end of the shift. Ideally, they finish one just before lunch and start another one right after.
In addition to the estimated time, other factors also affect how work orders are selected. In some cases, the department where the fault is located can influence whether a technician chooses to take the job. In one interview with a technician, it was mentioned that there have been cases where a technician had to visit the same department four times on the same work order without even finding the right person or the correct room. Such incidents have led hospital departments to become unofficially blacklisted in the service organisation.

> *"You know that things haven't worked well in that department before, so of course you hesitate to go back. There's a real risk that jobs in that department end up being handed over to an external contractor instead."* - Technician.

During one of the observations, participation in completing a work order provided valuable insights. Several of the issues raised in the interview also became visible and easier to understand during the observation. When the technician arrived at the department, the room number in the work order turned out to be wrong. Time had to be spent finding the person who had reported the issue. Not only was the location incorrect, but also the task itself. The work order said "*move one curtain rod*," but after talking to the staff, it turned into "*move two curtain rods and hang up curtains.*" During the observation, it was clear that the customer did not see this as a disruption in the process, but for the technician, the job became much larger than expected.

> The technician emphasised that *"Many technicians have told the customer that they only do what's written in the description on the work order, but I care about keeping the customer happy so I usually do what they want or follow their specific requests."*

In an interview with a technician at another hospital, he explains that they face the same issue with customers bringing up additional tasks once the technician arrives. However, they have a policy of never doing this type of work. Instead, they tell the customer to submit a new maintenance request. Beyond following the plan, it is crucial to ensure that the issue is thoroughly documented and appropriately invoiced.

As mentioned earlier in the request filing step, there can be issues with reaching the right contact person when the contact details to the customer are wrong. Even when the contact details in the work order are correct, it can still be hard to get hold of staff. One technician explained that sometimes the person who files the maintenance request only works a few hours a week in that department. If the technician arrives and has questions, it can be frustrating not being able to reach the person who wanted the issue fixed.

Additionally, access to the room where the work needs to be done may also be limited. On the maternity ward, for example, a different approach is needed to avoid disturbing an ongoing delivery. Since the rooms are often occupied, the technician usually prints the work order and puts it on the door along with a phone number. When the room is available, staff can call, and the technician returns to complete the job.

When the work order is completed, the technician enters what has been done, how much time it took, and the cost of materials into the system. Some technicians close the order right away, while others do it twice a week in larger batches. Since it requires a few manual steps in Facility, closing several at once can be a more efficient way to handle it. After the work order is closed, a request for feedback is sent to the customer. This serves as input to the customer satisfaction index. However, an interview with a technician suggests that not all technicians use the feedback form. According to him, their division tends to avoid sending it if they suspect the customer was dissatisfied with their performance. Furthermore, technicians have the ability to communicate updates on ongoing cases to customers through the system. However, according to an interview with customer service, they still receive inquiries about case progress, suggesting that this feature is not used consistently.

5.2 Qualitative Process Analysis

During the process discovery and the mapping of the current as-is process, several problems were identified and brought to light by different stakeholders. These issues are summarised in the Ishikawa diagram in Figure 7 below and are grouped into four themes: *Information and Communication, Process and Method, People and Role**s*** and *System*. The issues result in delays, increased costs for the client, and indirectly, higher costs for taxpayers. This qualitative process analysis represents the third step in the BPM lifecycle and uses these four identified themes as a framework to determine the root causes behind the identified issues.

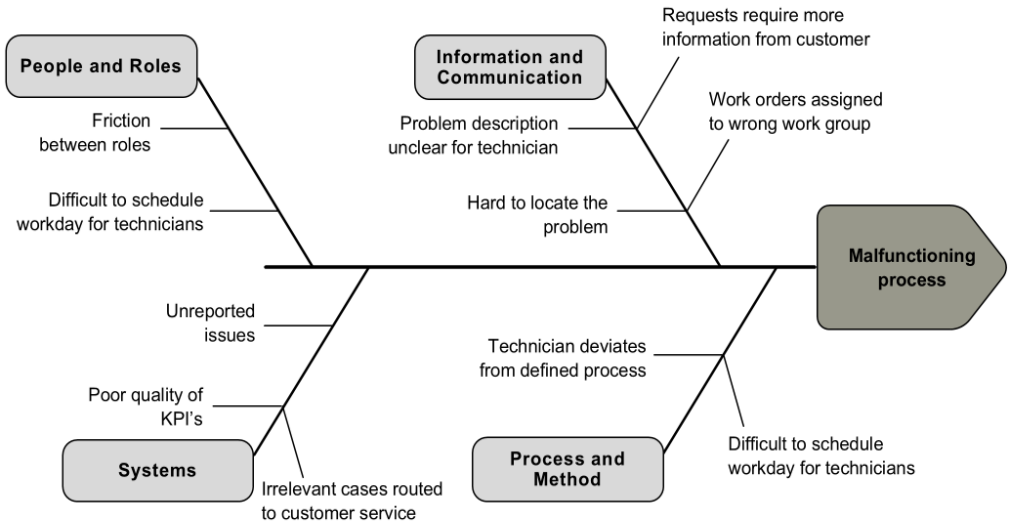

Figure 7
Ishikawa diagram illustrating the four main themes and the issues connected with each theme.

5.2.1 Information and Communication

A clear finding from the results is that the information provided by the client's organisation is often of poor quality, which frequently impacts following process steps. Inaccurate or incomplete information can cause maintenance requests to be assigned to the wrong work group, categorised under the wrong installation type, or require multiple additional on site assessments by a technician to fully understand the issue. These challenges typically result in delays and more work than otherwise would have been necessary. All issues related to information and communication are summarised in Figure 8 below.

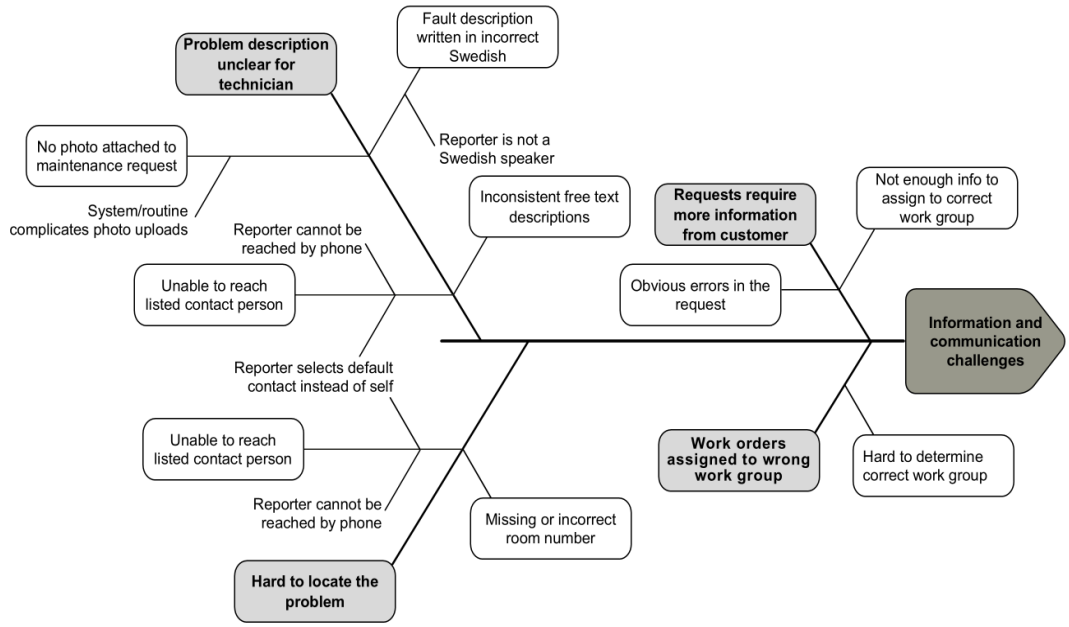

Figure 8
Ishikawa diagram illustrating root causes of issues related to Information and Communication.

A frequently recurring problem is that the technicians do not know what the issue actually is. Often they have to do an additional on site assessment of the issue to fully understand the issue and determine the necessary measures and tools required to resolve it. Sometimes, even after an on site assessment, the issue remains unclear, and when trying to reach the reporter it is not possible. Several factors contribute to this situation. First, the description field lacks a standard template and is used with a high variety of quality. Sometimes the description is too long and other times too short, in both cases they often fail to describe the issue in an understandable way, making it hard for the technician to rely solely on the description in their preparations. Another challenge is the Swedish writing in the descriptions where the grammar and incorrect word use sometimes make it hard to comprehend the meaning of the descriptions. This is most likely due to some nurses having a different native language.

Poor descriptions should typically be addressed already during the customer service step, where reports are initially reviewed and filtered. Customer service sends back maintenance requests if the information contains obvious errors such as wrong room number or contact details. Requests are also sent back asking for additional information if the description is so poor it cannot be decided to what work group it should be sent to. Despite this initial filtering, technicians still frequently point out problems with the quality of information in the orders, suggesting that the overall variation in initial report quality is even greater than what reaches them. However, the criticism of the poor descriptions and the misrouting of work orders rarely seems to reach customer service. This may be due to poor communication between the roles and the absence of a structured forum where such issues can be addressed.

In many cases, a photo would significantly have complemented the written description. A photo on its own would perhaps not have been useful, however, the combination

between a photo and the description could possibly have helped the technician understand the issue better. Thus possibly make the technician able to solve the issue without further contacting the reporter. Currently, the reason for not including photos currently seems to be a combination of a system barrier which makes it difficult to include photos in weblord, and the absence of established routines encouraging the inclusion of photos.

When the issue cannot be understood from the initial information, contacting the reporter is an option. There will always be situations where direct contact is necessary, even with perfect descriptions and supporting photos. However, reaching the reporter is not always straightforward. This is mainly due to two reasons: either the reporter is unavailable when the technician calls, or the contact information provided in the report does not match the reporter's actual details. When the reporter is unavailable, it is typically because they either do not have time at the moment of the call or are employed on an hourly basis and therefore work irregularly. In cases where the reporter's own contact details are not provided, it is usually for one of two reasons: either the reporter has been instructed to always list a standard contact person, such as a receptionist, or they select one of the pre filled contact options out of convenience or a lack of understanding of how to enter their own information.

Another issue for technicians due to poor information in the maintenance request is the difficulty to locate the issue geographically. A contributing reason seems to be the newly updated room specification. Other possible reasons include misprints or cases where the client, for convenience, only specifies the department or corridor, assuming the technician will contact them for further details. Furthermore, as previously discussed, reaching the report writer can be difficult, further complicating the ability to locate the issue when the provided room details are insufficient.

The poor information given by the clients in the reporting stage affects the technicians when they attempt to resolve the issues later in the process. First, it makes daily planning difficult. Without a clear understanding of the problem, technicians cannot accurately determine the necessary measures, tools, or materials, making it hard to plan their day efficiently. Second, if the issue is specified vaguely or incorrectly, the technicians have to assess the issue on site themselves and therefore wasting time when having to back and forth between locations. Furthermore, if they are unable to reach the reporter for clarification, a single unnecessary trip can escalate into multiple, causing even greater inefficiency and waste.

5.2.2 Process and Method

Another common source of issues relates to the process and methods used, as summarised in Figure 9 below. Mentioned in the results regarding the final process step, it was observed that technicians sometimes perform additional work that arises when visiting the customer. This is done out of goodwill and can, in some cases, be the most efficient solution for the individual work order. In many cases, it would likely take more time and resources if the customer had to register a new maintenance request, which would need to pass through customer service before reaching a technician who would then have to return to the site.

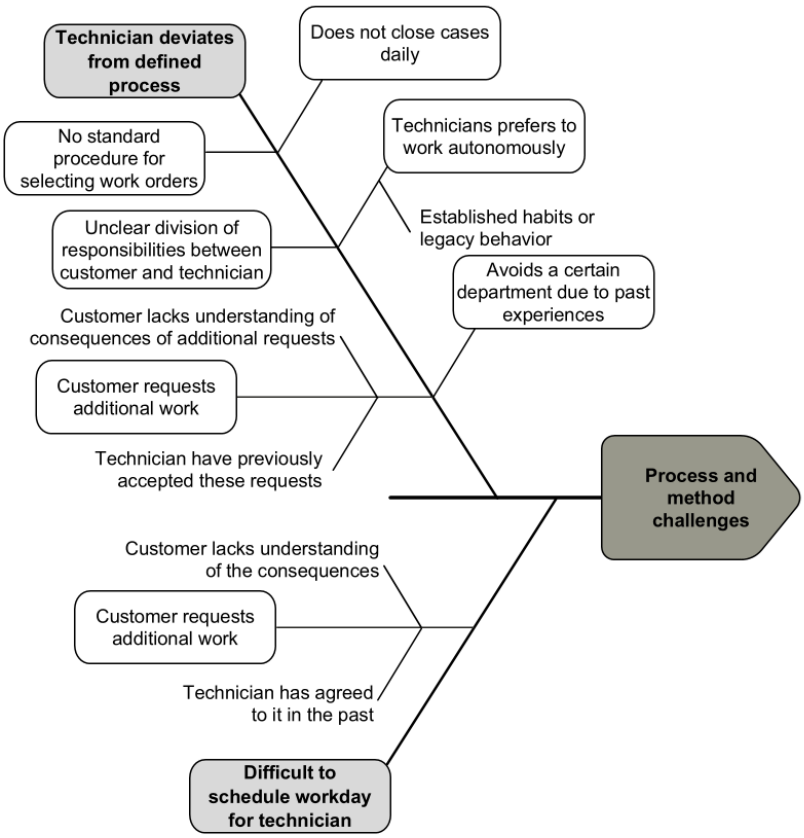

Figure 9
Ishikawa diagram illustrating root causes of issues related to Process and Method.

However, the analysis shows that one reason why customers request this additional work is a lack of understanding of how it affects the overall process. When extra work is performed, other customer requests risk not being completed as planned, and the technician's work schedule becomes difficult to follow. Another reason identified is that technicians have previously agreed to perform such extra tasks. Given this, there is both a direct negative consequence for the process when technicians accept additional work, and an indirect negative consequence where it builds expectations among customers that it is acceptable. It is therefore important that technicians follow the standard procedure in place. By doing so, a correct expectation is set and the process flow can gradually be improved, as customers also learn what rules apply.

It has also emerged that there is a desire among technicians to work autonomously, with the freedom to solve problems in the way they find best. This seems to be rooted in the fact that many technicians have learned different methods for what they consider the best way to carry out certain types of repairs. In an interview with a business developer, it becomes clear that for some types of faults, it is very important that repairs are carried out in a standardised way. This is necessary to ensure that warranties remain valid. Some training sessions have been held for this purpose but there seems to be room for improvement, especially concerning which faults actually require standardised repair procedures. This suggests that the problem might be a lack of a clear standard, rather than technicians deviating from one. Setting such a standard can help ensure that faults requiring urgent repairs are properly addressed, while still allowing room for a more

autonomous way of working in other cases, which seems to be an important factor for job satisfaction among many technicians.

As mentioned earlier, it is difficult for technicians to plan their workday when there is not enough detailed information in the fault descriptions. However, it should also be noted that there is no standardised approach for selecting work orders to make the day more efficient. While priorities do exist, the way technicians choose between work orders of the same priority is left up to each individual. The lack of standardisation is also visible in how technicians close work orders. Some close them immediately, while others do it in batches, maybe only once or twice a week. This can lead to an unclear picture of which work orders are completed and which are not, making it harder to know if another technician needs to step in and help.

5.2.3 People and Roles

In the fault handling process, there are certain steps that may lead to conflict or frustration among the participants. These issues often stem from a lack of understanding of each other's working conditions. However, by acknowledging and addressing these differences, it becomes possible to identify ways to improve the process with this in mind. The issues related to people and roles are summarised in Figure 10 below.

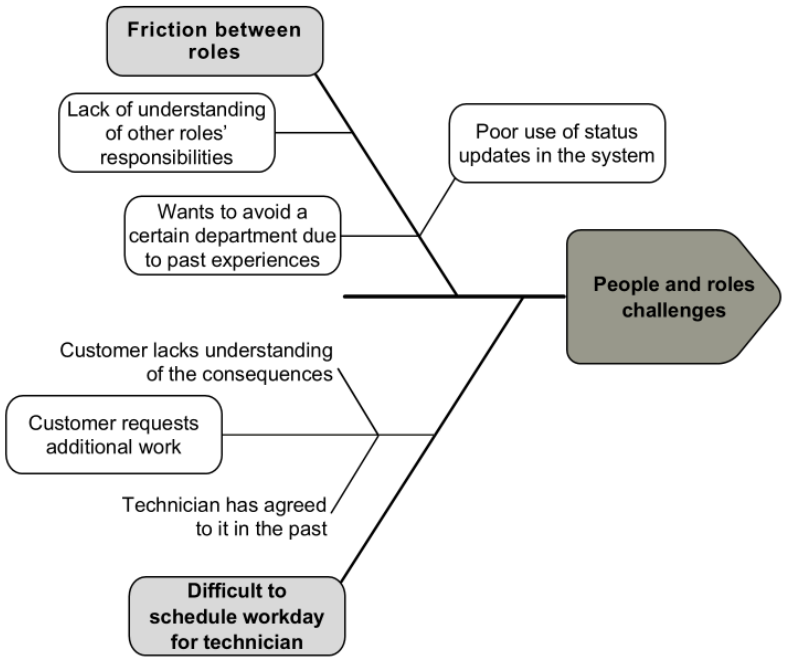

Figure 10
Ishikawa diagram illustrating root causes of issues related to People and Roles.

One issue that may cause conflict in the process is between customer service and the technicians. Customer service sometimes feels that technicians expect them to know more about the issue than they actually do. However, in most cases customer service does not have direct contact with the customer. Instead, they mainly categorise the work order or ask the customer to provide more information through the maintenance request

form. Customer service also explained that if they receive additional information over the phone, they document it in the work order. This ensures that technicians always have access to all available information. Furthermore, it should be noted that customer service sometimes finds it difficult to determine what a sufficient fault description looks like. Currently, a deeper technical competence is not part of the customer service role description. However, it could be argued that a certain level of technical understanding should be included in the role description in order to ensure that work orders are categorised more accurately.

Another point of conflict that may arise is related to what was mentioned earlier about insufficient information in the description of the maintenance request. This lack of information can lead to additional work requests from the customer. As mentioned, it is probably not ideal for the process if technicians accept these requests. However, refusing them might create a conflict with the customer, who may feel that "since you are here anyway, you might as well fix this issue". Such conflicts can escalate and lead to poor relations between the customer's department and the technicians.

5.2.4 System

Several issues that emerged during the process mapping are linked to the poor design of the system, these are summarised in Figure 11. A common comment from many participants was that the system is not user friendly, which sometimes forces users to adopt workarounds that would not be necessary if the system were better designed. In the worst cases, this can even result in issues not being reported at all. Additionally, the absence of photos in maintenance requests appears to be largely due to system limitations. With a better designed interface, including photos would likely be easier.

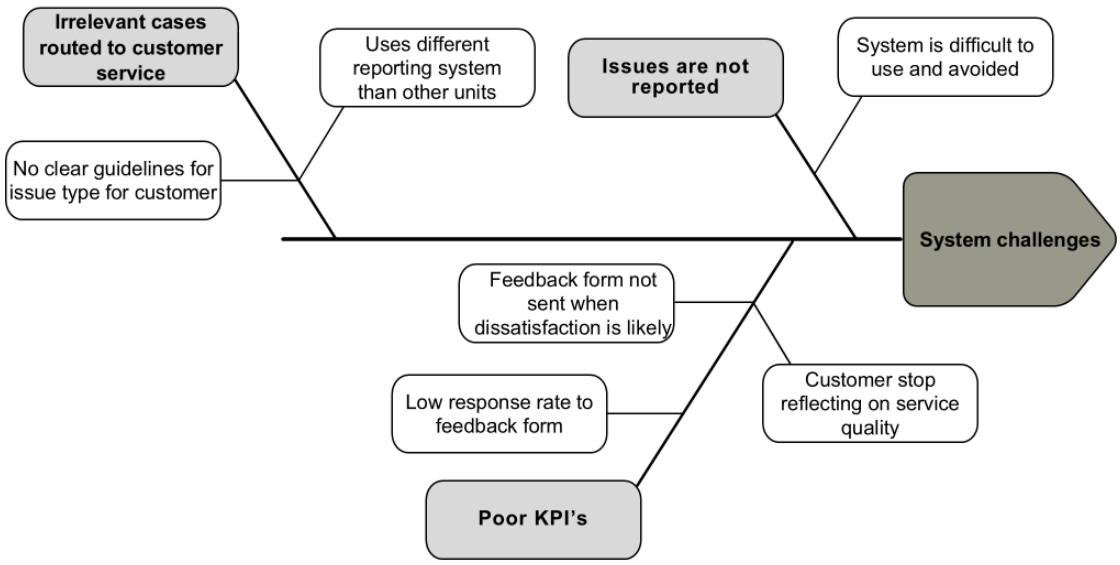

Figure 11
Ishikawa diagram illustrating root causes of issues related to the System.

Another issue raised is the difficulty for nurses to identify whether issues should be reported to the property management organisation or another technically responsible service organisation. This seems to be the result of a non existing border drawing list

that specifies responsibilities between organisations. Although this is not directly a system design issue, the use of different maintenance request systems across service organisations likely contributes to the problem. Without a shared platform or clear handover processes or a clear border drawing list, clients are left guessing where to report issues. This leads to delays, duplicated efforts or unreported issues.

A final system related issue is the KPI customer satisfaction. Although the organisation reports a 95 % customer satisfaction, several comments suggest that this figure is somewhat misleading. Instead of serving as a reliable tool to compare performance across units or areas, the KPI is compromised because some technicians selectively send customer feedback forms only to clients they believe are satisfied. If the technicians believe the clients were unhappy during their case, the feedback form is not sent to that specific client. Two additional factors contribute to the unreliability of this KPI. First, clients themselves say they rarely answer these feedback forms. Second, the business developer believes that customers have become used to a certain type of measures and no longer critically assess if they are truly satisfied. These three factors together contribute to a poor KPI with sample size not being accurate and inflated rating by default. The KPI cannot not be blamed on any single role, rather, it reflects a system failure that allows individual actors to manipulate the KPI.

5.2.6 Impact Assessment

Following the root cause analysis, an impact assessment was conducted to evaluate the potential effect of each identified issue and the benefits of addressing them. Since no frequency data of the issues was available, a Pareto analysis could not be used. Instead, a PICK chart was used to qualitatively assess and prioritise potential improvements based on perceived impact and ease of implementation. An illustration of this PICK is presented later in this subsection.

Not all identified root causes and their corresponding solutions are included in the PICK chart. Rather, a selection was made based on the estimated level of impact each root cause had on the process combined with occurrence and estimated level of ease of implementation. What makes the judgement of the estimated level of impact process difficult, is that one root cause can cause several different effects, while one effect can be the result of many root causes. Naturally, a root cause with many effects is better to treat then a root cause with just one effect, given that the effects are equally impactful. Furthermore, it is better to treat root causes rather than treating the symptoms of the root causes. However, not all effects are equally impactful, complicating the matter further.

To support this assessment, all effects, their top three primary root causes and estimated level of impact on the process are listed in Table 4 below. The level of impact on the process seen in Table 4 is difficult to determine based solely on the qualitative data. Ideally, the assessment would be based on quantifiable aspects such as frequency, cost, or customer satisfaction. However, given the available data, the impact score has been estimated based on what emerged from the interviews. Key factors include how a specific issue affects subsequent steps in the process, for example, by generating additional work and the estimated cost associated with the problem. Another important factor is how strongly the issue was emphasised by different actors. Issues highlighted

by multiple stakeholders were rated as having higher impact, whereas those mentioned by only one person received a lower score.

For example, the effect: *unclear what the problem is for a technician*, was considered highly impactful. It affects both the customer service team's initial assessment and, more critically, the technician’s ability to accurately assess and resolve the issue. The issue was also emphasised by all actors in the process. In contrast, the issue *Cases that do not belong to the organisation come to customer service* was only mentioned by one actor. Since these cases are easily filtered out by customer service, the associated cost and overall impact are considered low. A third effect, *Issues are not reported*, initially seems very serious, however, it was only mentioned once in an interview and seemed more like a speculation or rumour than a confirmed fact. Due to the uncertainty around its frequency and actual severity, it was considered a medium level of impact.

Level of impact on process	Effect	Primary Root Cause #1	Primary Root Cause #2	Primary Root Cause #3
3 (High)	**Problem description unclear for technician**	Poor information in the descriptions	No photo attached to maintenance request	Unable to reach listed contact person
3 (High)	**Hard to locate the problem**	Missing or incorrect room number	Unable to reach listed contact person	
2 (Medium)	**Technician deviates from defined process**	No standard procedure for selecting work orders	Avoid a certain department due to past experiences	Technicians prefer to work autonomously
2 (Medium)	**Difficult to schedule workday for technicians**	Customer requests additional work		
2 (Medium)	**Unreported issues**	Difficult to use system		
2 (Medium)	**Poor quality of KPI's**	Feedback form is not sent when customers are likely to be dissatisfied	Customers respond to the form to a limited extent	Used to the service, customers stop questioning their satisfaction
1 (Low)	**Requests require more information from customer**	Obvious errors in the request	Poor information in the descriptions	
1 (Low)	**Work orders assigned to wrong work group**	Hard to determine correct work group	Poor information in the descriptions	
1 (Low)	**Friction between roles**	Lack of understanding of other roles' responsibilities	Poor use of status updates in the system	
1 (Low)	**Irrelevant cases routed to customers service**	No clear border drawing list for different types of issues	Does not use the same reporting system as other technical units	

Table 4

Overview of Process Related Effects, Each Rated on a 1–3 Impact Scale and Linked to Their Primary Causes

Note. Similar or identical causes are highlighted in the same color.

From Table 4, it is seen that *Poor information in the description* fields causes three different effects: *Problem description unclear for technician, Requests require more information from customer* and *Work orders assigned to wrong work group*. This is an example of a root cause that is prioritised due to leading to multiple effects. Its corresponding solution in Figure 12 is *Improve fault descriptions* seen in the bottom right quadrant.

Another root cause that appears in multiple effects listed in Table 4 is *contact person cannot be reached.* Its corresponding solution, to *establish better routines for including contact details among request filers*, is placed in the bottom right quadrant of the PICK chart in Figure 12. Although this root cause is more attractive from an impact perspective to resolve than, for example, *poor use of status updates in the system*, which is listed as a root cause of the effect *friction between roles* in Table 4, both are included in the PICK chart. This is because the latter was selected based on its high ease of implementation, despite its lower overall impact.

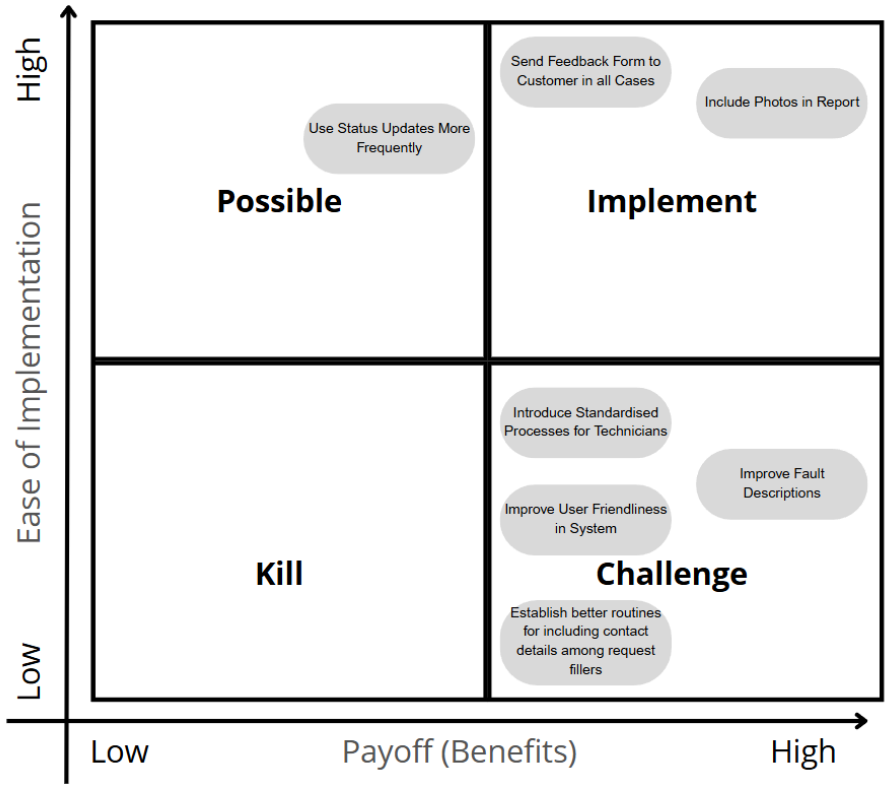

Figure 12
PICK chart illustrating perceived ease of implementation versus payoff for various improvement ideas.

As shown in Figure 12, two relatively easy improvements with high potential payoff are to include photos in all maintenance requests and ensuring feedback forms are sent after all work orders are completed. Automating the feedback process would require only a small adjustment, such as routing feedback forms directly to customers instead of relying on technicians to send them manually. Several possible solutions can make it easier to include photo attachments in maintenance requests. One short term option is to improve routines and provide training for users, in this case nurses, so they can use the current system more effectively. While this would be fairly easy to implement, it may still not be used if the photo attachment process is too complicated. Another

simple solution is to make small improvements to the existing system to allow easier photo uploads. However, the system itself is not very user friendly, and even smaller changes might be difficult without making bigger adjustments. A more complete solution could therefore be to either upgrade the system more significantly or switch to a new one that is easier to use. However, these larger changes are rarely quick fixes, they take more time and effort, even if the benefits are greater in the long run.

One relatively easy improvement with modest benefits seen in Figure 12 is encouraging technicians to use status updates more consistently. This will not impact cycle times for the process but will however impact customer satisfaction. In the challenge quadrant in the bottom right corner of Figure 12, four solutions are identified as high impact but demanding to implement. These are considered challenges because they lack straightforward fixes. Successfully addressing them will require both substantial change management efforts and technical solutions. For example, improving fault descriptions would substantially improve the process. However, there is no obvious step by step solution to improve descriptions. In particular since that step is performed by the customer's organisation. Similarly, the other three solutions in the bottom right quadrant also require additional efforts to succeed, such as system changes, revised routines, or the establishment of more structured processes.

5.3 Comparative Analysis with Leading Companies in the Industry

Following the impact assessment of the problems identified in the case organisation, a comparative analysis was conducted to explore potential solutions and best practices. The analysis focused on three leading organisations identified by the case organisation and can be seen in Table 5 below. From the analysis, three central themes emerged: *Quality of Information, Workflow* and *Digital Systems*, which form the structure of the comparison.

Organisation	**Type of Organisation**	**Type of Tenants**
Company A	Private	Residential and Commercial Properties
Company B	Public	Public Sector Properties
Company C	Public	Public Sector Properties

Table 5
Overview of the Three Reference Organisations

4.3.1 Quality of Information

All three companies included in the comparative study use free text fields for fault reporting. However, the quality of fault descriptions differs somewhat across the organisations. Company A mainly receives reports from private tenants, while Company B and Company C are public organisations where faults are reported during the workday. In Company C, faults are commonly reported by hospital staff which is a setup that closely mirrors the case organisation. Like in the case organisation, the broad

range of personnel involved in reporting leads to considerable variation in how faults are described, both in terms of detail and clarity. However, Company C does not report any issues related to language or communication barriers in the fault descriptions as the case organisation does.

The interviews suggest that Company A generally receives more detailed descriptions, and reports are also more likely to include images. One possible explanation to the more detailed descriptions is that tenants have a stronger incentive to describe the problem clearly as it directly affects their homes. This conclusion was also mentioned by respondents from the other two companies.

Company C, which shares many organisational similarities with the case organisation, is actively working to improve the consistency of fault reporting. The variation in quality is believed to be due to the large number of different individuals reporting faults at hospitals. To address this, Company C is aiming to reduce the number of people responsible for submitting fault reports. There are also plans to introduce AI based support tools to facilitate reporting and create more standardised fault descriptions. This would mean that the customer first enters free text describing the issue, and then answers yes/no questions to ensure that the fault is correctly categorised and that the nature of the problem is clear.

An early stage categorisation is already in place at Company B, however, where an external organisation performs the initial assessment. This will be discussed further in the following section but in practice, customer reported issues are matched against a list of standardised descriptions and the original input is replaced with a predefined template. This approach is generally considered helpful for technicians in understanding the nature of the fault. However, it is also noted that these templates are not always sufficient, and technicians sometimes need to contact the person who submitted the report for further clarification.

5.3.2 Workflow

All the companies included in the comparative study apply some form of internal sorting or allocation before a technician receives the fault report. As mentioned in the previous section, Company B even uses an external unit located within their clients organisation to carry out an initial assessment of the issue. This client based unit determines whether the responsibility lies with Company B or with the tenant. This assessment is based on a predefined border drawing list in which different types of faults are registered. The list includes both a standardised fault description and information on who is responsible for addressing it. This helps ensure that only faults that fall under Company B’s responsibility are passed on to their customer service.

In Company A, there is a customer service function that operates similarly to the one in the case organisation, particularly in how it sorts incoming requests and follows up for additional information when needed. What differs, however, is that cases are forwarded to a property caretaker responsible for the specific building. This person is able to resolve simpler issues but lacks technical expertise. Nonetheless, they always inspect the problem on site before it is forwarded to an external contractor if that is required. As a result, any image attached by the customer may have limited importance in the process, since the caretaker could document the issue themselves before

involving a contractor. However, such images can still be helpful for the caretaker in assessing whether the issue is something they can resolve on their own. Similar to the case organisation, Company A also encounters the issue of maintenance requests lacking additional information, even after requesting it. However, what sets Company A apart is a stricter approach to handling such cases. If a customer does not provide the requested information, the request is typically closed under the assumption that the issue has been resolved or is no longer relevant. Before doing so, customer service makes attempts to contact the customer by phone at different times of the day.

In Company C, there is a centralised customer service centre that assigns a priority level to each fault report, similar to the process in the case organisation. The case is then forwarded to a work group. Once received by the group, the case is reviewed collectively and distributed among team members. During the interview, the company described a clear team structure in which members collaborate to handle incoming work orders while also allowing room for individual autonomy in managing assigned tasks. Roles are often distributed within the group so that technicians with specific expertise take on the types of faults they are most skilled at resolving. The interviewee emphasised the importance of well functioning work groups with a strong sense of team spirit in order to achieve an efficient fault handling process and also to keep personnel in the organisation. Overall, Company C uses a similar approach as the case organisation, but its greater perceived success may be due to cultural factors rather than differences in the process itself.

5.3.3 Digital Systems

All companies included in the comparative study use digital platforms and CRM systems similar to those currently in place at the case organisation. However, what differs is the extent to which these systems are integrated into the rest of the organisation and how easy they are to use. At Company C, which shares the most similarities with the case organisation, customers report faults through the same form used for ordering food, extra cleaning, and other services. This may lead to greater user familiarity with the platform, resulting in better usage and higher quality in the information being submitted.

At Company A, observations of the customer service team revealed a largely similar division of roles and responsibilities compared to the case organisation. However, the use of a more modern and user friendly software system appeared to enhance efficiency and ease of use for staff. This system is also undergoing updates to support future AI based functionalities. One such initiative is the development of a chatbot designed to filter incoming requests, ensuring that only relevant issues reach customer service. Currently, many requests are submitted that could be resolved by information already available on the website. The goal of the chatbot is to reduce the burden on customer service while improving the quality of the handling of cases that do require manual attention. As mentioned earlier in the subsection 4.3.1, Company C has similar plans on such a service in their fault reporting process, where customers are guided by yes/no questions to a more accurate fault description. While this is not exactly the same as a chatbot on a website, the underlying idea is similar, which is to use AI to improve the quality of incoming requests.

Company C has also begun experimenting with QR codes attached to new installations as an improvement of the existing labeling system. These labels, which indicate the responsible service organisation are color coded by the organisation to help clients quickly identify who is accountable for each installation. The QR codes serve as a support tool for the technicians and can be scanned to access operating instructions. The aim is to give technicians immediate access to relevant information on site, rather than having to search through the system manually. Exactly how these QR codes will be used in the future remains to be seen, as the initiative is still in its early stages. Nevertheless, it reflects a forward looking mindset within an organisation that already appears to have a well functioning fault handling process.

6 Discussion

The following chapter discusses the key findings of the study in relation to the theory. It aims to reflect on the process differences observed between organisations, the specific challenges of working in a public sector context, and the applicability and limitations of the BPM framework. The chapter concludes with a section on future research and limitations.

6.1 Understanding Process Differences in Similar Organisations

As outlined in the background, most things in life can be understood as a process, a series of activities that deliver a specific output. However, while all processes share this basic structure, they are often designed and executed very differently. Even in this study, where both the case organisation and the reference organisations are in the same industry and provide the same service, differences in the processes were observed. Such variation is largely explained by contextual differences between the organisations. For example, Company B conducts their initial assessment by a service organisation embedded within their clients organisation. While this setup simplifies for Company B, it is arguably less cost efficient when considering the full end-to-end process. Although processes are context dependent and difficult to generalise, comparing and analysing them can still yield valuable insights.

While the overall process follows a linear and repeatable structure, the way technicians select and resolve issues often require specific decisions. This is due to vague or inconsistent information as well as the absence of clear standards for how the activity should be performed. This is not unlike the case described by (Teixeira et al. 2024) where activities in their as-is process were characterised by ad hoc decision making. In their case, the implementation of automation helped transform the process into a more standardised and structured flow, ultimately improving efficiency. However, in the case organisation, introducing standardisation is more complex. Not all variation is necessarily bad. However, the current variation appears unintentional and uncontrolled. Introducing standards in the technician's work could therefore enable consistency and increase efficiency. It could also create a foundation for improvement. In an ideal world, the use of standards will not eliminate necessary flexibility but rather eliminate unnecessary variation.

The case described by Venkatraman and Venkatraman (2019) shows similarities with the process of the case organisation, as both are fault reporting processes. In their study, the process is improved by eliminating an activity in the process. While this simplification led to significant efficiency gains in their context, such a change is more difficult to implement in the case organisation. Each of the process steps, reporting, categorising and resolving the issue are most likely needed due to technological conditions in both the case organisation as well as in the customers organisation. As a result, a process redesign in this context would be better suited for a heuristics approach, suggesting an incremental improval rather than a product based redesign (Dumas et al., 2013).

6.2 Public Sector Specific Challenges

While the BPM initiative based on the first four phases shows promise, the upcoming implementation phase for the case organisation will be critical. As noted by Fernandez and Rainey (2006), driving change in the public sector is typically more difficult than in the private sector. To better understand the factors that may complicate implementation, valuable insights have been noted throughout the project that offer potential relevance beyond the specific case studied. The following section discusses insights from the case that reflect challenges in public organisations.

6.2.1 Siloed Thinking and Inter Organisational Challenges

Gulledge Jr and Sommer (2002) highlights that a typical public sector related challenge is that public sector organisations often operate in siloed departmental structures that lack overarching understanding of each other's tasks. This challenge was also evident in the case organisation where the different roles often lacked insight on what impact their work had on others. For example, customer service occasionally misdirected work orders to the wrong work group, however, often unknowingly and without receiving feedback to prevent future errors. Communication between different roles seems to be limited to the official work order system. As a result, customer service worked independently of both customers and technicians, while technicians similarly worked in isolation, interacting with customers only when the nature of the issue was unclear. This fragmented structure is reflected by the irritation between roles. To address such challenges and better prepare for process oriented change, Gulledge Jr and Sommer (2002) recommends shifting focus from the siloed thinking towards the specific process and a shared responsibility for achieving an outcome together.

What complicates this further however, is that the siloed thinking is not just in the case organisation, but in their clients organisation as well. This impacts all of the subsequent steps of the process. It is evident that the client's organisation does not understand, or in some cases does not prioritise how their behaviour and information impacts the process in general. A recurring issue is that customers ask the technician to do more tasks than described in the maintenance, simply because the technician is already on site. What the clients fail to understand is that if the technician chooses to fulfill the client's request, it impacts the technician's schedule and might affect another client. These issues may stem from the fact that the case organisation is not a profit driven company, while the client organisation is understaffed and lacks cost awareness.

Another customer related challenge is that it sometimes seems as if the client's organisation lacks interest in getting things fixed, at least on an individual level. This is particularly noticeable when comparing the quality of problem descriptions in maintenance requests between tenants of all public sector properties and the private residential properties. Residents in privately owned properties tend to demonstrate a high level of ownership, submitting detailed descriptions, often with supporting photos. In contrast, tenants in public sector properties frequently provide vague or incomplete descriptions and rarely include photos. This indicates lower investment and ownership of a resolution as well as a less eager to actually solve problems in the property. The lack of ownership from the client's organisation might complicate the process implementation phase substantially if they are part of the intended solution.

6.2.2 System Challenges

The process implementation phase in the public sector is not only challenged by organisational factors hindering change. Gulledge Jr and Sommer (2002) brings up that public sector organisations often use old and fragmented IT systems that can challenge process automation which is a common outcome of a BPM initiative. The findings in this thesis support this view, as the case organisation experiences a fragmented system landscape with different systems in use. It is sometimes difficult to determine where information is located. Furthermore, the current system structure does not fully support basic functions, such as attaching photos, which weakens the quality of fault descriptions. Strengthening this line of reasoning further is that the reference organisation showed the same pattern, with both public reference organisations using the same system as the case organisation, while the private reference organisation used a more modern system. With the system related challenges within the case organisation, it is reasonable to argue that a process automation initiative in the current structure would, at the very least, be challenging.

Systems related challenges connected to public sector organisations might be understood through institutional logics as described by DiMaggio and Powell (1983). While private sector organisations often pursue efficiency and competitive advantage, the public sector tends to prioritise legitimacy and prioritise established norms. As a result, an outdated IT system is kept. Not necessarily because it is effective, but because its continued use aligns with expectations and reduces perceived risk. In this case, it might be a way of signaling legitimacy, even if it hinders organisational performance and limits value for their clients.

6.2.3 Change Beyond Organisational Boundaries

To successfully implement and sustain change within the case organisation, all identified issues must be addressed. Most of these challenges appear solvable through a structured change initiative. A suitable approach could, for example, be to follow Kotter's eight step framework (Kotter, 2009) and complement it with a greater focus on building external relations with political stakeholders, which is often required to successfully change public organisations (Fernandez & Rainey, 2006).

However, the most significant challenge lies outside the case organisation's direct control, namely, the siloed thinking and lack of ownership within the client's organisation. Addressing these issues would likely require broader change initiatives within the client organisation and cannot be achieved solely by the case organisation. Instead, the case organisation may need to focus on increasing either the incentive to improve the quality of maintenance requests or the ease of reporting faults, making it as simple as possible for users to submit accurate and complete requests.

Given that the current incentive, that reported issues are resolved, does not seem to be enough and alternative ideas like gamification appear misaligned with the public sector context, where legitimacy is often prioritised over innovation (Alford & Greve, 2017). Efforts should focus on simplicity. The key question becomes, how do we enable customers to report issues with as little effort as possible?

Ideally, the client would not have to report an issue at all. While technology and sensors have reached a high level, it is not sufficient enough to detect all issues, especially those that are not of a technical nature. A fault reporting process will therefore alway have to be in place, either as the main process or as a complement to sensor based detection and filing. A system that is easy to use and can increase the quality of maintenance requests seems to be a feasible and impactful improvement.

6.3 Evaluating the Use of BPM in the Case Organisation

Based on this project, it is easy to argue that a BPM initiative fits well within a public organisation. At least up until the implementation phase. One possible explanation for why BPM has the potential to work well in the case organisation is the presence of an already existing process thinking within the organisation. An important condition to successfully engage in BPM initiatives is the understanding of the business processes and what processes that are of interest to improve (Dumas et al., 2013). This kind of understanding is possessed by the case organisation as they have a clear overview of what processes they have in the organisation and how they relate to each other. However, to tell if this is generalisable in a broader public sector perspective is hard to tell. Since the fault handling process is both the main task of their organisation and it follows a linear structure, one could argue that it is more likely that the organisation is aligned on the process compared to if the process had a more ad hoc character.

Even though the process might be well suited for a BPM initiative, there are aspects that the BPM framework may overlook. One such limitation is its relatively weak emphasis on quantitative evaluation of the process. Unlike Lean which emphasises metrics like lead times and throughput times, BPM primarily relies on qualitative analysis. As a result it can be more difficult to identify bottlenecks or quantify the impact of improvements made during the implementation phase. Another challenge with the BPM framework is that its phases are relatively static and linear, which may result in a proposed to-be process that the organisation lacks the resources or capabilities to implement.

Altogether, while the BPM framework appears promising in the way it is applied in the study, it remains difficult to determine if the BPM initiative has been truly successful. Many valuable insights have been documented. The process has been thoroughly documented and analysed, which have resulted in recommendations and potential improvements. However, without completing and implementing a new to-be process that actually proves to be more efficient and sustainable over time, it cannot be known for certain that the BPM framework was in fact proven helpful. As highlighted by Armenakis and Bedeian (1999) change needs a social process as much as it needs tools and models. It therefore remains uncertain if the BPM framework, in its current form, fully accounts for social aspects to achieve lasting change in process improvement.

6.4 Limitations and Future Research

This master thesis was limited to only focus on the first three phases of the BPM framework, thereby excluding the implementation and monitoring phases and partly the redesign phase. Although the case study demonstrates the usefulness of the BPM approach in a public sector context in the first four phases it remains uncertain whether the initiative would ultimately lead to measurable improvements. Without insight into

how a redesigned process is implemented and monitored over time, it is not possible to assess the success of the initiative. Further research should therefore explore the practical implementation of processes, as well as the monitoring and control of BPM projects within the public sector context. Ultimately, it is important to understand the factors that contribute to sustained success. It would also be interesting to understand if such factors are primarily context dependent or if they can be actively influenced through specific focus areas during the change initiative.

A further limitation in this project was the reliance on an external client organisation to initiate the process. In this project, the process starts when the client reports a fault and the entire process is dependent on the input information given at the start. However, the BPM framework lacks tools and methods to drive and execute change initiatives in a client organisation on which the case organisation is dependent. This uncovered a gap in the BPM framework when applied in inter organisational settings. Future work could explore how BPM might be adapted or expanded to include strategies and tools for managing such dependencies, particularly in public sector ecosystems where cross organisational collaboration is common and challenging.

Like previous authors have concluded, the BPM framework requires adaptations to its context. It enables freedom to implement BPM in various settings but it also indicates that the BPM framework might be considered more as guidelines rather than a comprehensive framework. It might also indicate that the success of the BPM initiative depends more on who and how the BPM framework is used, rather than the actual framework.

7 Recommendations

Based on the qualitative process analysis, the comparative analysis and the discussion, this chapter presents our key recommendations for improvement. A detailed cost analysis for each proposed implementation has not been conducted. Instead, recommendations are based on a best case scenario, with a focus on initiatives offering the highest potential impact. Feasibility has been considered through an assessment of implementation ease, taking into account both the required effort and resource demands. Ultimately resulting in the three recommendations:

1. *Implement a Chatbot in the Maintenance Request System*
2. *Improve Work Routines and Process Standards*
3. *Increase the Quality of KPIs*.

7.1 Implement a Chatbot in the Maintenance Request System

To improve the issue of poor information in the description, the implementation of a Chatbot solution is recommended. The analysis indicates that unclear or incomplete descriptions are the primary reason technicians struggle to understand reported issues, leading to longer resolution times and higher resource use. The quality of information also affects customer service in their filtering and categorisation. As argued in the discussion, any improvement should focus on making it as simple as possible for users to submit accurate and complete requests. A potential solution is discussed in the comparative analysis, where both Company A and Company C are exploring chatbot tools to streamline their intake processes. Notably, Company C is planning a feature that follows a free-text input with yes/no questions to enhance the clarity of the report.

An AI chatbot solution is especially attractive because it could help clarify user submitted issues and even potentially identify likely root causes. Ideally, the chatbot solution would have the same function as a first on site assessment or first call, potentially eliminating the need for either and enabling technicians to proceed directly to resolution. As a further consequence and benefit, the chatbot could also take over some of the current responsibilities of customer service, such as categorising and routing cases.

Several design approaches could be taken when implementing this solution. A first option would be through complementing the free text by yes/no question based on the input. Another potential option is to complement the free text by slightly more advanced questions, such as asking for extent or quantifiable inputs, like the number of screws needed for a task. A more advanced option would be to allow users to upload photos, enabling image recognition to support the chatbot in diagnosing the issue more accurately. As mentioned earlier, a photo would in many cases help support the technicians in their assessment. Regardless of which AI chatbot solution is chosen, if any, integrating functionality that allows users to upload photos is strongly recommended, as it enhances the accuracy and efficiency of issue evaluation.

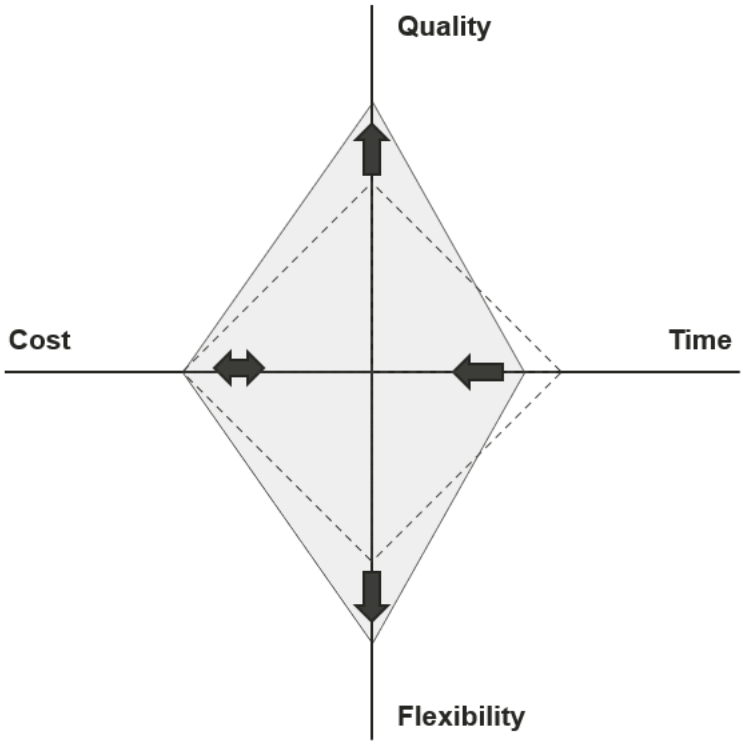

Figure 13
Devil's Quadrangle illustrating the impact of implementing a chatbot solution to improve the quality of user submitted maintenance requests.

Figure 13 illustrates the anticipated effects of implementing a chatbot solution to improve the quality of issue descriptions in the maintenance request process. The Figure highlights expected improvements in information quality, reduced resolution time and greater flexibility through the use of AI. The cost dimension is affected by a mixed impact, as the initial investment required for development may be justified by long term efficiency gains.

7.2 Improve Work Routines and Process Standards

In the findings it became evident that technicians occasionally deviate from the defined process. The underlying reasons have been discussed in the report, stemming from lack of standards in process steps, friction between technicians and customers to the fact that some technicians prefer to work in their own way. Based on the interviews conducted, we believe that in cases where standards do exist, there is greater potential to ensure that technicians adhere to them. One recommendation to support this would be to introduce a new role or assign this responsibility to an existing role, with the responsibility for overseeing the workgroup. This responsibility should include overseeing unresolved cases that require to be prioritised and also ensuring that standard procedures are followed for work orders where it is required. Additionally, this person should require technicians to handle cases even in departments where working relationships may be affected by previous conflicts.

Beyond the creation of new responsibilities, work routines could be improved by establishing a forum where technicians can raise issues they encounter in their day to day work. Instead of, for example, bad relationships with certain departments leading

to cases being outsourced to external contractors, such issues should be addressed in a problem solving context to identify how the situation with the customer can be improved. This forum could also be used to develop new standards for tasks or procedures that are currently unclear.

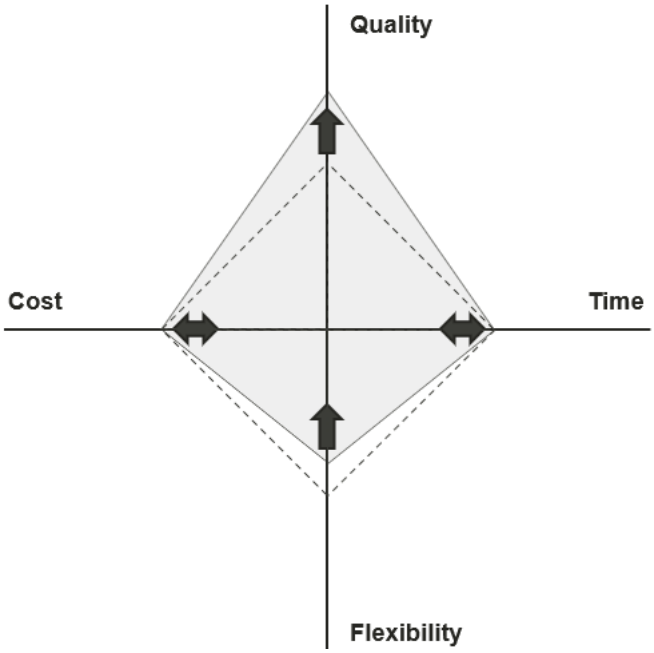

Figure 14
Devil's Quadrangle illustrating the impact of improved work routines and process standards.

Figure 14 illustrates that clearer work routines and process standards will improve the quality of the process by making the execution of tasks more consistent. Flexibility will decrease as standardisation limits how much individuals can work in their own way. The effects on time and cost are mixed, as both the creation of a new role and the introduction of a problem solving forum will require time and resources initially, but are intended to reduce inefficiencies and save both time and money over the long term.

7.3 Increase the Quality of KPI's

One recommendation that is probably easy to implement is to ensure that the feedback form is sent to all customers. Today, we found that the form is sometimes not sent when the technician expects negative feedback. This leads to skewed data, and the actual customer satisfaction KPI is likely lower than reported. To improve the quality of this KPI, the process could be automated so that the form is sent automatically when a work order is closed.

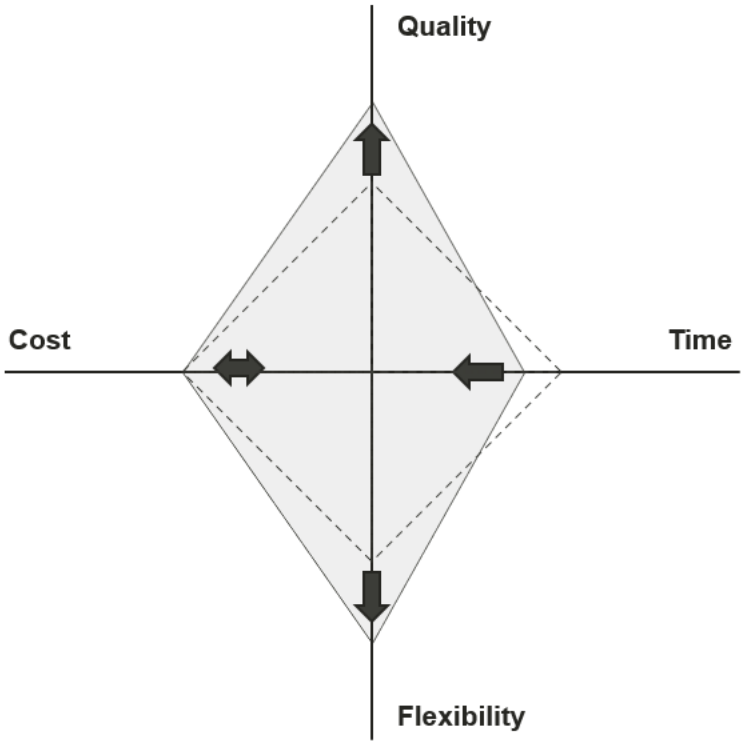

Figure 15
Devil's Quadrangle illustrating the impact of improving the quality of KPIs through automated feedback collection.

Figure15 shows how automating feedback collection will improve the quality of KPIs by ensuring that customer input is requested on all work orders. This strengthens the reliability of reported data and reduces the risk of bias. Time is positively affected as automation reduces manual handling. Cost is mixed as initial investments are required for the implementation but will hopefully make the process more efficient and reduce cost long term. Flexibility is slightly improved as more reliable data supports better informed decisions.

8 Conclusion

The study aimed to examine a fault handling process within a public property management organisation and explore how it could be improved through the application of the Business Process Management (BPM) framework. To support the analysis and strengthen the recommendations, insights were gathered from three leading organisations in the industry. To guide the study and fulfill the aim, the following three research questions were formulated:

RQ1: How is the fault handling process structured within a public property management organisation, and what are its main challenges?
RQ2: How does the current process compare to practices observed in leading organisations within the industry?
RQ3: *What contextual factors influence the applicability and effectiveness of Business Process Management (BPM) in public sector organisations?*

The results show that the process of the case organisation is structured around three main roles: the customer who submits the maintenance request, the customer service team responsible for creating, categorising, and routing work orders to the appropriate work groups, and finally, the technician who assesses and resolves the issue. Based on the analysis of the inefficiencies in the case organisation, the problems were grouped together in four different themes: *Information and Communication*, *Process and Method, People and Roles* and lastly *System*. Among these, it became particularly evident that many of the issues faced by customer service and technicians stem from the poor quality of the descriptions in maintenance requests. Addressing this issue requires a solution that simplifies the process for clients to submit accurate and complete maintenance requests, especially since initiating large-scale changes within the client's organisation may be difficult for the case organisation to influence directly.

The three reference organisations demonstrated similar processes for their fault handling process. However, each organisation had slightly different attributes and features in their respective process. What stood out the most was the problem descriptions in the maintenance requests at the private company A, which manages both commercial and residential properties. The tenants of company A demonstrated a stronger sense of responsibility for resolving faults, which was reflected through their detailed fault descriptions and willingness to include photos. The analysis suggests that this higher level of engagement is likely because the issues directly affect tenants' homes. Another thing that stood out was that while all organisations used a single system to manage maintenance requests and work orders, the system used by the public organisations, including the case organisation, appeared less user friendly and poorly integrated with other internal tools. Compared to the frictionless experience observed at the private Company A, the public system's limitations, such as weak photo support, contributed to the need for workarounds.

The system differences highlights one of several differences between the private and the public organisations that might be generalisable to a broader context than this study. Such challenges impact a BPM implementation, as adoption to the specific context is necessary. While the project shows potential for process improvement through BPM, its success cannot be confirmed until a redesigned to-be process is implemented and demonstrates sustained efficiency gains. It is therefore too early to classify the initiative

as either a success or failure. What is clear, however, is that there are several differences between private and public organisations and that these public specific challenges must be addressed to successfully implement challenges from the BPM initiative. The most significant challenges of a future implementation lies in the inter organisational nature of the process, the fact that the case organisation is dependent on the client's organisation and the quality of information they provide.

In conclusion, a BPM initiative is likely to succeed in a public organisation if it is carefully adapted to the specific context. However, its effectiveness cannot be confirmed until a redesigned process is successfully implemented and sustained. In the case organisation, the greatest inefficiency stems from poor information quality in maintenance requests submitted by the client’s organisation. Addressing this inter organisational challenge requires a focused effort on simplifying and supporting the submission of accurate and complete fault reports.

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