User-Centered Dashboard Design for the Reykjavík City Service Center

by

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Abstract

Decision-making plays a vital part in the work of management. It is not enough for managers to base their decisions solely on their intuition and feelings. Managers can make their decisions based on more vital evidence with data-driven decision-making. Continuous improvements, higher transparency, increased operational efficiencies, and increased competitive advantages are examples of data-driven decision-making benefits. This project aims to design and develop an interactive performance dashboard for the Reykjavík city service center to aid in such decision-making. The design process consisted of user-centered design for an interactive system, according to the ISO 9241-210 standard. User-friendliness was a number one priority during the process, so the design was centered around the users. The dashboard contents, including performance metrics, key performance indicators (KPIs), and targets, play a critical role in the dashboard design. A structured survey was conducted. At larger service centers in Iceland, the goal was to gain insight into their working practices to acquire a better basis for determining the contents of Reykjavík's city service center dashboard. Design is all about usability—so the dashboard evaluation was conducted through usability testing. The usability test results revealed a successful implementation of the performance dashboard at Reykjavík's city service center.

Keywords: Business Intelligence, Business Performance Management, Data-Driven Decision-Making, Interactive Performance Dashboard, Key Performance Indicators, Usability Testing, User-Centered Design

Notendamiðuð mælaborðshönnun fyrir þjónustuver Reykjavíkurborgar

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Útdráttur

Ákvarðanataka gegnir mikilvægu hlutverki í starfi stjórnenda. Það er ekki nægjanlegt fyrir stjórnendur að byggja ákvarðanir sínar eingöngu á eigin innsæi og tilfinningum. Með gagnadrifinni ákvarðanatöku geta stjórnendur byggt ákvarðanir sínar á sterkari grunni. Stöðugar endurbætur, aukið gagnsæi, meiri hagkvæmni í rekstri og aukið samkeppnisforskot eru allt dæmi um ávinning gagnadrifinna ákvarðanatöku. Til að styðja við slíka ákvarðanatöku er markmið þessa verkefnis að hanna og þróa gagnvirkt árangursmælaborð fyrir þjónustuver Reykjavíkurborgar. Hönnunarferlið samanstóð af notendamiðaðri hönnun fyrir gagnvirk kerfi samkvæmt ISO 9241-210 staðlinum. Í gegnum ferlið var notandinn útgangspunktur hönnunarinnar. Innihald mælaborðsins samanstendur af árangursmælikvörðum, helstu árangursvísum og markmiðssetningu þeim samfara. Þessir þættir gegna veigamiklu hlutverki í hönnunni. Könnun hjá stærri þjónustuverum á Íslandi var gerð með það að markmiði að fá betri innsýn inn í starfshætti þeirra. Niðurstöður könnunarinnar voru hafðar til hliðsjónar við ákvörðun á innihaldi mælaborðs þjónustuvers Reykjavíkurborgar. Við mat á árangri mælaborðsins var notast við nytsemisprófun þar sem notagildið er í brennidepli allrar hönnunar. Niðurstöður nytsemisprófunar leiddu í ljós árangursríka innleiðingu á frammistöðumælaborði hjá þjónustuveri Reykjavíkurborgar.

Efnisorð: Viðskiptagreind, Árangursstjórnun, Gagnadrifin Ákvarðanataka, Gagnvirkt Árangursmælaborð, Helstu Árangursvísar, Nytsemisprófun, Notendamiðuð Hönnun

This thesis is dedicated to the memory of my big brother.

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List of Abbreviations

ASA	Average Speed of Answer
CSAT	Customer Satisfaction Score
BI	Business Intelligence
BPM	Business Performance Management
FCR	First Contact Resolution
DDDM	Data-Driven Decision-Making
HCI	Human-Computer Interaction
KPIs	Key Performance Indicators
PM	Performance Management
SUS	System Usability Scale
UX	User Experience
UCD	User-Centered Design

Chapter 1

Introduction

The data volume that companies have at their disposal expands rapidly every day [1]. In 2010 the amount of data created, stored, and consumed worldwide was two zettabytes [2], compared to 64.2 zettabytes in 2020 [3]. According to Statista forecast, a statistics portal, this number will reach 149 zettabytes in 2024 [2]. Therefore, it is common for companies to lose sight of what data is and is not critical for the business. Information overload is a well-known problem that emerges from the fast-growing volume of data [4], [5]. Specific and relevant information needs to be sifted from a large amount of data available to prevent this problem and further facilitate the optimal result and, from there, provided to decision-makers [5].

Every day, managers make various decisions. Even though intuition plays a significant role in the decision-making process, it is not sufficient on its own. Managers need to have verified information [6]. The practice of making decisions based on data analysis rather than intuition alone is known as data-driven decision-making (DDDM) [7]. All decisions are based on some degree of uncertainty. The goal of the data-driven approach is to reduce that uncertainty [8].

Previous studies have shown that integrating business performance management (BPM) and business intelligence (BI) is the first step in managing an organization's performance [9]. BI and BPM help to optimize performance in terms of better-informed decision-making [1], [9]–[11]. The dashboard is considered one of the most valuable tools in BI [4], [10], [12]. When developing a dashboard, collaboration with stakeholders and user feedback is critical [13]. A valuable dashboard will help the decision-maker be more efficient and responsive by supporting the decision-making process [1], [14]. The dashboard's most important content is the key performance indicators (KPIs) [14]. Therefore, it is vital for the dashboard's long-term success that KPIs and performance metrics are selected precisely [1], [14]–[16]. Because those metrics have the potential to affect the organization's decision-making greatly [16].

As a way of delivering essential services to customers, service centers have become increasingly important. Organizations are attempting to reduce costs while also improving their customer relations [17]. Therefore, managers need to make well-considered decisions within the operation. As previously stated, information overload makes it difficult for managers to differentiate between relevant and irrelevant data.

1.1 Current Situation

Information overload is a well-known dilemma in the Reykjavík city service center. The service center's role is to provide the customer with information about the city's services [18]. The service center has four main service channels: visits, phone calls, tips, and e-mails. Unprocessed data containing information about the service center's performance is contained in separate databases for the various channels. Moreover, the service center's managers cannot comprehend all of the information included in the raw data. As a result, the managers often need to base their operational decisions on their intuition or experience. The city's service center management lacks an integrated overview that shows the operational performance of all the different service channels.

1.2 Aim of the Thesis

This study intends to introduce a real-life project. The thesis aims to design and develop a performance dashboard for the Reykjavík city service center by making the raw data readable and accessible. The design is conducted by utilizing BI and BPM practices to help to optimize performance using better-informed decision-making. As previously stated, the user's feedback is essential when developing a dashboard. Therefore, the dashboard design follows the ISO 9241-210 standard, a user-centered design (UCD) methodology for interactive systems.

This thesis follows a case-study design with an in-depth analysis of Reykjavík city's service center. When evaluating the dashboard's success, special emphasis is on usability. Therefore, usability testing is conducted according to the ISO/IEC 25022 standard. The desired result is to create a usable dashboard with the various service channels integrated. By doing so effectively, the service management can gain better insight into customer behaviors, the service provided and make more data-driven decisions to improve the service.

1.3 Thesis Structure

The thesis is structured as follows. Chapter two provides a literature review of BPM and BI characteristics needed to fulfill the project aim. Various aspects to consider regarding the design and development of a dashboard are discussed. Chapter three presents background information about the Reykjavík city service center. There the project's workflow in question is explained, and current and desired solutions are discussed. In chapter four, the thesis methodology is displayed. In that chapter, the four phases of user-centered design are further explained. Chapter five includes precise data from the various service channels, a data architecture that includes the data cleaning and data integration. In chapter six, the results from the dashboard design process are reviewed. Then lastly, in chapter seven, the discussion and future work will be presented.

Chapter 2

Literature Review

The chapter provides an overview of relevant literature and research related to the dashboard design. First, business performance management and performance metrics are examined. There follows a discussion on business intelligence and performance dashboards. Finally, the connection between business performance management and business intelligence is observed, along with the benefits of user-centered design in the design process.

2.1 Business Performance Management

Business performance management (BPM) is a group of management methods that complement one another and contribute to operational success. It is based on the notions that management is a process and there is a causal relationship that managers can influence in all operations [19]. Several definitions of business performance management have been proposed. The terms "business performance management (BPM)," "performance management (PM)," "corporate performance management (CPM)," "enterprise performance management (EPM)" are often used alternately [20]. In this project, the abbreviation BPM will be used to refer to business performance management.

Many published studies, e.g., [9]–[11], reported that BPM is a vital business initiative that allows organizations to align strategic and operational goals with business practices. It helps optimize performance by better-informed decision-making and action.

Organizations have realized the value of implementing their strategy's objectives through metrics-driven management in recent years [9]. Table 2.1 shows the steps of BPM. The implementation of business performance management begins with strategic planning [19].

Table 2.1: Steps of performance management [19]

Steps	Description	What question is answered?
Status	Where the organization is today	What is the status of the organization today?
Mission	The purpose of the organization	Why do we exist?
Values	Values that the organization works by	What do we stand for?
Vision	What the organization intends to do in the future	What do we want to achieve?
Strategy	How the organization approaches the vision and fulfills its mission	How do we approach the vision?
Goals and CSFs	Factors that the organization needs to perform well to implement the strategy	What do we need to do well?
Objectives	Measurable objectives	What is the estimated success within a certain time frame?
Performance metrics	How the organization monitors performance	How do we measure success?
Initiative	Action that needs to be taken to achieve the goals	What do we need to do to achieve our goals?
Monitoring	How the organization maintains performance metrics as a living process	What needs to be done to maintain and improve the results that have already been achieved?

Managers frequently rely on their instincts when making decisions, so intuition plays a significant role in decision-making. However, that alone is not enough; a manager needs to have confirmed knowledge [6]. The consistency of a company's strategy with information technology that supports decision-making and helps organizations achieve their set goals is critical to its success [1], [11]. Critical success factors (CSFs) are essential for the organization to achieve good results. The main focus of CSFs is on the desired outcome. Providing effective and excellent service to the organization's users is an example of a CSF [21].

The core of BPM is integrated metrics and data. It provides a measurement framework for assessing the effectiveness of management and strategic processes. Performance metrics are an essential factor of BPM. Therefore, accurate measurements are powerful tools for organizations. The right metrics accurately interpret the organization's strategy and goals in actions that employees on all levels can pursue daily [11].

Þorleifsdóttir [6] mentions three principal reasons for BPM. Firstly, measurements should meet the ethical and legal obligations of organizations. Second, measurements ensure that managers can fulfill their roles and guarantee that operations follow set goals and expectations. Finally, performance metrics can provide feedback to management and employees while improving job motivation. All of these reasons lead to improved success if done right.

In a 2019 survey conducted in Iceland [21], only 28% of respondents said that performance metrics were visible and accessible to everyone in the company. Even fewer, or 21% of companies, stated that performance metrics are precisely related to goal setting. This survey strongly demonstrated that clear, visible, and linked-to-rewards performance metrics are still in high demand in Icelandic companies.

Managers usually have the freedom to determine measurements, leading to problems because it can be challenging to determine the proper metrics and targets [6]. The implementation of the strategy is a significant challenge that businesses face in terms of success. Setting consistent performance metrics that are related to the company's overall strategy is critical. Then the importance of planning, coordination, and follow-up is paramount [21]. The three main pillars of performance management are strategy, measurements, and monitoring. There is no particular right way to implement performance management successfully; local circumstances and tasks will always affect successful implementation. Management techniques that have proven to be effective in one organization may not appeal to another organization. A balanced scorecard is implemented in some organizations, whereas project management or quality management is used in others.

Benchmarking can be helpful to gain insight into the goals and role of other institutions, domestically and abroad, at the beginning of strategic planning. This way, organizations can get good ideas with relatively little effort. However, it is essential to keep in mind that the circumstances and procedures of one institution may be different from another even though the companies in question are from the same industry [19].

2.1.1 Benchmarking

Benchmarking is one of the most comprehensive performance management methods available. Benchmarking aids organizations in identifying the most effective methods for enhancing performance and processes [22]. The benefits are gaining and maintaining a competitive advantage and finding a gap in the operation to improve performance. It helps companies evaluate performance objectively, identify areas for cost decrease, and examine whether the improvement actions have been successful. Benchmarking is the measurement tool used to identify the distance between how the company is currently performing and the desired performance [23].

External and internal benchmarking are the two most common types of benchmarking. Whereas external benchmarking is much more familiar, internal benchmarking can be extremely valuable as well [22]. A typical internal benchmark is an organization's previous year's results. In contrast, an external benchmark could be a comparison of the organization's performance against the performance of an industry leader [11]. External benchmarking can take many forms [22]:

- *Competitive benchmarking.* Also termed performance benchmarking. This tool is used to evaluate organizations' roles compared to main product and service performance characteristics. Benchmarking partners come from the same industry [24].

- *Process benchmarking.* This tool is used when the aim is to improve particular essential processes and operations rather than the business itself [24].

- *Functional benchmarking.* This tool is used when an organization compares itself to another industry with similar metrics or work processes [24].

- *International benchmarking.* This tool is used when organizations search for firms to compare themselves to in other nations, either because the strongest ones are based elsewhere globally or because there are very few benchmarking organizations in the same region capable of providing accurate outcomes [24].

2.2 Performance Metrics

A metric is a measurement of an organization's activity [11], [14]. Performance metrics should support organizations to align day-to-day activities to their strategic objectives [25]. For a real and positive effect on operating results to be possible, performance metrics need to be carefully selected. The most effective means is to measure what matters most in the company [6].

David Parmenter divides performance measures into four types in his book *Key Performance Indicators: Developing, Implementing, and Using Winning KPIs* [25]:

1. *Key result indicators (KRIs)* provide a clear picture of whether an organization is moving in the right direction at the right speed. They give a broad overview of how the organization is performing. This measure is often inadvertently defined as KPIs [25].

2. *Result indicators (RIs)* summarize the overall performance of more than one team [14] and indicate what the organization has done [25].

3. *Performance indicators (PIs)* focus on explicit activity and show an organization what actions are needed to improve performance [25].

4. *Key performance indicators (KPIs)* focus on the elements of organizational performance that are most important for long-term success [25].

David Parmenter [25] states that most organizations use an irrelevant mix of these four categories and call them all KPIs. An organization usually has many metrics but few KPIs. KPIs are generally the most critical of an organization's metrics. Metrics and KPIs are often used identically but are, in fact, different concepts. The term metric is generic, while KPI is particular [26]. It is crucial to develop appropriate performance metrics to reach and sustain customer satisfaction [27]. Measures are failing companies globally: companies use the wrong indicators, and employees often lack knowledge of KPIs [25].

2.2.1 Key Performance Indicators

KPIs are a set of measurable values focusing on the organizational performance critical for the organization's success [25], [26]. They support users to decrease uncertainty aiming to make better decisions [26]. Therefore, managers face a significant challenge when determining a company's overall performance's critical [6]. There are two crucial types of KPIs. Lagging indicators, also known as outcome KPIs, measure past activity's output; they are typically, but not always, financial. Leading indicators or driver KPIs measure activities that have a considerable impact on the lagging indicators. They measure activities in their current state, and individuals have more time to modify behavior to influence the desired outcome [11]. They measure how the work done today will affect long-term outcomes [26].

KPIs can be either qualitative or quantitative. Qualitative KPIs represent personal opinions or feelings; the best known are customer or employee satisfaction. Quantitative KPIs, on the other hand, are measurable numbers, for example, response rates [11]. Choosing the proper KPIs and the correct number of KPIs has many benefits. These include better decision-making, improved project performance, and better customer relations. It also helps to identify problem areas more quickly to act [26].

2.2.1.1 Optimal Number of KPIs

To not lose sight of what is essential, it is crucial to have few metrics and focus on choosing the right ones [6]. From a literature review, the optimum number of KPIs in organizations varies from author to author. In 1996, up to 20 KPIs were suggested [28]. This number appears to have declined over the years. In 1997, Slater et al. [29] recommended 7–12 KPIs, while in 2003, Hope and Fraser [30] as well as Parmenter [25] in 2010 suggested fewer than 10 KPIs. One approach when choosing the number of KPIs is to follow the 10/80/10 rule. The rule states that the KRIs and KPIs should amount to approximately ten each, and PIs and RIs together to 80 [25]. Research has shown that lower levels of organizations have more KPIs than higher levels. The average is 16 KPIs at the executive level and 24 KPIs at departmental and workgroup levels [11]. KPIs are often used differently in each company. Therefore, it may not be possible to transfer KPIs directly from one industry to another or between companies within the same industry [26].

2.2.1.2 Characteristics of Effective KPIs

KPIs must have an obvious purpose, be simple, and be directly related to the strategy and overall performance of the company. If they are implemented correctly, managers have the opportunity to keep their attention on the things that matter most, collect and share information systematically, and respond to results in an appropriate manner [6]. If KPIs do not assist the organization in achieving its strategic objectives, they are a failure. According to Eckerson, effective KPIs are [31]:

1. *Strategic:* The organization's strategic objectives must be involved. These objectives aim to help the company evaluate whether or not it is on track to achieving set goals. The process starts at the opposite end, with the goal or desired outcome, and works backward from there.

2. *Simple:* KPIs must be straightforward to understand. Users must know what is measured and how to calculate it. Furthermore, they must particularly understand how they can positively influence the results.

3. *Owned:* KPIs should have a business owner and a data owner.

4. *Actionable:* Users should know how to affect a positive outcome in terms of the KPIs.

5. *Timely:* Timely data is required for actionable metrics. The performance metrics must be revised regularly enough for users to react before it is too late.

6. *Referenceable:* For users to be willing to work with the KPIs, they have to trust the data. The data behind a KPI has to be clean, reliable, and discerned as accurate. Users ought to be able to read sources and the context.

7. *Accurate:* Creating performance metrics that accurately gauge an activity can be difficult. Part of the issue could be the underlying data, which frequently needs to be integrated before being displayed to the user. Users do not trust performance metrics that are built on poor system data.

8. *Correlated:* KPIs have to be compelled to impact performance in the right direction for the required outcome.

9. *Game-proof:* Users should not be able to evade the KPIs. Including employees in determining the KPIs and targets is one way to bypass this problem.

10. *Aligned:* KPIs must be aligned with the organization's objective and should not accidentally undermine one another.

11. *Standardized:* The definitions of terms in the performance metrics must be agreed upon by the users to apply an exact translation.

12. *Relevant:* When employees are first introduced to the metrics, they experience increased motivation, and performance improves. The metrics lose their effect over time, so it is necessary to refresh, revise, or discharge them.

2.2.1.3 Elements of a KPI

A KPI differs from a metric in that it involves strategic goals and evaluates performance against a goal. Because KPIs' goals describe a measurable result rather than a pure destination, they are referred to as targets [11]. It has been demonstrated that KPIs' targets should be SMART (specific, measurable, assignable, realistic, and time-related) [14], [32]. Table 2.2 presents the main elements of a KPI.

Table 2.2: Elements of a KPI [11]

Strategy	KPIs represent a strategic goal.
Targets	KPIs are metrics that track how well a company performs with its goals.
Ranges	Performance ranges exist for targets (e.g., above, on, or below target).
Encoding	Software encodes ranges, allowing for a visual representation of performance (e.g., green, yellow, red).
Time frames	Targets are given deadlines by which they must be met.
Benchmarks	Targets are compared to a benchmark or baseline. The findings from the previous year are often used as a baseline, although random numbers or external benchmarks can also be used.

Most organizations divide the target into ranges to help employees gauge their performance, with the most common ranges being above target, on target, or below target. The ranges may then be encoded into a graphical display on a dashboard or report. Organizations must have encoding consistency. Ranges that are above, on, or below goal, for example, are conveniently translated into red, yellow, and green color encodings, respectively. A threshold is the boundary line that separates the ranges. Users can easily assess the status of key business processes using threshold-based encodings. That is one of the main reasons why performance dashboards are so general.

Target time frames influence the way KPIs are calculated and displayed. Organizations frequently set annual targets for their most essential processes and programs. Many companies split time frames into intervals calculated regularly to keep workers on track to meet specific long-term targets. The origin point for enhancing performance is the KPIs' targets measured against a baseline or benchmark. Benchmarks can be either external or internal [11].

2.2.2 Service Center Performance Metrics

The service centers have become a crucial way of delivering essential service for customers. Companies are therefore trying to reduce costs and improve the quality of the communication with customers at the same time. Managers are often struggling to balance the efficiency and quality priorities of the organization [17]. The definition of a call center involves handling various types of communication in addition to phone calls. The terms "call center," "contact center," and "service center" are often used interchangeably, with "call center" being the most common [33]. Throughout this project, the term "service center" will be used.

The efficiency and effectiveness of a service center operation are measured using various performance metrics. Some of the metrics are focused on individual employees, while others are more focused on the service center's general performance. These metrics share in common that the primary purpose is to ensure that the service center achieves its targets and that the employees optimize their work potential [33]. According to the literature, frequently used performance metrics in service centers are as follows:

- *Abandonment rate.* The ratio of the numbers of calls abandoned by the customer [33]–[36].
- *Agent turnover.* Percentage of agents quitting in a specified time [34], [36].
- *Average handle time (AHT).* The average time to handle per customer per agent [33], [34], [36].
- *Average speed of answer (ASA).* The average time to answer a call [33]–[36].
- *Average talk time.* The total time customer was connected to an agent [34]–[36].
- *Average work time after-call.* The average time required to finish the work immediately after service is provided [33]–[36].
- *Cost per call.* A metric is calculated by dividing the total operational cost by the total number of calls for a specified time period [33], [36].
- *Customer satisfaction score (CSAT).* Measure how satisfied or unsatisfied customers are with the service provided [36].
- *First-contact resolution (FCR).* Percentage of customer issues resolved in a single interaction [33]–[36].
- *The longest delay in a queue.* The longest time taken before a customer receives an answer or abandons the call [33], [34], [36].
- *Percentage of calls blocked.* Percentage of customers who cannot access the service center in a given time [33]–[35].
- *Queue time.* The total time a customer is waiting in a queue before an agent answers [34], [35].
- *Schedule Adherence.* The percentage of time an agent spent working compared to the time he is scheduled to work [33]–[36].
- *Service level (SL).* The ratio of the number of calls answered within a defined threshold [33]–[35].

- *Total calls.* The number of calls made to the service center [34], [35].
- *Transfer rate.* The percentage of calls that have been transferred to another person to handle [33], [36].

Preliminary work on KPIs was undertaken by the North American Quitline Consortium (NAQC) [33]. KPIs are divided into three broad categories: service, quality, and efficiency measures. Most service measures gauge the service center's overall performance, such as accessibility and speed of answer. Furthermore, the quality measures concentrate on the actual processes of the call and resolution. Finally, the efficiency measures provide an essential view of how well resources are utilized.

The importance of service center metrics has changed a lot over the years. In 2008, average handle time (AHT) and cost per call were considered to be the most crucial metrics. Results from recent reports consider these metrics to be less important than more customer-focused measures. The Nordic respondents place the first contact resolution (FCR) rate as the most critical service center metric, following by customer satisfaction score (CSAT) [36].

2.2.2.1 Importance of Communicating the Results

What matters most is what the company does with the results of the measurements [6]. It is essential to consider different communication channels to ensure that information is received effectively and efficiently. Once the performance metrics and targets are determined, the final step is the dissemination of the results. Effective communication of results will provide a comprehensive review of the service center's performance. The communication platform must be relevant, accurate, and timely to be effective. It should provide ways to identify performance gaps, what is effective and what is not, and recommend steps to enhance the service center's performance [33].

A promising way to succeed is to respond in a timely, correct manner to events and take advantage of the opportunities created by them [6]. It must be evident how the information is presented, how frequently, and in what format. Managers need to know how well customers' needs are being served and how well their customer service utilizes its resources. It is also critical that agents receive feedback on how well their performance meets requirements and whether any changes are needed. Choosing the proper format to present the data from various charts and graphs will help make the data as relevant and valuable as possible [33].

2.3 Business Intelligence

Business intelligence (BI) is a broad concept. Therefore, it is frequently interpreted in different ways. It incorporates the processes, tools, and technology used to translate data into information, information into knowledge, and knowledge into plans that propel profitable business operations [5]. There are multiple definitions of business intelligence. The abbreviation BI will be used in this thesis to refer to business intelligence. BI continues to evolve. It transforms the way businesses operate, how people go about their jobs and how decisions are made [37]. Data warehousing, information management, and analytical business software are all a part of business intelligence [5].

It is not hard to extract data from a company's complex and large data sources. The challenging part is to make the data accessible at the right place, in the correct format, to the right individuals who will exploit and benefit from their added value [1]. BI includes two main activities: getting data in and getting data out. Getting data in usually requires transferring data from various data sources into an integrated data warehouse. That is the challenging part; it takes up approximately 80% of the time and effort and generates more than half of unexpected project costs. The problem arises from several causes, including poor data quality in the source systems, data ownership politics, and outdated technology. Organizations are paying more attention to getting data out, generally known as BI. That is where users and applications access the data and make decisions based on it. At that point, the organization realizes the total value from its data warehouse [37].

The creation, collection, and data use have dramatically changed in recent decades [5]. There is a tremendous value hidden within sets of raw data that companies have at their disposal. This information is waiting to be identified and analyzed to aid project monitoring and decision-making [1], [5]. Processes that provide knowledge to the end-users, processes for operating on that knowledge, and the right people to make decisions are all examples of business intelligence's value [5].

2.3.1 Data-Driven Decision-Making

Making decisions based on data analysis rather than intuition is known as data-driven decision-making [7]. Information and analytics have to be part of the organization's culture instead of decisions based on intuition or "gut feelings." [37]. Data-driven decision-making has numerous benefits [7]. It involves, among other things, using data to develop a more detailed understanding of the business context and potential problems [8]. According to research, the more data-driven a company is, the more profitable it is [7]. In a comparatively recent study from 2011, Brynjolfsson et al. show statistically that the more data-driven an organization is, the more productive it is. Higher asset utilization, return on equity, return on assets, and market value is also correlated with data-driven decision-making, and the relationship appears to be causal [38]. All decisions are made with some uncertainty. Being data-driven is about reducing that uncertainty [8]. BI supports three categories of decisions [39]:

1. *Strategic decisions* have broad, long-term consequences. Decisions that are infrequently made, perhaps annually. There could be decisions as to whether to launch a new product.

2. *Tactical decisions* are made more often, perhaps on a weekly or monthly basis. These could include, for example, an increase in productivity.

3. *Operational decisions* are more detailed and affect fewer people than strategic decisions. Decisions are regularly made, perhaps on a daily or weekly basis. It could be making decisions about customer complaints.

2.3.2 Information Overload

Data utility will grow to facilitate organizational operations and tactical and strategic decisions today and in the future [5]. Information overload is a well-known problem associated with the ever-increasing amount of data to be processed [4], [5]. A potential problem that can arise is that decision-makers are sometimes prevented from making the optimal decision because it does not provide them with the requisite information. Giving more information is not a solution to the problem; instead, sift out specific information to aid in making the right decision [5].

2.3.3 BI Benefits

When best practices are applied, BI has the power to change the way people work. It enables companies to compete more efficiently and effectively. It will embrace cultural change, new ways of thinking, and continuous technological innovation [37], [39]. The key to successful business intelligence has a lot to do with the organization's people, processes, and culture. Individuals that use business intelligence effectively will only add value to the organization [39].

Many benefits of business intelligence have been demonstrated, such as cost-saving. It saves time for both data suppliers and users because of more reliable data delivery. It can also provide more beneficial information and support better decisions. It will help companies achieve their strategic objectives by improving business processing and providing support [37].

As previously stated, better data access has little bearing on the company's performance. What makes the difference is how organizations use the data. BI allows people to access, interact, and analyze data to manage the operation, discover opportunities, improve performance, and operate efficiently. BI brings managers information to know what is happening in the organization [39].

2.3.4 The Most Important Factors to BI Success

Success with BI is not self-evident. Organizations are more likely to succeed when certain conditions occur. Senior management must believe in and drive BI's use; it must come from the top [37]. The first step on all occasions is to get access to the data. Improving performance also requires human interaction to analyze the data and determine actions to improve [39]. The organization, BI strategies, and effective BI management must be aligned. People, committees, and processes must be in place to support and manage BI [37]. Data architecture is the key to successful BI. Each part of the data architecture is essential. Data quality is critical [39]. There must also be a solid data system for decision support. Users will not rely on data they do not trust. A lack of high-quality data is the most common source of BI failure. Users must have the appropriate tools, training, and support for BI to be successful [37].

2.3.5 Data Visualization

Data visualization is a process of presenting numerical data in a graphical format that is easy for users to comprehend [40]. It is much easier for individuals to recall information displayed graphically. People remember approximately 10% of the information presented orally when tested three days after revelation. This number increases to around 65%, with a picture added.

In other words, the more visual the input becomes, the more likely people can recognize it and evoke it [41]. Dashboards are tools for data visualization [1]. Dashboards combine various concepts, such as scorecards, to help stakeholders and employees boost performance and make informed decisions [4]. The human brain can elaborate, develop, absorb, and interpret vast quantities of information simultaneously using visualization [1].

Fresher data, meaning real-time BI, has always been in demand. Scorecards and dashboards are becoming increasingly important elements of BPM initiatives in many organizations. These resources provide visual representations of vast volumes of data related to organizational performance. Users can quickly see how the current performance compares to the goals, targets, and past performances on a single or a few screens. BI is often rooted in business processes such as call center operations to increase organizational performance, making the analytic visible to users [37].

2.4 Performance Dashboards

Dashboards show measures or reports highly visually, presenting information from various data sources. Dashboards are created by analyzing the data and representing key measures critical to decision-makers [39]. The dashboard can be seen as a data-driven decision support system, which brings information to decision-makers. Dashboards have their function in organizational performance metrics and management [15].

A large number of published studies, e.g., [4], [10], [12], consider that the dashboard is one of the most valuable tools in BI. Effective dashboards will support decision-makers to be more efficient and responsive by supporting the decision-making process [1], [14]. The successful development and design of a dashboard can be challenging because there is no standardized framework [13], [15], [42]. It is now well established from various studies that proper dashboard design is critical because the dashboard's success depends on it [15], [16], [26], [39].

Since they are living tools, the dashboards must be adapted and updated as appropriate [13]. It is the accountability of organizations to implement decision support tools, such as dashboards. That is, dashboards are well-suited to multiple tasks performed by various users, assisting rather than hindering employees' jobs [15]. With the growing amount of data and data sources available to businesses, BI tools can be seen as critical in supporting these processes by extracting, analyzing, and visualizing data. The company's decision-makers cannot reach and comprehend all of the information contained in the raw data. So, making these data readable and accessible is one challenge [1].

To determine the effects of performance dashboards, Watson and Wixom [37] showed that a dashboard in a call center significantly increased the performance of the call center agents. The dashboard was updated every 15 minutes and was used to monitor and courage the agents.

2.4.1 Performance Dashboards Key Contents

KPIs are commonly the crucial content of dashboards [14]. Many historians have argued that it is essential to choose performance metrics and KPIs with caution for the dashboard's long-term success [1], [14]–[16]. These key metrics can influence decision-making in an organization [16].

Performance measurement is the foundation for companies to evaluate how well it moves towards its predetermined goals. It aids in identifying strengths and disadvantages and the selection of future projects to enhance the organization's success. A measurement is a tool for further effective management, with results indicating what happened, not why it happened. For an organization to obtain proper use of performance measurement, it must have the ability to shift from measurement to management. [43]. The information needed to make decisions must be formulated, accessible, and exploitable; the dashboard is one tool that can help with KPI presentation [1].

A dashboard is only helpful if the data it contains is valuable (accurate, relevant, complete, and timely). Dashboards should be simple, concise, and intuitive to use. Dashboards will likely succeed and resolve the information overload when specific visualization concepts and features are present. There needs to be a certain balance between the usability and complexity of dashboards. Unnecessary features may affect decision-making negatively [15]. Decision-makers can easily interpret and exchange data and keep track of KPIs at all times with the help of dashboards [1]. Collaboration with stakeholders is critical when developing dashboards, eliciting user feedback [13].

2.4.1.1 Types of Performance Dashboards

Performance dashboards are often categorized into three main types:

1. *Strategic dashboards* support organizations' alignment with strategic goals. Usually highly summarized and is less frequently updated. It is more likely to include global trends, external and growth measures [14]. They mainly consist of lagging KPIs used to monitor past performance monthly [11].

2. *Tactical dashboards* are intended to assist mid-level and departmental managers to enhance people's performance and processes under their guidance. These dashboards gather summary and accurate data on a daily or weekly basis [11]. It is suitable to monitor progress and related trends for strategic initiatives of the organization. It could include a critical project measured against a predetermined goal [14].

3. *Operational dashboards* are displayed regularly, perhaps weekly, daily, or near real-time basis. This type of dashboard is usually used at a department level rather than the senior executive level. The department managers use this type of dashboard frequently. So, they can discover problems and take action to fix them more quickly accordingly [14]. Front-line employees can also track and control critical processes frequently using operational dashboards [11].

The differences between these three types are highlighted in Table 2.3. A closer inspection of the table shows a specific hierarchy of an organization. The strategic dashboards are more on the executive level and are less frequently updated. The operational dashboard is often updated daily or many times a day.

Table 2.3: Comparison of performance dashboard types [11]

	Strategic	**Tactical**	**Operational**
Focus	Execute strategy	Optimize process	Control operation
Use	Management	Analysis	Monitoring
User	Executives	Managers	Employees
Scope	Organization	Department	Operational
Metrics	Lagging KPIs	Lagging and leading KPIs	Leading KPIs
Data	Summary	Summary/detailed	Detailed
Sources	Manual/external	Manual/core systems	Core systems
Updated	Monthly/quarterly	Daily/Weekly	Everyday
"Looks like a..."	Scorecard	Portal	Dashboard

2.4.2 Dashboard Layout

A well-designed dashboard that displays crucial information can assist managers in identifying issues in their business. As a result, the managers can improve the organization's performance [39]. The visual presentation of a dashboard is vital for the long-term success of a dashboard [14]. According to the literature, different users and organizations want different information [42]. It is not enough to have a good-looking dashboard. Users need to understand the information presented on the dashboards and draw the proper conclusions from it. If the goal of a dashboard is to enhance effectiveness and efficiency, the KPIs must reflect controllable factors where users can change the result [26]. Some criteria when designing a dashboard layout [14]:

- *Colors.* There is a choice of various colors when designing a dashboard. Caution must be taken not to choose too many colors, and the "wrong" colors are worse than too few colors. It is also good to keep in mind that some individuals are color blind, so it is suitable to use various shades.
- *Fonts.* It is crucial to stick with one font type and not mix several different font sizes. Too small or too large font size can make or break the look of the whole dashboard.
- *Utilization of screen real estate.* The dashboard should fit on one screen, allowing users to display all performance indicators simultaneously without having to swipe up, down, or to the sides.
- *Component placement.* When selecting the order of components on the dashboard, it is needed to ask the users about their most critical information. Arranging the most important information first, and so on. Most people read from left to right, the order of the essential components should be accordingly.

2.5 Business Performance Management and Business Intelligence

BPM and BI appear closely linked because BI is a critical enabler in BPM [10]. The first step in managing company performance is integrating BPM and BI [9]. BI often provides the base for BPM since these applications require access for planning and measurement purposes. What starts with better access to data becomes more purpose-driven when placed in the context of optimizing performance in line with the company's goals [39].

Information technologies are used to integrate BPM information into a BI system and make it available across the company. Business performance can be managed, compared, and aligned with the organization's business strategies, goals, and objectives through integration with the BI environment [10].

BI allows organizations to access, analyze, and utilize data to make better decisions. BPM aids BI in making operational decision-making more proactive and timelier and supporting a diverse set of business users [10]. Table 2.4 compares traditional BI and BI for BPM. A closer inspection of the table shows that BI for BPM is more personalized and timelier, and the users can be everyone. On the other hand, traditional BI is more conventional and relies more on historical data, and its users are typically business analysts.

Table 2.4: Comparison of traditional BI and BI for BPM [10]

Category	Traditional BI	BI for BPM
Implementation	Departmental	Enterprise-wide
Focus	Historical	Timely (right-time or real-time)
Decisions	Strategic and tactical	Strategic, tactical, and operational
Users	Business analysts	Everyone
Orientation	Reactive	Proactive
Output	Analyses	Recommendations and actions
Process	Open-ended	Closed-loop
Measures	Metrics	KPIs and performance metrics
Views	Generic	Personalized
Visuals	Tables, charts, and reports	Dashboards and scorecards
Collaboration	Informal	Built-in
Interaction	Pull	Push (events and alerts)
Analysis	Trends	Exceptions
Data	Structured	Structured and unstructured

BPM concentrates on information that BI provides. The information that reflects an organization's performance shows whether it is successful or not, and it encourages companies to enhance their performance. BPM entails processes that connect strategy to execution. Strategy (setting targets and objectives), planning (establishing initiatives and plans to accomplish these aims), tracking (monitoring actual performance against defined targets), and acting and adjusting (taking corrective action) are all used to achieve optimal performance [9].

The ability to link performance metrics to business strategies is crucial to effective BPM. Performance metrics may be considered a BI platform for automatic data exchange, analysis, and reporting. Three core deliverables should be produced from BPM. They should provide [9]:

1. Information to managers so they can understand the business.
2. Performance oversight for the managers to manage the business.
3. Performance effectiveness to allow the managers to enhance the business.

2.6 User-Centered Design

The study of how users relate to a product is known as usability [44]. Human-computer interaction (HCI) is embedded in usability by focusing on how individuals connect to computing products. HCI practice research has steadily expanded since 2012 [45].

User-centered design (UCD), which emerged from HCI, is a software design methodology for designers and developers. It helps them make an application with the needs of its user in the center of the design [44]. UCD is one of the leading design approaches in human-computer interaction (HCI) [45]. Besides, user experience (UX) summarizes the whole experience of a software product. It covers the functionality and also how delightful and engaging the application is to use. Practicing UCD will ensure that the applications maintain good usability and a good user experience [44]. Figure 2.1 shows the relationship between usability, HCI, UCD, and UX.

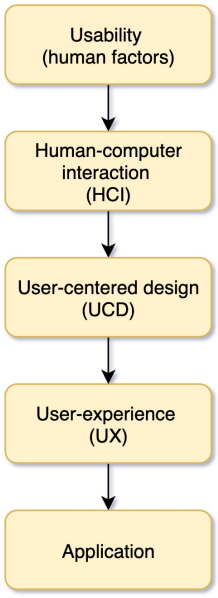

Figure 2.1: The relationship between usability, HCI, UCD, and UX [44]

According to ISO 9241-210 standard from an International Organization for Standardization, UCD is an approach to the development of interactive systems. This approach makes systems usable and practical. It is accomplished by concentrating on the users' needs and requirements. Systems designed using UCD methods improve quality, for example, by increasing the organization's operational efficiency, providing a competitive advantage, improving user satisfaction and accessibility [46]. Besides, being user-centered ensures ethics in the design process. It guarantees that the designer is truthful and open in the design practice [47].

The UCD approach increases the possibility of completing the project successfully, on time. It can reduce the risk of the project failing or being rejected by the end-users [46]. Figure 2.2 shows the interdependence of user-centered design activities.

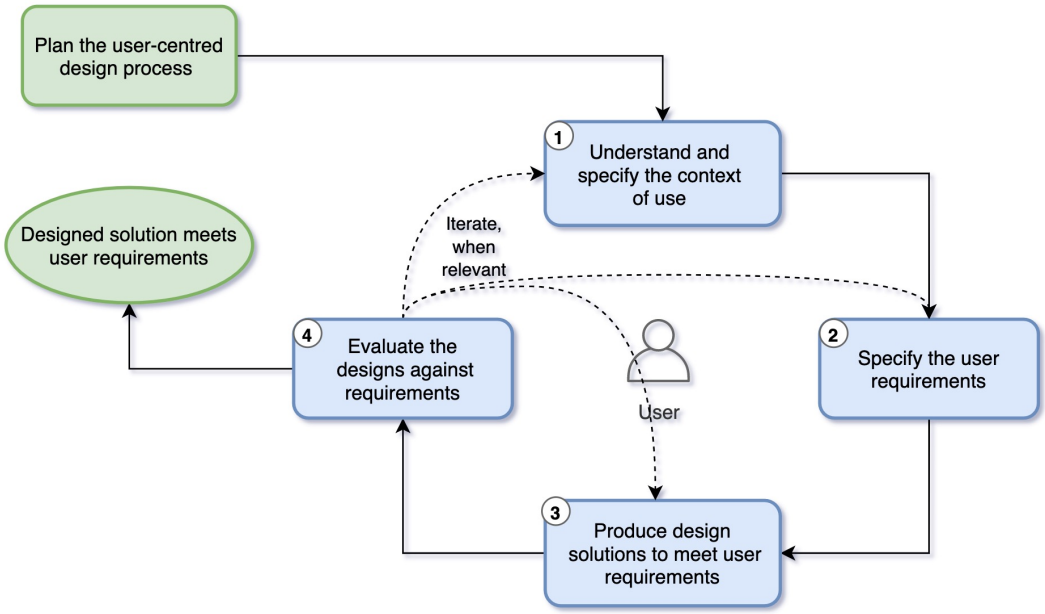

Figure 2.2: User-centered activities [46]

The process is iterative, meaning that it is possible to jump back to previous steps at every given time. The four main activities of UCD are as follows [46]:

1. *Understanding and specifying the context of use.* These factors determine who will use the product and their needs, what it will be used for, and under what circumstances [46].

2. *Specifying the user requirements.* Identify any business or user goals that must be reached for the product to succeed [46]. It is an essential part of the UCD strategy, and it set the base for the remaining steps in the process. The process insists that the users' requirements are taken and converted to meaningful needs [44].

3. *Producing design solutions to meet user requirements.* This part can be developed in phases, starting from a rough idea and processing to a finished version [46].

4. *Evaluate the design against requirements*, preferably through usability testing from real users [46].

UCD can save time by guaranteeing the users' needs are met and eliminating misunderstandings and expensive mistakes. It supports the developer to move correctly from the users' requirements to a technological solution. Combining usability, UCD, and UX ensures a complete approach to an application's development. By allowing the users to give feedback constantly, the developer can test their assumptions and guarantee to move in the right direction. UCD ensures that the designer studies how practical an application is in accomplish its designed purpose [44].

In Norman's book, *The Design of Everyday Things* [48], good design includes testing, problem area identification, and alteration. Then it is constantly retested and re-modified until resources depart. The user is always in the center of design in the UCD process. Four recommendations are provided for the design:

- Make it easy to determine what actions are possible at any given time.
- Make all things visible, from the visionary model to the results of actions.
- The present state of the system is easily accessible.
- Follow intrinsic mappings between intentions and the needed actions.

2.6.1 Usability

Good design is about usability, ensuring that the system is acceptable to the user. Therefore, it is essential to include the user in the design process [47]. Usability testing from actual users is a preferable method for design evaluation [46]. It is well established that usability testing is an essential part of the UCD process [49], [50]. For determining usability, usability testing has become the industry standard [49].

According to ISO 9241-210 [46], the degree to which specific users may use a device, product, or service to accomplish specific goals with effectiveness, efficiency, and satisfaction in a specified context of use is known as usability. The measure of usability should cover:

- *E ectiveness.* The users' abilities to accomplish tasks using the system and the quality of the tasks' output [46].
- *E ciency.* The level of resources it takes to complete tasks [46].
- *User satisfaction.* Users' reactions to the system [46].

Chapter 3

Project definition

The chapter includes background information about Reykjavík city and the Reykjavík city service center. The workflow of the service center is explained, as well as the different service channels they provide. The city's service strategy will also be discussed. Furthermore, the current solution of the service center will be considered, and finally, the desired solution will be explained.

3.1 Background

Reykjavík is the capital of Iceland. In December 2020, the population of Reykjavík was 133,197. Meanwhile, the number of residents of the country was 368,620 [51]. At the end of 2020, there were 10,557 employees in the City of Reykjavík, the largest municipality in Iceland [52]. Figure 3.1 shows the organizational chart consisting of eight departments, including three core departments, colored gray in the figure, that operate across the other departments [53].

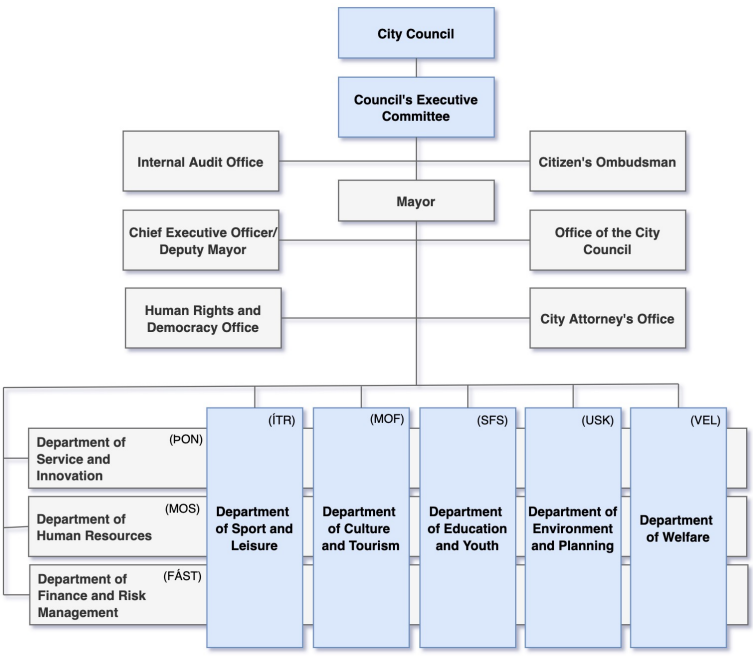

Figure 3.1: Organizational chart of the City of Reykjavík [54]

3.1.1 City Service Center

The Department of Service and Innovation is one of three core departments of the City of Reykjavík. The department's key role is to take care of the city's internal and external services to promote innovation in its operations. Department of Service and Innovation comprises five offices, and the service center is within one of them. The city is a service provider that focuses on providing residents with accessible and excellent services. Most of the city activities lie in service, whereas the residents and visitors of Reykjavík are its customers. The goal of the city service strategy is to ensure efficient service to its users. The strategy was designed and planned with the needs and perspective of its users in mind. Furthermore, the service should be simple to use and run seamlessly for the users.

The Reykjavík city service center, hereafter the city service center, is usually the first point of contact for the customers. It operates throughout the city and constantly collaborates with other offices and city departments. The role of the service center is to provide information on services directly to the customers and through various electronic channels. The task of the service agents is diverse and includes, among other things, selling culture cards, assisting residents with various applications, and providing information on several issues [18].

Figure 3.2 below shows the service process workflows by a graphical flowchart. It briefly depicts the processes that occur from the moment the customer seeks the service.

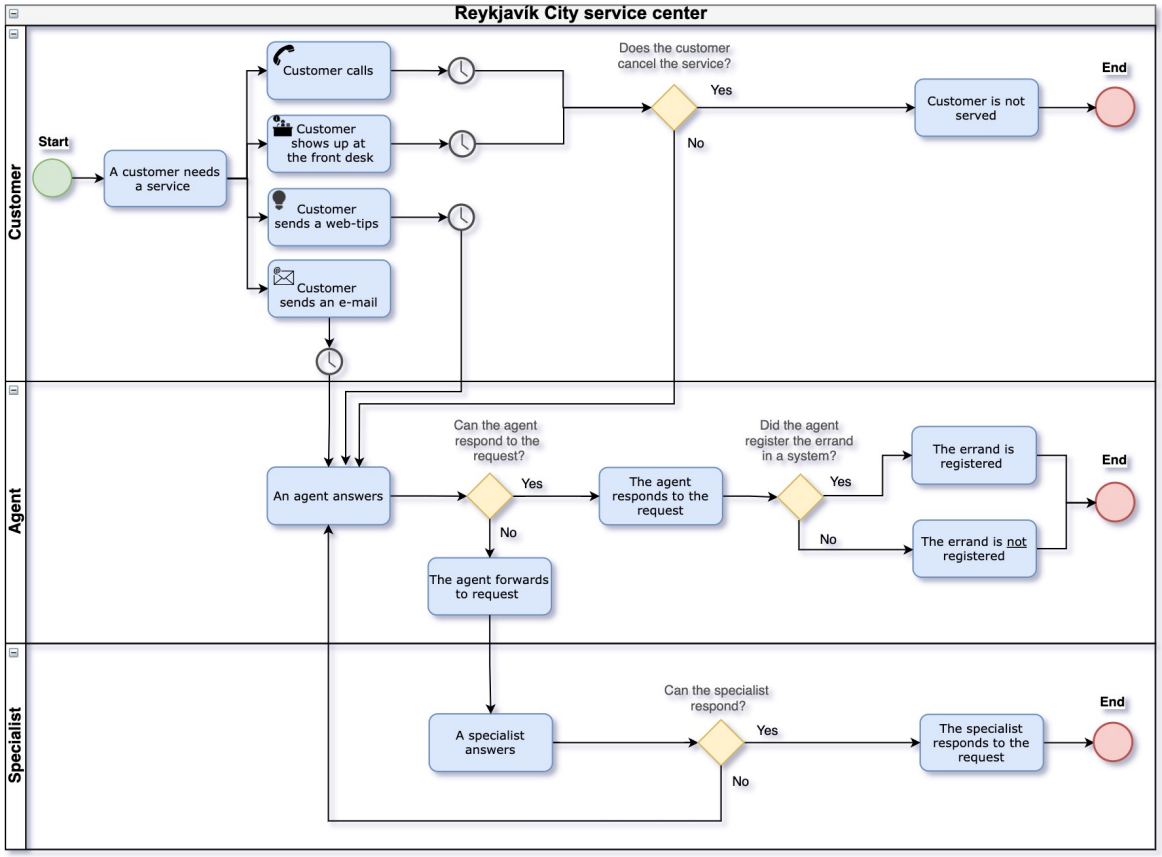

Figure 3.2: Workflow of the city service center

3.1.1.1 The Service Channels

The workflow above shows the four service channels the service center provides. Two channels are arranged directly to the customer through a phone call or at the front desk. In addition, there are two electronic channels. Through the city's website, customers can fill out feedback in an electronic form. Furthermore, the customer can also send an e-mail [18].

All service channels provided by the service center necessitate some level of waiting time. If a user is waiting for a service, at some point, he gets in touch with an agent. If the agent cannot respond to the request, then he forwards it to a specialist.

3.1.1.2 Project Scope

The city service centers are located on the one hand in Höfðatorg and on the other hand in Reykjavík City Hall. This project will focus solely on Höfðatorg. In Höfðatorg, there are 20 service agents. In addition, the service management team consists of the head of the service and transformation, department manager, project manager, and business analyst. In addition to the four service channels mentioned above, there is also a webchat. Currently, the city does not monitor that channel, and therefore, the project focus on the other four channels.

3.1.1.3 The Service Strategy

The City of Reykjavík is a service provider emphasizing offering accessible, diverse, and excellent services to its users. Service is involved in most of the city's activities. Residents, tourists, guests, and employees who seek the services are referred to as users. The city's service strategy describes a harmonized vision of what service provision is all about and can help employees in their daily work. It also establishes general criteria and measures for the service. The provision of services shall be accordingly to other strategies, such as human rights strategy and information strategy. The city's service strategy consists of four main goals: offering excellent and effective service to its users. These goals are [55]:

1. *Professionalism* implies that the service is specialized, and critical professional knowledge is integrated into all aspects of the city's operations. Constant attention is paid to coordinating services between departments, institutions, and neighborhoods of the city using a quality and service management approach. It also entails that employees show initiative in providing services and are provided with appropriate training, time, and resources to deliver excellent service. Measurable service quality indicators are developed and targeted systematically.

2. *User-centered design* implies that the service must be developed and planned in active consultation with the users, based on their needs and perspectives. It allows the service to respond to the demands of its users continuously. It considers that users have diverse needs, and it examines how accessible the city's services are and whether they meet users' needs.

3. *E ciency* ensures that service provision runs seamlessly, and those service users will quickly follow it and use it. Users are not asked for unnecessary information, and their information is shared such that the same information is not needed repeatedly.

4. *Proximity services* shall be provided as close as possible to its users in the forum in which the user is present at any given time. Self-service payment through electronic

solutions is always the first choice. It is essential to ensure that users' errands are addressed or sent to the appropriate individual.

3.1.2 The Current Solution

As previously stated, separate databases for the different channels hold unprocessed data containing information about the service center's performance. The management of the service center lacks a comprehensive overview of the services provided to be able to make well-informed decisions.

Previously, there was a dashboard for the tips, but it showed only limited information and was not for the other service channels. The service agents manually registered all visits in Excel files to track the total number of visits and the visits specific to each department. This excel file dates back to 2008. Furthermore, the service managers obtained raw data reports straight from the system and tried to obtain some information. Finally, management also lacked an overview of the errands that were registered.

The ideal procedure for the service agents is to register all errands in a system, so it is possible to keep track of the performance and link services provided to a specific department. The service center aims to obtain assertive internal communication between departments. It is, therefore, evident that the management of the service center lacks a comprehensive overview of the performance to make decisions that will hopefully result in, among other things, more efficient operations, improved services, and better utilization of human resources.

3.1.3 The Desired Solution

The desired outcome is to fulfill the project aim by successfully developing and design an interactive performance dashboard for the city service center. The objective is to solve the real problem that the service center managers face. It will be done by combining data from four different systems and designing the dashboard around the users' needs. Hopefully, the users' requirements will be met, and the final dashboard will be usable that supports and facilitates decision-making.

Chapter 4

Methodology

The chapter provides an overview of the methodology used in the study. The main objective of this study was to design and develop an interactive performance dashboard for the city service center. A case study approach with a user-centered dashboard design was selected to accomplish this.

4.1 The Research Approach

Research methods are generally classified into two types: qualitative and qualitative. The main difference between these approaches is the researcher's flexibility in the research process. In contrast, the quantitative approach follows a series of structured and predetermined procedures. On the other hand, the qualitative approach takes a more open, unstructured, and flexible approach aiming at the different aspects of a problem, situation, or phenomenon. However, researchers are gradually using mixed methods, incorporating quantitative and qualitative approaches to understand a complex phenomenon better. The mixed-method combines the strengths of both approaches to achieve the research aim best [56]. A mixed-method approach is ideally suited for designing an effective performance dashboard to achieve the study aim.

4.1.1 Case Study

A case-study approach was adopted to gain more in-depth information on the design processes for the city service center. A case study is an in-depth study of a particular case within a specific real-life setting, preferred in examining contemporary events [57]. It can be an effective tool for gathering requirements and evaluating dashboard interfaces [58]. This method is advantageous when the researcher has limited control over events [57].

The capability to deal with a wide range of data and evidence is a case study's unique strength. It enables the researcher to address a broader spectrum of historical and behavioral problems. Any case study findings or conclusions based on various sources of information are likely to be more accurate and trustworthy [57]. Therefore, the case study approach was chosen. The case study was conducted between December 2020 and May 2021 in the city service center using a mixed-method approach.

Throughout the project, many interviews and meetings were conducted with the service management team. The researcher sees the interviewees as informers rather than interviewees, assisting throughout the design process. As Yin mentioned, the more the interviewee assists in the process, the more the role can be considered one of the informants rather than the respondent. A case study's success depends heavily on key informants [57].

As indicated before, the service management team consists of the head of the service and transformation, the department manager, the project manager, and the business analyst. They are defined as the dashboard users. Throughout this project, the dashboard design team refers to the service management team and the researcher.

4.2 The Research Design

In the city service strategy, user-centered design (UCD) is one of the four main goals. UCD refers to the process of designing and planning around the interests and perspectives of the user. Another strategy goal was professionalism, where measurable service indicators are developed and targeted systematically [55]. To support the city's strategy and ensure an effective dashboard design, the process chosen for this project is UCD, including developing performance indicators and targets.

UCD ensures that the designer studies how practical an application is in accomplish its designed purpose [44]. UCD approach is iterative, so it is possible to jump back to previous steps at every given time [46]. By allowing the users to give feedback constantly, the developer can test their assumptions and guarantee to move in the right direction [44].

Case studies, interviews, and survey methods have remarkably been used as research methods in UCD [45]. According to a UCD study conducted in the Icelandic software industry in 2011, the most popular methods used in software projects were meetings. Participants also gave positive feedback on the interviews and low-fidelity prototypes [59]. Users' feedback was collected and documented in a research diary at each phase of the study. Figure 4.1 shows the research approach, which follows the UCD process.

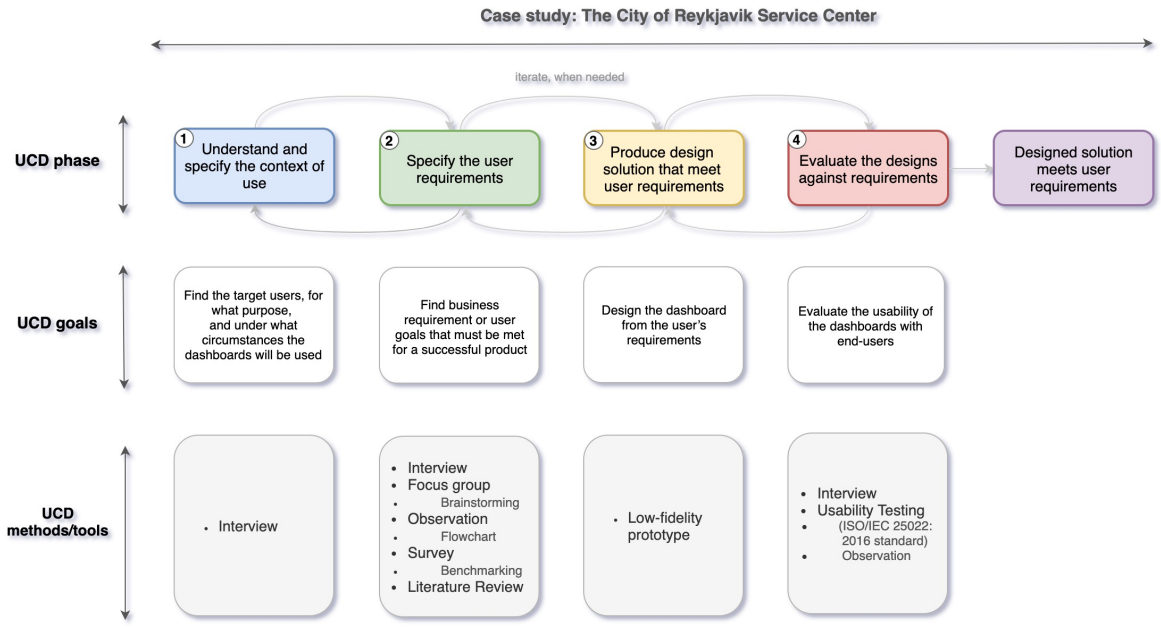

Figure 4.1: The user-centered design (UCD) process

4.3 User-Centered Design

Usability is the cornerstone of good design. Usability is concerned with making systems accessible to all users. Likewise, the design is acceptable for the users and the context they will use them in. Therefore, it is essential to involve the users in the design process [47]. The four main UCD activities specified in the ISO 9241-210 standard was the framework for this project [46]:

- Understanding and specifying the context of use.
- Specifying the user requirements.
- Producing design solutions that meet user requirements.
- Evaluating the design against requirements.

4.3.1 Phase 1: Understanding and Specifying the Context of Use

The first phase intends to understand the context contemplated for the design. It aims to identify the users, their general goals for using the system, and its circumstances. It is beneficial to collect information about the present context to comprehend it and the context that will apply in the future system [46].

4.3.1.1 The Interviews

Interviews are one of the most effective methods for determining what people want and what problems they are currently facing [47]. It was essential to use methods for collecting information straight from users to perform the first phase. Thus, in the early stage of the project, interviews with the head of the service and transformation were conducted. The interviews were conducted to learn more about the dashboard users, the city service center's requirements and needs, current solutions, and the desired outcomes.

4.3.2 Phase 2: Specifying the User Requirements

The second phase aimed to understand the requirements better and establish a baseline for the dashboard design. This phase is the key to the design process, whereas users' requirements are converted into meaningful needs [44].

4.3.2.1 The Interviews

Due to the iterative characteristics of UCD, further information was obtained explicitly from users as needed. In this phase, more people were interviewed to get a broader insight into user needs. The interview is an essential source of information in a case study; instead of structured questions, the interview will be more of a guided dialogue. The key respondent should be questioned about the facts, and their opinions in an in-depth interview [57]. Interviews were conducted with individuals in the service management team.

4.3.2.2 The Focus Group

In addition to the interviews, a focus group was conducted to gather even more knowledge about the users. With a focus group, which is a type of unstructured interview, the researcher explores the experiences, perceptions, and understanding of a group of people with shared experiences among a situation or event. Members of a focus group share their opinions when addressing broad discussion topics formulated in advance [56]. Group participants may stimulate one another in a focus group, and conversation can flow more spontaneously than in an individual interview.[47].

The focus group consisted of the dashboard design team. The dashboard design team consists of the researcher and the service management team. The focus group was conducted several times throughout the project, sometimes including all five participants or part of the group. The focus group was convened either in a meeting room at Reykjavík city or online, through Teams, an online collaboration platform.

Brainstorming
Brainstorming is an important group activity [47]. Brainstorming sections were conducted in the focus group interviews. The dashboard's content and design were considered.

4.3.2.3 Observation

Observation is beneficial since the case study should take place in a natural setting. It is often helpful in offering more knowledge about the topic studied [57]. Therefore, the researcher visited the service center, observed the operations, and gained a better insight into the work processes and the service agent's job. It is essential to understand the operation to ensure the quality of data and an effective dashboard design.

Flowchart
A flowchart was designed to present an overview of the services provided by the support center, from the time a customer searches for a service until it ends. It helps to see how the service is performed and the connection between service channels.

4.3.2.4 The Survey

Based on the interviews, focus group sessions, observation, and a literature review, an exploratory survey was conducted to gain insight into how performance metrics, key performance indicators (KPIs), and targets have been set in service centers in Iceland. Furthermore, the survey aimed to provide information about working practices in other service centers.

It was a structured survey, including fixed response options and open-ended questions. Open questions can be helpful when inquiring about opinions in the respondent's own words [47]. The benefit of open-ended questions is that respondents can express themselves openly, resulting in a greater variety of information. Whereas closed questions help extract truthful knowledge [56]. A more comprehensive range of information and better insight was obtained by combining open and closed questions. The questions in the survey must be straightforward and easy to comprehend. The layout of the questions should follow a proper flow since the order of questions matters [56].

The survey was conducted as a part of the case evidence from the user requirements. The questionnaire was sent to 22 firms operating larger service centers in Icelandic from diverse sectors. Eight individuals responded to the survey. The participants were appropriate for this project, although the sample size was not large. The sample extended beyond other municipalities, such as the financial sector, and the public sector, to get a broader understanding of a service center practice regarding performance management. No such survey has been conducted in Iceland, so it is a valuable contribution to research on service centers in Iceland. The survey consisted of 14 questions shown in Appendix A. An introductory letter to participants noted that the project was conducted in collaboration with the City of Reykjavik and that complete confidentiality would be maintained with the answers. The results could not be traced to individual companies.

Benchmarking
As previously indicated, the service center did not have an integrated dashboard showing the service center's performance. Therefore, it did not have KPIs or targets. It needs to be possible to look at today's performance and have goals towards which to work to improve performance.

With the results from the survey, and information obtained from the literature review, the focus group decided to embark on even more broad benchmarking. International benchmarking was obtained as well.

An interview was conducted with the development manager at Copenhagen's citizen service through Teams, an online collaboration platform. The team organized a few questions in advance, but the goal was to have an open meeting and gain insight into Copenhagen's city service activities.

With wide external benchmarking obtained, the last step was internal benchmarking. Internal benchmarking was used, where previous year data was observed and compared with the results of the external benchmarking. Benchmarking technology was a good basis for determining the content of the city's dashboard. Based on that information, performance metrics, KPIs and targets were chosen for the city service center.

4.3.3 Phase 3: Producing Design Solutions

The system's tasks and sub-tasks for achieving the user's goals were determined. Several dashboard versions were produced from the user requirement and context before the final dashboard was designed.

4.3.3.1 Low-fidelity prototype

Low-fidelity prototypes were created in the dashboard design process. The prototypes are used widely in design processes, applied at any stage during the process. Low-fidelity (lo-fi) and high-fidelity (hi-fi) prototyping are the two main types of prototyping. Hi-fi prototypes resemble the finished version in the appearance and feel of a product. Lo-fi prototypes, also known as paper prototypes, are intended to be made more quickly. Prototypes made of paper are commonly used in practice [47].

Sheets of paper were used after the users' suggestions, and requirements were gathered. The aim was to sketch how information regarding KPIs and targets in the service center should be structured and how the dashboard layout should be designed.

4.3.4 Phase 4: Evaluating the Design

An evaluation of the dashboard was conducted during the last phase of the UCD process. A usability test was used for the dashboard users, aiming to validate the final dashboard.

4.3.4.1 Usability Testing

Design is all about usability [60]. Usability must be defined in the context in which it is used [61]. The usability of the dashboard was evaluated applying the methods Farinango et al. [61] presented in a study from 2018, using usability metrics (efficiency, effectiveness, and user satisfaction) determined by ISO/IEC 25022 standard [62].

The usability test contained a ten-item task that users were supposed to perform. An observation technique was established during the usability testing. That is, while users took the test and interact with the dashboard, the researcher observed. The test was conducted remotely, where the users shared their screens. Each user took the test alone, but all users received the same test. Initially, the researcher explained the test arrangement. The test consisted of ten questions. Each question was read aloud, and after that, a stopwatch was switched on. Each task had a specific time target, determined by the researcher in advance, based on the task's difficulty. The users did not know the time target before the test.

After completing the test, users were thanked for their participation. Then, they were sent a questionnaire to estimate their satisfaction with the dashboard shortly after the test ended.

4.3.4.2 Effectiveness

The first quality measure of usability was effectiveness. Effectiveness is the certainty and completeness with which the user accomplishes stated goals [46]. The success rate, that is, how many tasks users could complete, was examined to evaluate the dashboard's effectiveness.

4.3.4.3 Efficiency

Efficiency is defined as the resources (often time, materials, cost, and human effort) used to achieve the outcome [46]. The questions were divided into three difficulty levels, where the time target for the most challenging task was 60 seconds, the most straightforward task was 20 seconds, and in between was 40 seconds. An evaluation of whether or not the user could complete the task within the set goal period was performed to measure dashboard efficiency.

4.3.4.4 User Satisfaction

The degree to which the user experience comes from actual usage of the system that satisfies the user needs and expectations is user satisfaction. The most commonly used systematic test for assessing perceived usability is the System Usability Scale (SUS) [60].

In 1986, John Brooke created the SUS. It is a low-cost consisting of a ten-time Likert scale for evaluating the usability of systems. The questions cover a wide range of topics related to the system's usefulness, including the need for training, complexity, and support. SUS is typically used when a user has had the possibility to use the system being evaluated. People can be prompted to fill out the list right away rather than thinking about it for a long time. All items have to be checked. If respondents do not want to answer a specific item or the item is not applicable, they should mark the scale's center point (neutral) [63]. SUS questionnaire sent to users after the usability test can be seen in Appendix E.

The SUS scores range from 0 to 100. The evaluation produces a single number that represents a composite measure of the system's overall usability. The following equation calculates the SUS score for each participant [63]:

$$SUS = \frac{\textit{(sum of the points for all odd-numbered questions) - 5}}{\textit{25 - (sum of the points for all even-numbered questions)}} \quad 2.5 \tag{4.1}$$

A system with a SUS score of 85 or higher is considered excellent usability, while one with a 68 to 84 is considered good usability [64]. In 2008, Bangor et al. compiled statistics from 2,324 surveys dated back to 1996, where the average SUS score for all surveys is 70.14 [50].

Chapter 5

The Data

The chapter describes the data from the city's service center. The data comes from several sources in various formats. The data processing steps to gather further information on different service channels (tips, visits, phone calls, and errands) will be illustrated.

5.1 Data Architecture

The BI architecture consists mainly of operating systems and BI front-end tools for people new to business intelligence organizations. ETL (extract, convert, and load) tools, a data warehouse, data marts, BI front-end tools, and other components may be used in more advanced BI implementations, especially for enterprise customers [39]. Therefore, the former is used in the city and, therefore, on the BI architecture of this project. Figure 5.1 below illustrates the data architecture for this project.

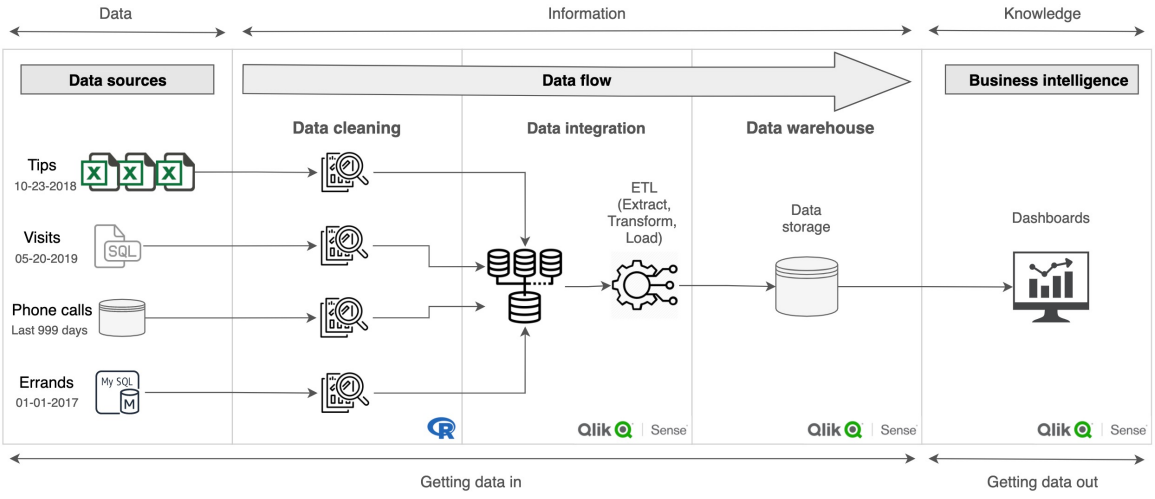

Figure 5.1: The data architecture

5.1.1 Data Cleaning

The data was cleaned using the R programming language. There were no shared columns between channels because each channel had its data source. As a result, the first step was to create shared columns between channels, where it was possible, aiming to integrate the shared columns later on. Dates on all channels were formatted appropriately to create new, shared time columns. Hours, days, day of the week, day of the month, and year that the service was provided were included in the new time columns.

The columns of the departments were formatted precisely and competently through all channels. Finally, special Icelandic characters were treated since they often do not appear in the proper format and are usually unreadable directly from the data sources. Code showing the data cleaning for the visits can be seen in Appendix D.

5.1.1.1 Tips

The tips, which dated back to October 23, 2018, were included in three Excel files. These files were combined into a single data frame with a total of 26 columns. The columns were assigned descriptive names. Finally, columns in the data frame deemed redundant for this project, such as the coordinates at the service center, were removed.

5.1.1.2 Visits

The visit data came from a database in a Microsoft SQL server, with the initial data dated May 20, 2019. There were nine relevant data frames in the database, compiled into one frame forming 109 columns. The database also contained places other than Höfðatorg, such as Reykjavík's City Hall and other service centers in Reykjavík. Since this project focused solely on Höfðatorg, other possible locations in the database were filtered out. New columns were generated that measured the handling time, waiting time, and total time of processing. There were 11 columns left after the unnecessary columns were removed.

5.1.1.3 Phone Calls

The phone data were revealed in a TASKE Contact Driver, which keeps track of the previous 999 days. In TASKE, there were two relevant data frames; together, they contained 25 columns. There was also information about telephone calls at places other than Höfðatorg, such as Child Welfare and schools. Inappropriate destinations were filtered out of the data framework. Finally, columns containing call waiting times and duration were added.

5.1.1.4 Errands

When a service agent has completed service, the work practices are such that he registers the errands in a system. The errands were stored in a MYSQL database, with the first data dating back to January 1, 2017. Initially, the errands contained 17 columns. After adding the shared columns and deleting unnecessary columns, the errands contained 11 columns. Detailed errands were categorized into the correct departments. For example, errands regarding parking funds, construction representatives, and garbage collectors were registered together in the Department of Environment and Planning.

5.1.2 Data Integration

The next step was to integrate the data frames because they had reached the desired format from the four channels in question. Qlik, a business analytic tool, was used for it. Qlik can be used as an ETL (extracting, converting, and loading data) solution and data warehousing (data storage). Data warehouses are used to combine data from different sources, and an ETL solution is used to write the code used to prepare and load data into the data warehouse [65].

Figure 5.2 below illustrates the data model in Qlik Sense. It shows how the four channels are linked. Across all channels, the time and department columns have been integrated.

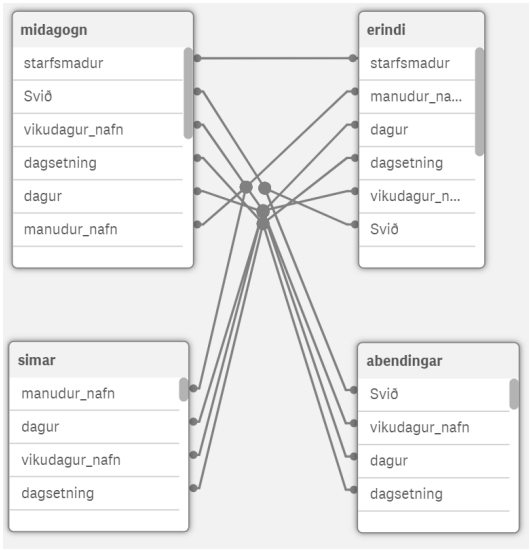

Figure 5.2: The data model in Qlik Sense

Chapter 6

Results

The project followed a case study approach. The four main UCD activities specified in the ISO 9241-210 standard were the framework for this project. Results from each UCD phase will be illustrated.

6.1 Phase 1: Understanding and Specifying the Context of Use

The context of use was defined from interviews and meetings with the service management team. The previous system of the service center was mapped from there. Interviews with the service management team revealed that they lacked information about the service center's performance. The management had to look at various places to obtain some information from each service channel. Moreover, the service center lacked performance metrics, KPIs, and targets. Thus, it became clear that there was a great demand in the city service center to get insight into their performance. The interviews also indicate the need for service agents to obtain information about the service center's performance and acquire a dashboard.

Therefore, the project objective expanded, and the project aimed to design and develop two performance dashboards, one for the service management team and another for the service agents. The former, a tactical dashboard for the service management teams, was supposed to be more detailed. The purpose was to support data-driven decision-making, so the service management team could make decisions based on more than own intuition and compare the service center's performance historically. The latter, the operation dashboard for the service agents, was supposed to be a simpler version of the tactical dashboard to provide service agents with information on a screen in the service center, automatically switching between sheets on the dashboard.

The results from interviews with the service management team obtained the context of use, summarized as follows:

- The users of the tactical dashboard are the service management team, which consists of the head of the service and transformation, the department manager, the project manager, and the business analyst.
- It should be interactive.
- It should be viewed regularly on a daily or weekly basis. Data should be loaded here daily.

- The purpose is to support data-driven decision-making provides a comprehensive overview of the service center's performance. It should also provide information on where the integration of service channels has been made. Furthermore, it should be possible to compare performance today with historical data.

- The users of the operational dashboards are the service agents, a total of twenty employees.

- It should be visible on a screen in the service center. It should be viewed multiple times each day.

- Its purpose is to provide service agents with a comprehensive overview of the service center's performance. They should be able to see the situation today compared to previous data.

6.2 Phase 2: Specifying the User Requirements

Phase two of the UCD project is critical, as a successful dashboard requires clear communication and understanding between the developer and the users. To get better insight into the work process of the service, the researcher visited the service center. As shown in Figure 3.2, a flowchart was designed to visualize the service workflow.

The user requirements that must be met for a successful dashboard were established through various methods. The interviews, focus group interviews, brainstorming sessions revealed that the dashboard contents matter a lot. As previously stated, the service center did not have a performance dashboard before. Therefore, it did not have defined performance metrics, KPIs, and targets. It was clear that the determination of the dashboard content was crucial for the dashboard to be successful. A benchmarking technique was chosen as a criterion for the KPIs and target selection in the focus group.

6.2.1 Survey of Service Centers in Iceland

An exploratory survey was conducted, based on the interviews, focus group interviews, observations, and the literature review to gain insight into how performance metrics, key performance indicators (KPIs), and targets have been set in other service centers in Iceland and to get to know their work practices. As previously stated, results from the survey were not used for the selection KPIs in the dashboard. Instead, they used as criteria when selecting performance metrics, KPIs, and targets.

The response rate to the survey was approximately 36%. Of the 22 individuals who were sent invitations, eight returned the questionnaires. The survey included 14 questions, with some sub-questions. More detailed participant answers are in Appendix B.

The survey consisted of three parts. The first section, consisting of the first two questions, aimed to obtain insight into the organization's background. Section two, which included questions 3-9, focused on how the organizations determined their KPIs and targets. The final section, covering questions 10-14, aimed to delve deeper into the companies' working practices in performance management.

6.2.1.1 The Organizations Background

In the first part of the survey, respondents were asked about the organizational background. Table 6.1 provides an overview of the work sectors of the participants. This table makes it apparent that participants come from diverse work sectors. No detailed information on the participants' work sector was provided to ensure that their answers could not be traced back to individual companies.

Table 6.1: Work sector of participants

PARTICIPANT #	SECTOR
1	Municipalities
2	Other
3	Financial
4	Service
5	Other
6	Other
7	Financial
8	Public

Figure 6.1 presents an overview of the service center's size. Thirty-eight percent of those surveyed reported that employees in the service center were more than 30; likewise, 38% of participants said that the employee number less than ten. A minority of participants (25%) indicated that the number was between 11-20, and none reported between 21-30 employees.

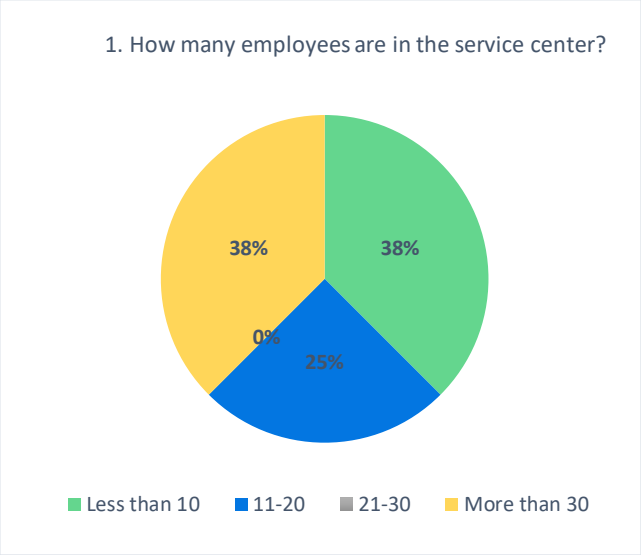

Figure 6.1: How many employees are in the service center?

Figure 6.2 summarizes statistics for the proportions of their service center's channels. The most interesting aspect of this graph is that all respondents indicated that phone calls were by far the most significant channel, from 40%-74%, except participant number 6, which reported that other electronic channels were the majority (60%) of the service provided in that company. The phone calls were followed by other electronic channels, such as e-mail, and social media, ranging from 17%-60%. Interestingly, only two participants had a somewhat high percentage of visits (15% and 24%), another municipality, and a financial sector. Visits were only 0-1% among other participants.

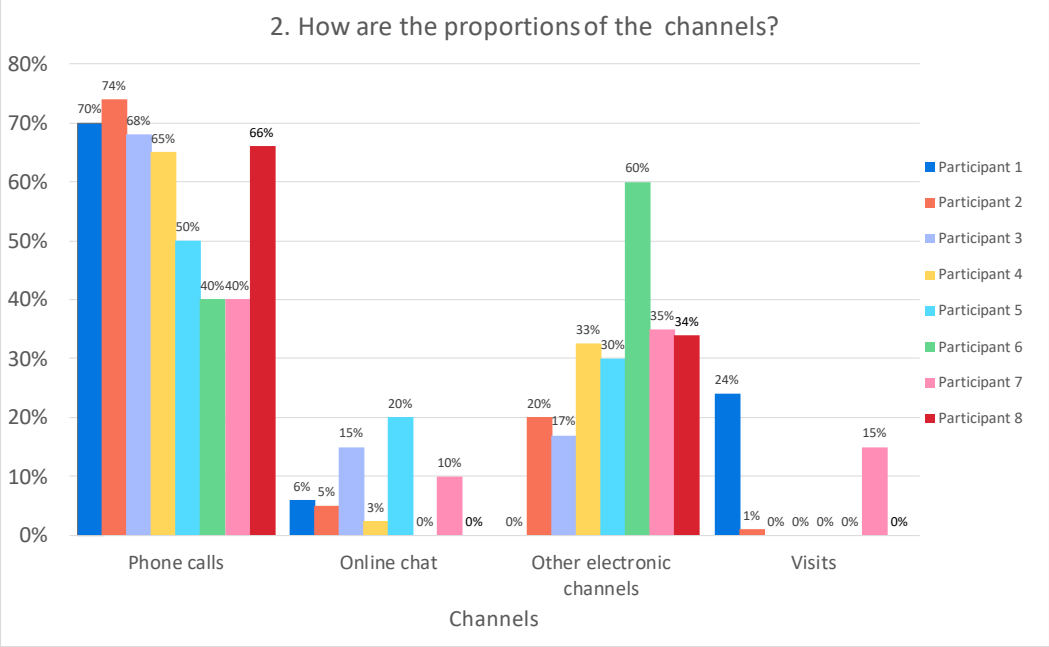

Figure 6.2: How are the proportions of the channels?

6.2.1.2 Determination of the KPIs and Targets

The next section of the survey was concerned with key performance indicators (KPIs) and targets. In all cases, the informants reported that they were using a dashboard and/or statistical report monitoring the performance in the service center. Table 6.2 below shows that the most frequently used KPI is abandonment rate (response rate), followed by average speed to answer. The table below illustrates the most-used KPIs in descending order, with the most common KPI at the top abandonment rate (response rate). Eighty-eight percent of respondents used it. It was followed by the average speed of answer, average call duration, and total calls, respectively.

Table 6.2: What KPIs are being monitored?

	PARTICIPANT #									
KPIs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**TOTAL**	**PROPORTION**
Abandonment Rate (Response rate)	x	x	x	x	x		x	x	**7**	**88%**
Average speed to answer (ASA)	x	x	x	x	x			x	**6**	**75%**
Average call duration	x		x	x	x	x			**5**	**63%**
Total calls	x		x	x		x	x		**5**	**63%**
Registration of errands		x				x		x	**3**	**38%**
First resolution rate (FCR)	x	x						x	**3**	**38%**
Customer satisfaction score (CSAT)		x			x				**2**	**25%**
Channel mix			x		x				**2**	**25%**
Cost/Revenue per call (CPC)				x	x				**2**	**25%**
Agent performance (is everyone involved)		x							**1**	**13%**
How is it going to retrieve information in a system		x							**1**	**13%**
The longest delay in a queue (LDQ)			x						**1**	**13%**
Longest call			x						**1**	**13%**
Transfer rate				x					**1**	**13%**
Average waiting time of abandonment calls	x								**1**	**13%**
Active waiting calls							x		**1**	**13%**
Status of agents (available, in a call, busy)							x		**1**	**13%**
Number of agents							x		**1**	**13%**
Total calls per agent							x		**1**	**13%**
Total abandonment calls per agent							x		**1**	**13%**
Lost call rate					x				**1**	**13%**
The number of visits/ page views on the website								x	**1**	**13%**
The most popular article visited per week								x	**1**	**13%**
Where do users come from (Google, websites...)								x	**1**	**13%**
The proportion of mobile/tablet versus desktop/laptop								x	**1**	**13%**
TOTAL Numbers of KPIs per participant	**6**	**7**	**7**	**6**	**7**	**3**	**7**	**8**		

: Participant is monitoring KPI in question.

In response to Question 4, when participants were asked the basis for deciding the KPIs, the answers were quite different. In one case, participant number 1 from another municipality reported that they focus on the first contact resolution (FCR). Therefore, it looks at an increased length of the call, short waiting time, and reasonable response rate. In contrast, another commented that they aim to maximize service level while reducing cost and increasing customer satisfaction. More detailed answers from all participants can be found in Appendix B below.

When the participants were asked about what targets have been set for the KPIs, only four were willing to provide information, given the response rate of 50%. A common view among those not willing to provide answers was that target information was confidential. Table 6.3 shows the targets from those who answered this question. One participant reported that their target was 92% response rate and average speed of answer (ASA) below 10 seconds. Another participant stated that their target was 90% registration of errands, 85% first contact resolution (FCR), and 4.2 customer satisfaction score (CSAT) obtained through a survey.

Table 6.3: What targets have you set for the KPIs?

	PARTICIPANT #			
	1	**2**	**6**	**8**
TARGETS	92% Response rate	90% Registration of errands	100% Response rate	Phone calls: 80% Response rate
	10 sec ASA	85% FCR		Phone calls: 3 min ASA
		4.2 CSAT		Electronic channels: 5 hours ASA
				100% Registration of errand
				Electronic channels: 70% FCR

Abbreviation: ASA: Average speed of answer, FCR: First contact resolution, CSAT: Customer satisfaction score.

There were seven responses to Question 6: "Who was involved in setting targets for the KPIs?" As shown in Figure 6.3, all respondents reported that the department manager and/or customer experience manager were involved in setting targets for KPIs. Approximately 43% reported the service agents as well.

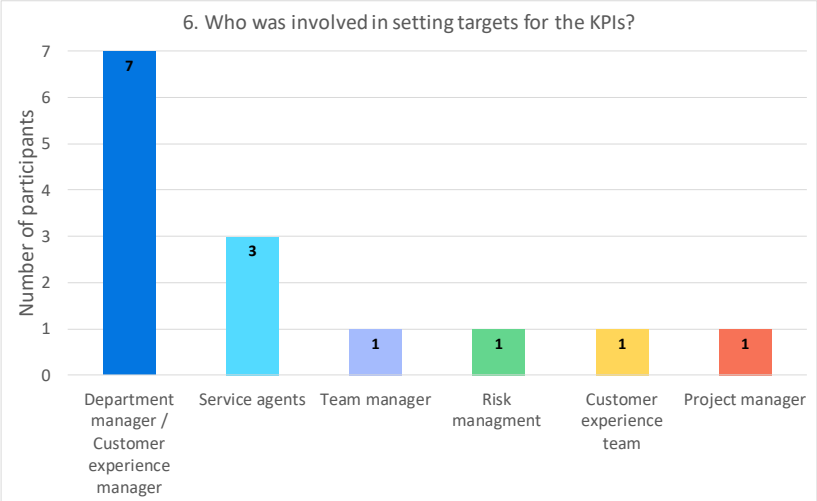

Figure 6.3: Who was involved in setting targets for the KPIs?

From the data in Figure 6.4, it is apparent that internal benchmarking (own statistics) was the most common way of selecting a basis for the target settings for the KPIs. A literature review and external benchmarking followed it.

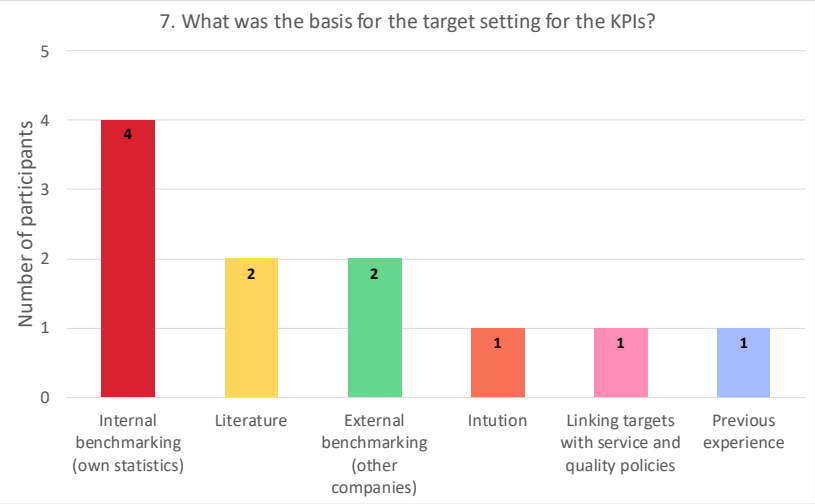

Figure 6.4: What was the basis for the target setting for the KPIs?

In response to Question 8, as shown in Figure 6.5, 43% of participants said that they had managed to achieve set targets extremely well; and 43% said very well. One participant reported that they had somewhat well managed to achieve it. The most interesting aspect of the data is that none of the participants considered that they had failed to hit set targets.

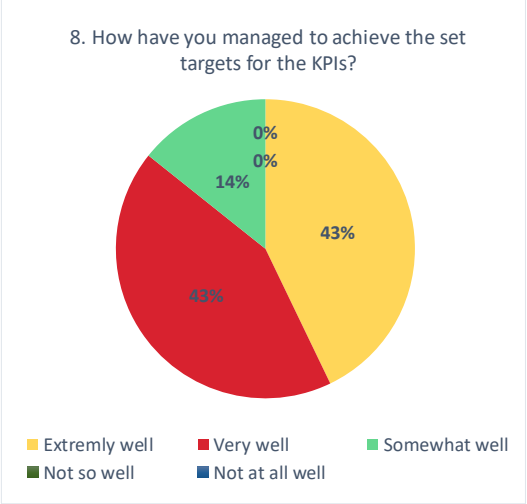

Figure 6.5: How have you managed to achieve the set targets for the KPIs?

In the final question of this section, respondents were asked whether goals have been revised since initially set. Three-fourths (75%) said yes. Regarding how the targets had evolved, a variety of perspectives were expressed. For example, one participant commented they had changed emphasis and focused more on first contact resolution (FCR), with that the call duration and customer satisfaction have increased. Another participant commented that they had changed little, slightly adjusted, and re-evaluated.

6.2.1.3 Working Practices Around the KPIs and Targets

The final section of the survey was concerned with working practices around the KPIs and targets. In response to Question 10, when asked whether the service receptionists aware of KPIs and targets, all of those who responded to this question (88%) reported that they were aware. As shown in Figure 6.6, the results indicated that various perspectives were expressed. The majority of those who responded to this question reported meetings (71%), 57% mentioned that they were discussed, and 29% said through e-mail.

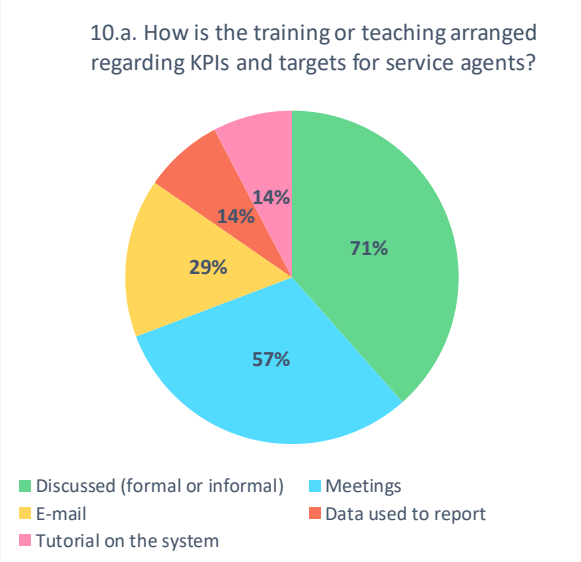

Figure 6.6: How is the training or teaching arranged?

In response to Question 11: "Do you measure customer satisfaction in the service center?" most commented that they do. Only a small number of respondents indicated that they did not (29%), whereas one said that they did not have a system that keeps track of it, the other mentioned that they plan to send out a survey at the end of May. In the first sub-question: "If yes, how often and how do you do it?" the participants reported various ways. In one case, the participant sent a digital survey by e-mail three days after the service was provided. Another one said they sent out a survey twice a year. In the latter sub-question: "If yes, can you see the satisfaction linked with the set targets? If so, how?", the response rate was 37%. Two of the three who answered saw a positive link, including a happier customer. Interestingly, one respondent did not see a strong connection there based on their data.

Question 12 provides the summary statistics for how often managers review the KPIs. Figure 6.7 shows how the responses vary from one participant to another. 29% review some of the KPIs daily, some weekly, while other monthly.

In the following question, respondents were asked whether or not the service center's performance was reviewed regularly with employees. In all cases, the informants reported so. The results from the sub-question: "If yes, how is it done and how often?" are presented in Figure 6.8. 33% of the respondents reported that meetings were their way to review service center performance with the employees. Two participants mentioned it was accessible on a screen in the service center.

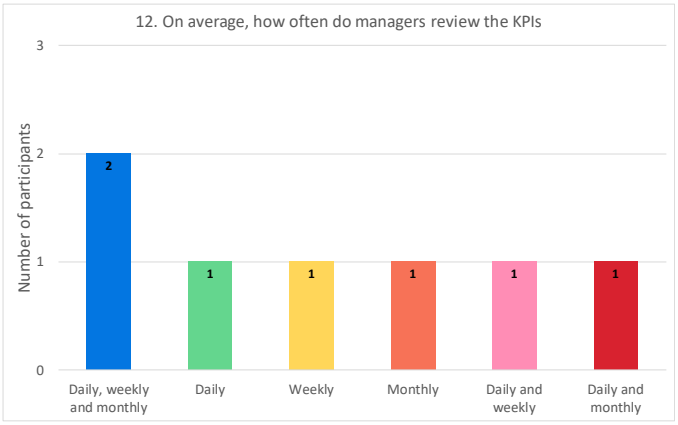

Figure 6.7: On average, how often do managers review the KPIs?

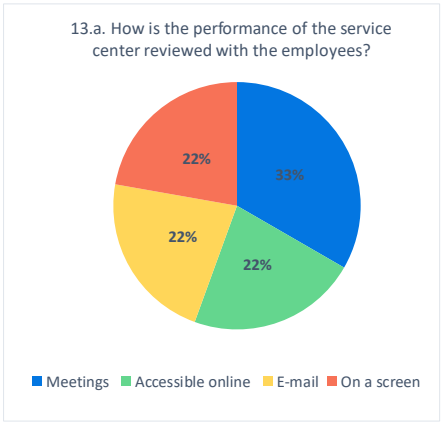

Figure 6.8: How is the performance reviewed with the service agents?

In the survey's final question, respondents were asked what weighted heavier: customer satisfaction, operating costs, or equal weight when determining the targets for the KPIs. The majority of participants (60%) agreed with the statement that customer satisfaction weighed heavier, while 40% reported that it was equal weight. It is an interesting outcome, as no one mentioned the operating costs.

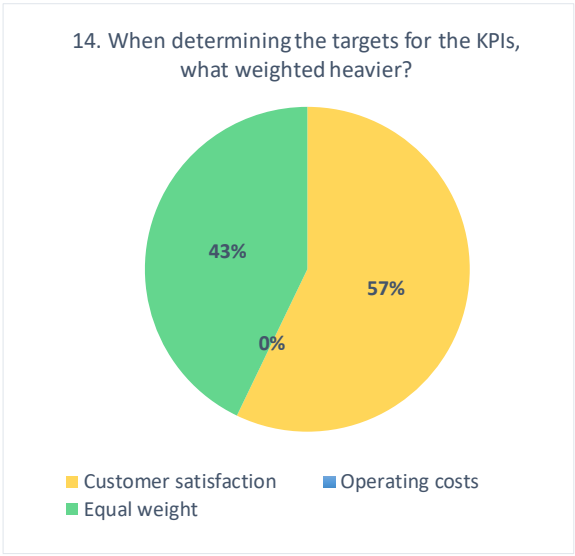

Figure 6.9: When determining the targets for the KPIs, what weighted heavier?

Results from the survey provided important insights into KPIs, targets, and working practices in larger service centers in Iceland.

6.2.2 Benchmarking

As stated in previous chapters, there are several things to keep in mind when choosing effective performance metrics. It is essential to choose appropriate performance metrics and set realistic objectives for the service center; for the first time, it can be challenging. Therefore, the dashboard design team decided to embark on a benchmarking process. External and internal benchmarking were used. As each organization is unique, the final decision of KPIs and targets must follow the strategy and goals of the organization. Therefore, it is not possible to wholly transfer the practices of other companies; it always needs to be adjusted.

6.2.2.1 External Benchmarking

The survey and information about other service centers globally were used as a benchmark when selecting KPIs and targets.

Performance metrics in the Nordics
ContactBabel, a leading analyst firm for the service center industry, released a report in 2018 [36]. The report shows industry averages for service center statistics, segmented in various ways. According to the report, Nordics has a low agent turnover rate, with a median of 5% compared to other regions with an average median of 13%. The dashboard design team decided to focus on the Nordic countries abroad, as they are often more similar to Iceland in terms of work practices than other countries.

Table 6.4 shows the mean of performance metrics in Nordics inbound call centers and the order of importance, with one being the most important and seven being the least important.

Table 6.4: Performance metrics in the Nordics [36]

Importance ranking	Performance metrics	Mean
1	First service resolution (FCR)	82%
2	Customer satisfaction score (CSAT)	-
3	Average speed to answer (ASA)	55sec
4	Transfer rate	8.5%
5	Average call duration	4min 38sec
6	Abandonment rate	9.4%
7	Cost per call	€ 4.00

Performance metrics in Copenhagen's citizen service
An interview was conducted with the development manager at Copenhagen's citizen service through Teams, an online collaboration platform. The team organized a few questions in advance, but the goal was to have a more open meeting and gain insight into the citizen service activities in Copenhagen. The interview revealed that the performance metrics are divided into three categories: volume, quality, and efficiency. According to the development manager, there is a fine line between quality and efficiency. In Copenhagen's citizen service, the service agents are aware of their performance, and it is also displayed on a screen. In addition, they also get feedback about their performance at the end of each day. Table 6.5 provides an overview of the performance metrics used in Copenhagen's citizen service.

Table 6.5: Performance metrics in Copenhagen's citizen service [66]

	Category		
	Volume	**Quality**	**Efficiency**
KPIs	Offered calls	Average speed of answer	Average handling time
	Transferred calls	Served within target	Adherence to schedule
	Answered calls	Calls not transferred	Scheduled shift on the phone
	Answered calls cf. to last year	First contact resolution (FCR)	Answered calls per agent per hour
	Number of errands per call	Availability	
		Customer satisfaction score (CSAT)	

Abbreviation: cf: compare.

Furthermore, Copenhagen's citizen services also had KPIs and set targets. The targets were color-coded, a green status color indicates on-target performance, while yellow implies acceptable performance, but continued acceptability is at risk. And red indicates below-target performance [66]. The target set by Copenhagen's citizen service can be seen in Table 6.6.

Table 6.6: KPIs and targets in Copenhagen's citizen service [66]

	TARGET		
KPIs	**Green**	**Yellow**	**Red**
Average speed of answer (ASA)	< 01:30	< 03:00	> 03:00
Service level	> 80%	> 70%	< 70%
Calls not transferred	> 50%	> 45%	< 45%
Availability	> 92%	> 80%	< 80%
Customer satisfaction	> 7.5	> 7.0	< 7.0

6.2.2.2 Internal Benchmarking

After reviewing the practices of other companies, the dashboard design team decided to review the service center's internal data and compare it with previous years' statistics. That was the final step in the benchmarking process.

6.2.3 City Service Center KPIs and Targets Selection

Results from the benchmarking process were examined and used as a guide in the KPIs and target selection. There are various things needed to keep in mind when selecting performance metrics, KPIs, and targets. For example, the organization's strategic objectives must be involved. In addition, KPIs must be simple, actionable, timely, and accurate.

With the Reykjavík city strategy and goals in mind, the dashboard design team selected four KPIs and targets. Moreover, several performance metrics were also selected. Table 6.7 shows the four KPIs determined, as well as their importance ranking.

A closer inspection of the table revealed the importance ranking of the four KPIs selected. The upper part of the table shows the benchmarking results. Whereas the external benchmarking contained the relevant KPIs from the survey results and information obtained from Nordics and Copenhagen's citizen service. The selection of KPIs was also based on the city service center's previous year's statistics.

Table 6.7: City service center KPIs and target selection

		KPIs			
		RESPONSE RATE	**AVERAGE SPEED OF ANSWER (ASA)**	**TRANSFER RATE**	**REGISTRATION OF ERRANDS**
	RANKING	**1**	**2**	**3**	**4**
EXTERNAL BENCHMARKING	Nordics (average) [36]	90.6%	55 sec	8.5%	-
	Copenhagen [66]	92%	1:30 min	50%	-
	Municipalities	92%	10 sec	-	-
	Public sector	80%	3 min (phone calls) 5 hours (electronic channels)	30% (from FCR)	100%
	Other sector	100%	-	-	-
	Other sector	-	-	15% (from FCR)	90%
INTERNAL BENCHMARKING (average, own statistics)	2021	86.8%	2.3 min (1.2 min visits)	25.8%	73.4%
	2020	93.1%	1.0 min (0.7 min visits)	25.7%	60.7%
	2019	93.2%	0.9 min (0.4 min visits)	25.4%	78.8%
	2018	92%	0.9 min (0.4 min visits)	20.7%	-
	2017	-	1.1 min	23.5%	-
CITY SERVICE CENTER TARGETS	Green	**>= 91%**	**<= 1 min**	**<= 25%**	**>= 90%**
	Yellow	**>= 85%**	**<= 3 min**	**<= 30%**	**>= 80%**
	Red	**< 85%**	**> 3 min**	**> 30%**	**< 80%**

Abbreviation: sec: second, min: minute.

An interesting aspect of the table is the city service center targets. KPIs and goals were selected based on the city's goals and strategy. The targets were color-coded, where green status color indicates on-target performance, yellow implies some caution needs to be made, and red indicates below-target. In addition, performance metrics were selected, which will be explained in more detail in the next phase. The mathematical equations for the KPIs are as follows:

$$\textit{Response Rate} = \frac{\textit{(Number of o ered calls - Number of abandoned calls)}}{\textit{Number of o ered calls}} \quad 100\% \tag{6.1}$$

$$\textit{Average Speed of Answer (ASA)} = \frac{\textit{Total waiting time of answered calls}}{\textit{Total number of answered calls}} \quad 100\% \tag{6.2}$$

$$\textit{Transfer Rate} = \frac{\textit{Number of transferred calls}}{\textit{Total number of calls}} \quad 100\% \tag{6.3}$$

$$\textit{Registration of Errands} = \frac{\textit{Total number of errands registered in a system}}{\textit{Total number of errands}} \quad 100\% \tag{6.4}$$

The results of the methods described above obtained the user requirements, which is summarized as follows:

- Both dashboards should:
  - Contain relevant performance metrics, KPIs, and targets.
  - Be simple, accurate, and loaded daily.
  - Support the city strategy.
  - Follow the city's design standard regarding colors on the dashboards.

  - Contain multiple sheets.
  - Provide an integrated overview of each service channel and an overview of all service channels together.

- The tactical dashboard for the service management team should:
  - Be interactive, that is, allowing users to interact with the dashboard.
  - Provide detailed information about the service center's performance.
  - Contain filters, therefore, making it possible to gain deeper and fresher insight into the data.
  - Provide historical data, so it is possible to compare performance together—for example, today's data with last year's data.
  - Be simple to switch between multiple sheets.

- The operational dashboard for the service agents should:
  - Be on a screen in the service center, visible for the service agents at any given time.
  - Rotate between sheets every twenty seconds.
  - Show the performance of the day in question and provides an overview of the last five workdays.
  - Not be as detailed as the tactical dashboard. Rather it should provide an overview of the service center's performance.
  - Provide historical comparisons, that is, compare today's data with the same day last year.

6.3 Phase 3: Producing Design Solutions

The results of the interviews, focus group, literature review, survey, and brainstorming section provided a good foundation using benchmarking technique in terms of the content of the dashboards. With performance metrics determined, KPI, and targets essential for the city service center, the first iteration of the tactical dashboard was designed. As in the previous phases, the researcher was in constant contact with the users throughout the designing process.

Low-fidelity prototypes
Several prototypes were drawn on paper before the actual design took place. In the design phase, prototyping is the most used technique [45]. A prototype was made to facilitate the design and save time. It was done so the dashboard could be designed according to a paper prototype based on information obtained from the users. An example of a low-fidelity prototype conducted in the final stage of the dashboard design is shown in Figure C.1 in Appendix C.

Through various iteration from user's feedback, the final performance dashboards were published. From the user's requirements, both dashboards are loaded daily, at 7 am. As previously stated, the main difference between the two dashboards is the level of detail, whereas the tactical dashboards are more detailed than the operational.

6.3.1 City Service Center Tactical Dashboard

The tactical dashboard's primary purpose was to provide the service management team with information about the service center's performance. The final dashboard contained a total of 20 sheets, and all can be seen in Appendix F.

The dashboard is interactive, meaning that the users can drill down and filter information. As a result, view the data from different perspectives and in a greater depth. For example, if the user selects one department, the dashboard shows only that department's data. In addition, it is also possible to select multiple departments. This feature is possible for all sheets of the dashboard.

Figure 6.10 shows the first sheet of the dashboard, containing the KPIs and targets. One critical feature required from the service management team was picking a date range or specific dates and getting an overview only from selected dates. The date range filter and other date filters were applied on all dashboard sheets to fulfill that request. A closer inspection of the figure shows that the year 2021 was selected on Wednesday, Thursday, and Friday. When these dates are selected, the dashboard only displays data for selected dates.

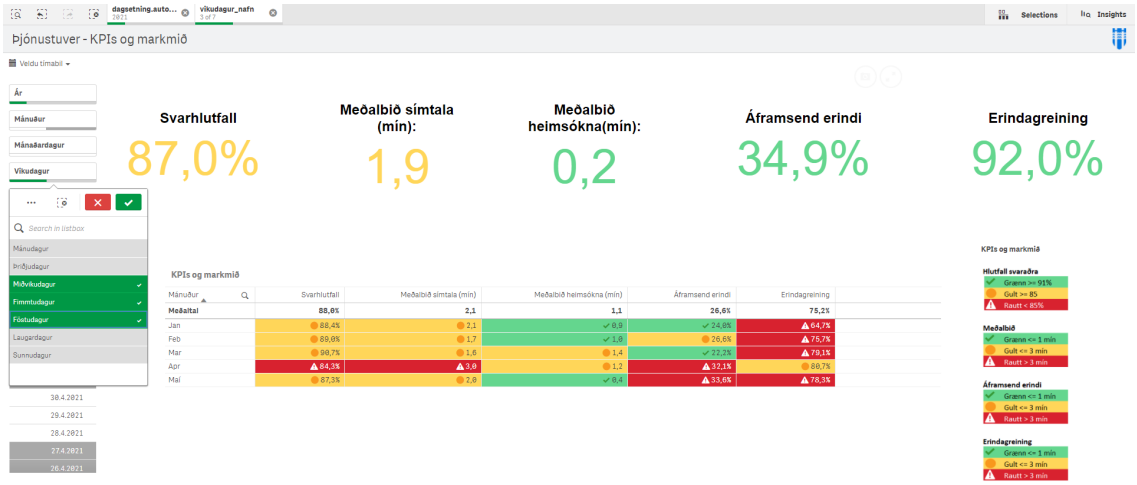

Figure 6.10: KPI and targets on the tactical dashboard

The figure above shows how the targets for KPIs are color-coded. To the right is an image that explains the targets that have been set as well as the target ranges.

Figure 6.11 shows the date range filter. A closer look at the figure reveals that it is relevantly simple to pick a date and compare it to another or select a date range. For example, if a manager wants to examine the service center's performance during the date range 4-20 April 2021.

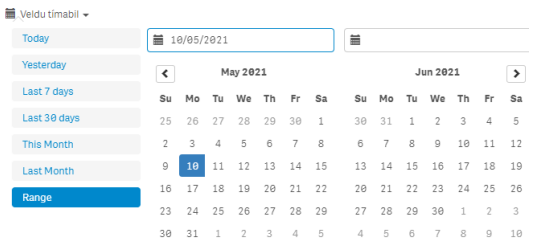

Figure 6.11: The date range filter

The date filter, shown in Figure 6.12, makes it easier to compare specific dates. The date filter allows the user to select a year, month, day of the month, weekday, and date.

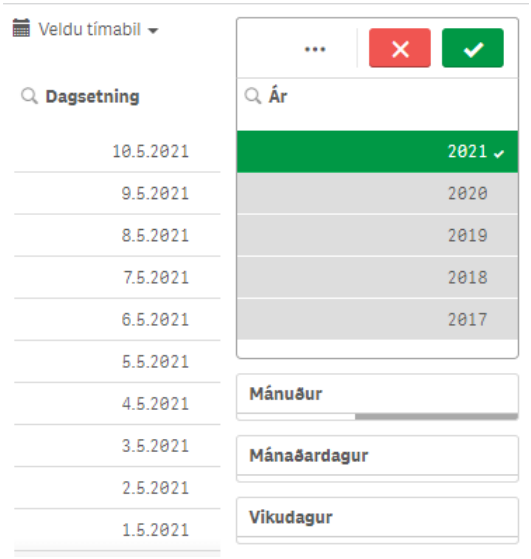

Figure 6.12: The date filter

Figure 6.13 shows the overview of the tips. The figure revealed that the year 2021 and the Environment and Planning Department had been filtered when looking at it more closely. Hence, the numbers showing are only for that particular department in 2021.

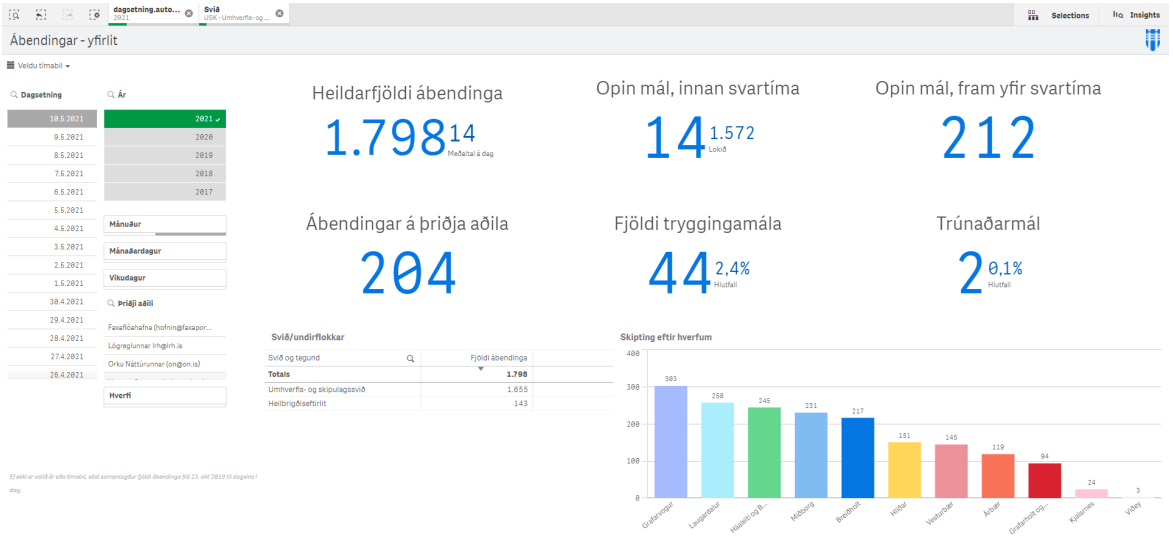

Figure 6.13: Tips overview on the tactical dashboard

Figure 6.14 shows the registration of errands. The figure showed the results for three departments in March 2019. The bar chart on the Environment and Planning Department has the most errands on the selected dates.

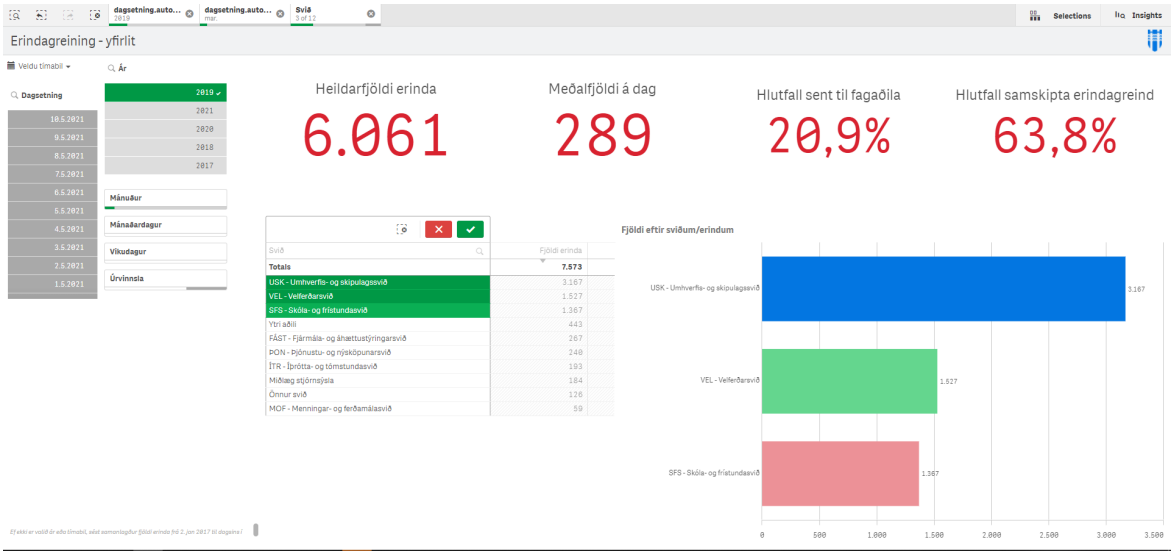

Figure 6.14: Registration of errands overview on the tactical dashboard

The years 2020 and 2021 have been chosen in Figure 6.15. The subcategory can be seen if the figure is examined more closely. Based on the selected dates, the construction representative with most errands, followed by the child welfare and the parking fund can be seen.

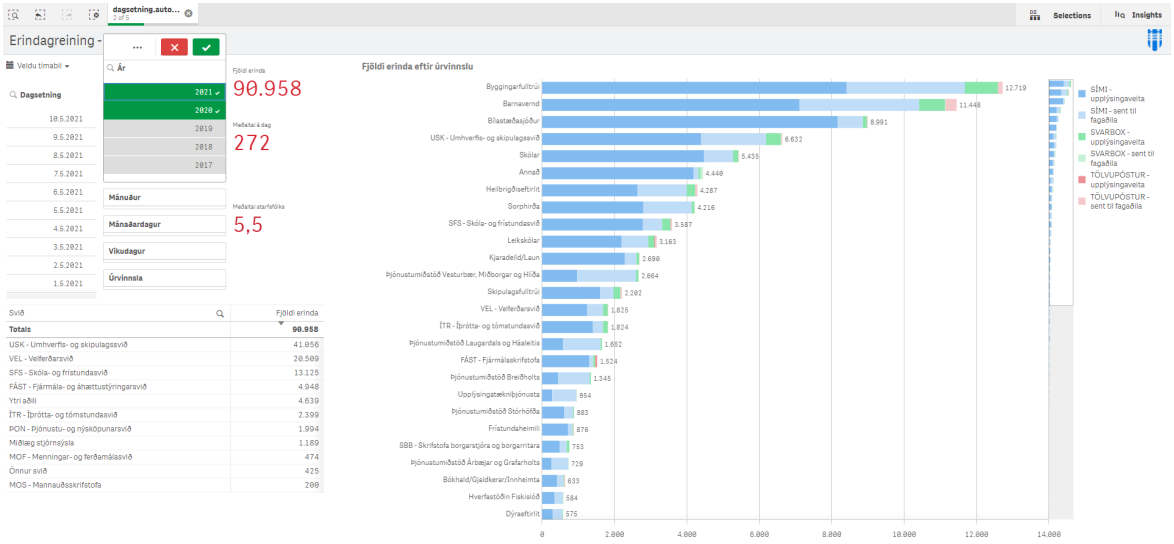

Figure 6.15: Subcategories of errands on the tactical dashboard

Figure 6.16 shows eight of the twenty sheets that the tactical dashboard contains. Each service channel has its own color, according to the city's design standards. The tips have a blue-colored theme, the visits a green one, the errands registration a red one, and the phone calls a yellow-colored theme. As previously indicated, the final tactical dashboard can be seen in Appendix F.

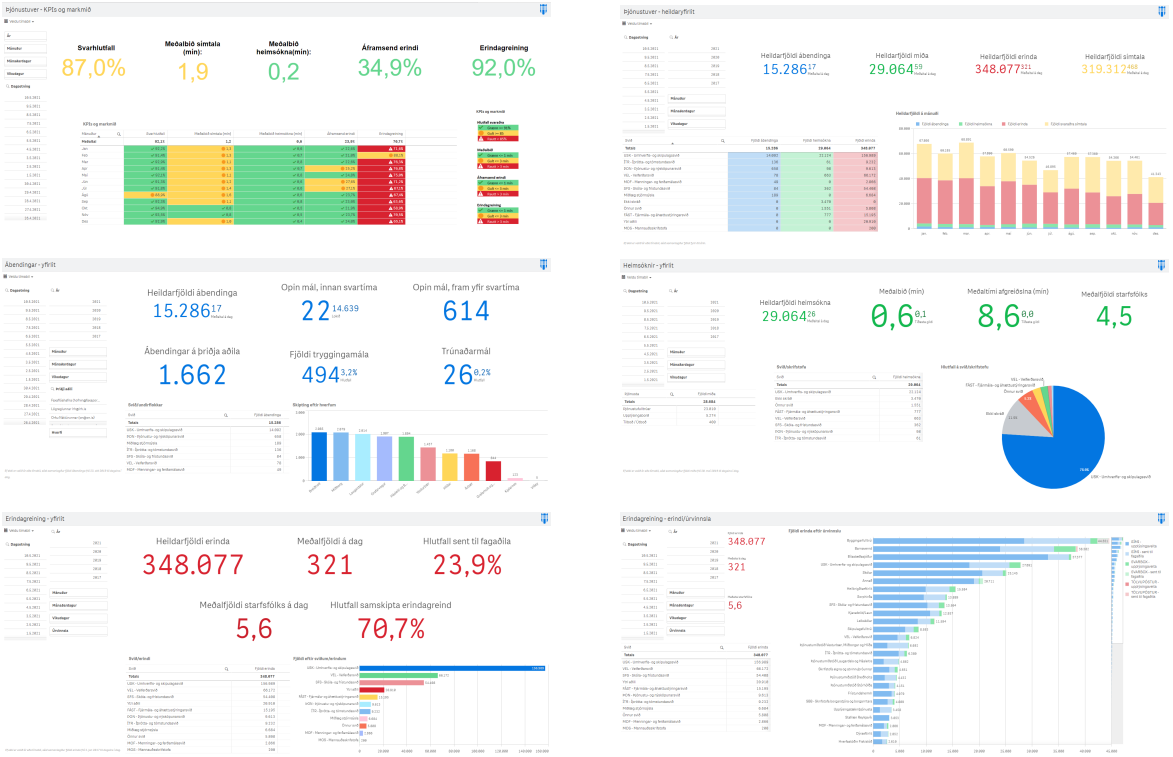

Figure 6.16: Tactical dashboard overview

6.3.2 City Service Center Operational Dashboard

The operational dashboard was developed and designed from user requirements. The dashboard aimed to provide the service agents with a comprehensive overview of the service center's performance. The operational dashboard was built similarly to the tactical dashboard but was a simpler version of it. The final version of the operational dashboard contained ten sheets. The dashboard shows the current date when the data was loaded at 7 am. It also shows the status of the previous five workdays. In addition, the KPI and target overview shows the last year as a comparison.

Figure 6.17 shows an overview of the KPIs and targets. The figure shows that the appearance of KPIs and targets are tactically similar, as illustrated above. The main difference is that the former shows information about KPIs a year earlier. In addition, a symbol is shown, where the arrow is pointing up means that today's KPI is higher than last year. Likewise, if the arrow points down, it means that today's KPI is lower than last year.

Figure 6.17: KPIs and targets on the operational dashboard

Figure 6.18 shows the operational dashboard. A new sheet appears every twenty seconds. It shows the color theme for each service channel, according to the city's design standards. Each service channel had either one or two sheets. The two first sheets were overviews of the integrated service channels.

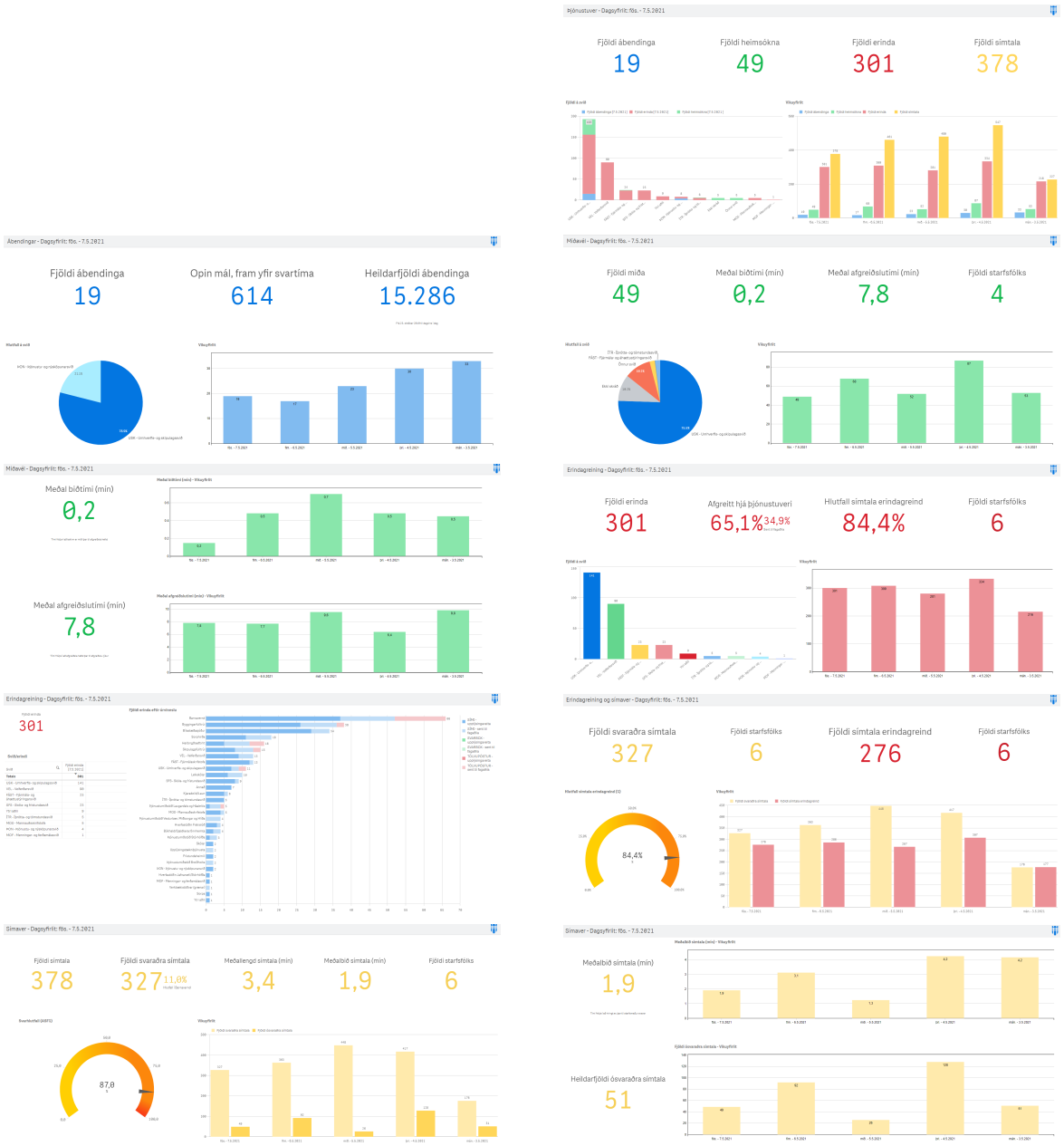

Figure 6.18: Operational dashboard overview

6.4 Phase 4: Evaluating the Design

Design is all about usability. Therefore, the dashboard evaluation is a critical part of the design process. The evaluation of the dashboards was done using usability testing, measures using usability metrics (efficiency, effectiveness, and user satisfaction) which, as previously stated, were defined by the ISO/IEC 25022 standard [62].

6.4.1 Usability Testing

The usability test contained ten tasks, as previously explained. The dashboard usability was evaluated based on the results from the test and interviews with the service management team. The usability test contained two questions about each service channel and two questions about the overview, where service channels were integrated. The tactical dashboard was interactive, but the operational dashboard was only visible on a screen in the service center. The usability test was conducted on the tactical dashboard. Therefore, the service management team took the test. The questions for the usability test were as follows:

1. *Overview:* How many calls were there in February 2021?
2. *Overview:* How many visits were registered in the Services and Innovation Department (ÞON) in June 2020?
3. *Tips:* Which neighborhood received the most tips in January 2021? How many tips did the neighborhood receive?
4. *Tips:* Which department had the most tips during the week: April 4-8, 2021? How many tips were in that department?
5. *Visits:* How many visits were recorded in Environment and Planning Department (USK) 29.3.2021?
6. *Visits:* What was the average wait for visits (min) in December 2020?
7. *Registration of errands:* What percentage of errands were sent to specialists on Mondays in January 2021?
8. *Registration of errands:* How many calls were registered during the week: 3-7 May 2021?
9. *Phone calls:* What was the proportion of answered calls on 4.5.2021?
10. *Phone calls:* What was the average waiting time (min) in August 2020?

6.4.1.1 Effectiveness

Table 6.8 shows the results of the evaluation of the dashboard effectiveness. As shown in the table, all users completed each task successfully, resulting in a 100% completion rate.

Table 6.8: Effectiveness evaluation of the dashboard

Task	User 1	User 2	User 3	User 4
1	✓	✓	✓	✓
2	✓	✓	✓	✓
3	✓	✓	✓	✓
4	✓	✓	✓	✓
5	✓	✓	✓	✓
6	✓	✓	✓	✓
7	✓	✓	✓	✓
8	✓	✓	✓	✓
9	✓	✓	✓	✓
10	✓	✓	✓	✓
Successful tasks	10	10	10	10
Proportion (%)	100	100	100	100

✓: Task accomplished, : Task not accomplished.

6.4.1.2 Efficiency

Table 6.9 provides an overview of the dashboard efficiency. It can be seen that all users completed each task within the time target from the data in the table. A closer inspection of the table shows that the average time per task was 21 seconds. The questionnaire consisted of three rather straightforward questions, three challenging questions, and four moderately challenging questions.

Table 6.9: Efficiency evaluation of the dashboard

	Time per user (sec)						
Task	**User 1**	**User 2**	**User 3**	**User 4**	**Average per task (sec)**	**Target (sec)**	**Time target**
1	10	23	25	25	21	40	✓
2	19	23	34	25	25	40	✓
3	12	15	8	14	12	20	✓
4	32	29	48	15	31	60	✓
5	29	16	50	17	28	60	✓
6	15	22	9	11	14	40	✓
7	20	26	22	22	23	40	✓
8	53	10	35	18	29	60	✓
9	14	17	17	14	16	20	✓
10	13	16	10	19	15	20	✓
Average	22	20	26	18	21		

✓: Task accomplished within the time target, : Task not accomplished within the time target.

6.4.1.3 User Satisfaction

The service management team answered a questionnaire about their satisfaction with the dashboard shortly after the usability test. The system usability scale (SUS) was obtained to evaluate user satisfaction. The average SUS score from the questionnaire was 88.75. Based on the literature, that is an excellent score, which demonstrates great user satisfaction.

Table 6.10: User satisfaction of the dashboard

	User 1	User 2	User 3	User 4
SUS score	82.5	90	90	92.5
Average SUS score		88.75		

SUS score that was used to evaluate the dashboard usability [63].

6.4.1.4 Summary

All usability metrics were reached by looking at the usability metrics (efficiency, effectiveness, and user satisfaction) defined by ISO/IEC 25022 standard. In terms of effectiveness, all users completed all tasks, resulting in 100% effectiveness. Furthermore, in terms of efficiency, the time user completed all tasks was below the time target. Finally, the SUS score of 88.75 shows an excellent score. In addition, interviews with users revealed their satisfaction.

Chapter 7

Discussion

This project aimed to develop and design a performance dashboard for the Reykjavík city service center, using a user-centered design process. This project describes the design and development process according to ISO 9241-210 standard, where user feedback was obtained continuously throughout the project. This study was conducted using various data collection methods, such as interviews, focus groups, and surveys, as required from the standard. One strength of the study was the involvement of end-users throughout the project, aiming to meet user requirements and needs. Through the user, requirements became clear that an additional dashboard for the service agents was needed. Furthermore, it was clear that emphasis was on dashboard content because no such dashboard had been in the city service center before.

The service management team decided to embark on a benchmarking technique to support a good foundation and content of the dashboard. A survey conducted among larger service centers in Iceland provided good insight into their working practices. Several interesting results emerged from the survey. For example, it was interesting to see that calls are still among the most common service channels, followed by other electronic channels. Some people may have estimated that social media would be a more significant proportion, but this did not turn out to be the case. The most common KPIs that participants observed were the abandonment rate, the average speed of answer, average call duration, and the total calls. It was interesting to see that only half of the participants were willing to provide the set target. Everyone was willing to indicate which KPIs were being monitored. Internal benchmarking was the most common way the organization set targets for the KPIs, followed by literature and external benchmarking. It turned out to be the path chosen by the dashboard design team. It was interesting to see that no participant evaluated that the set target had not been achieved. Meetings and discussions were the most common way to teach or train KPIs and target service agents. Finally, when determining the targets for KPIs, customer satisfaction weighted heaviest, followed by customer satisfaction and operating cost, and no one said operating costs.

In addition, international benchmarking was used to gain even better insight and broader input. An interview with the developer manager at Copenhagen's citizen service provided further insight into performance metrics, KPIs, and targets. Furthermore, a report that showed the average of customer service statistics in the Nordic countries was used. The last step in the benchmarking process was internal benchmarking, where own statistics from previous years were utilized. The benchmarking techniques undoubtedly provided a good foundation and a good idea for choosing the content for the performance dashboards.

In a focus group session where external and internal benchmarking was used, the contents of the dashboards were determined. Four KPIs were set along with the target. An additional

performance measure was selected, as well as the desired dashboard design. The design results yielded two dashboards, one tactical for the service management team and another operation dashboard for the service agents. All user's requirements were met, and the final step in the UCD design process was the design evaluation. A usability test was conducted following the ISO/IEC 25022 to evaluate the dashboard usability. The usability test consisted of three quality metrics: effectiveness, efficiency, and user satisfaction.

The usability test shows that all users completed all tasks, resulting in 100% dashboard effectiveness. Regarding the efficiency, each of the ten tasks had some time target, divided into three difficulty levels. Results from that test show that all users completed each task within the time target. Finally, user satisfaction was obtained with a system usability scale score, where a questionnaire was sent to the users after the usability test. The average SUS score was 88.75. Judging from an excellent SUS score and interviews with the service management team, user satisfaction was met. The final step was the dashboard implementation, as the designed solution met user requirements.

7.1 Recommendations

For future work, it is suggested to evaluate the system usability after some time. The final dashboards design was ready and implemented at the city service center at the end of the project period. The next step for the service center managers is to present and explain the KPIs and targets for the service agents.

Usability testing can be conducted in a variety of ways. In this project, it was done remotely, where the user shared their screen. The usability test was also created by the researcher, where he assessed the level of difficulty. It would be interesting to conduct another type of usability test containing different kinds of tasks.

Furthermore, because the needs and goals of companies are constantly changing, it is essential to maintain a continuous improvement regarding the performance dashboards, redesign, adapt and update as relevant. Moreover, as there were four KPIs and targets set, more KPIs could be considered in the future and evaluate whether the performance dashboard affects the performance of the city service center. Finally, it would be possible to create a forecasting model, which predicts the workload.

The findings were from a single case study, so it not possible to generalize the results to the broader population. Therefore, it would be interesting to see this research method used in other service centers in Iceland and abroad.

7.2 Conclusion

This project describes the development and design of performance dashboards for the Reykjavík city service center, using a user-centered design process. The literature review, interviews, focus group sessions, and survey provided a good foundation for the dashboard content. With the user requirements at the center of the design process, two performance dashboards were implemented. Results from usability testing and interviews with users revealed a successful implementation of the performance dashboards for the Reykjavík city service center.

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Appendix A

Questionnaire Sent to a Larger Service Centers in Iceland

The questionnaire and the cover letter were sent to 22 companies operating larger service centers in Iceland. The survey consisted of three parts, including both fixed response options and open-ended questions. The results were then used as criteria when selecting performance metrics, KPIs, and targets for the Reykjavík city service center.

First section: Background of the organizations

1. How many employees are in the service center (less than 10, 11-20, 21-30, or more than 30)?
2. How are the proportions of the following channels in your service center:
    a. Phone calls?
    b. Online chat?
    c. Other electronic channels (for example, through emails)?
    d. Visits?

Second section: Determination of the KPIs and targets

3. Do you use dashboards or statistics reports to monitor the service center's performance (yes/no)?
    a. If yes, what key performance indicators (KPIs) are monitored?
    b. If no, how do you monitor the performance?
4. What was the basis when deciding the KPIs (for example, examining the possible impact of the KPIs, the experience of other companies (benchmark), known measurements according to the literature, intuition, or something else)?
5. What targets have you set for these KPIs?
6. Who was involved in setting the targets?

7. What was the basis for the target setting for the KPIs (For example, statistics from own service center, the experience of other companies (benchmark), known targets from the literature, intuition, or something else)?
8. How have you managed to achieve the set targets for these KPIs (Extremely well, very well, somewhat well, not so well, not at all well)?
9. Have the targets been revised since they were first set (yes/no)?
    a. If yes, how did the targets evolve?

Final section: Working practices around the KPIs and targets

10. Are the service receptionists aware of KPIs and targets (yes/no)?
    a. If yes, how is the training or teaching arranged?
11. Do you measure customer satisfaction in the service center (yes/no)?
    a. If yes, how often and how do you do it?
    b. If yes, can you see the satisfaction linked with the set targets? If so, how?
12. On average, how often do managers review these KPIs (several times a day, daily, weekly, monthly, quarterly)?
13. Is the performance of the service center reviewed with the employees regularly (yes/no)?
    a. If yes, how is it done and how often?
14. When determining the objectives for KPIs, what weighted heavier:
    a. Customer satisfaction
    b. Operating costs of the service center
    c. Equal weight

Appendix B

Participants' Answers to the Survey

Eight individuals responded to the survey. Table B.1 below shows the participant's answers to the rst part of the survey about the organization's background. Secondly, Table B.2 provides an overview of participant's answers to the second part of the survey concerning KPIs and target setting. Finally, Table B.3 illustrates participant's answers to the nal part of the survey about work practices around KPIs and targets.

Table B.1: Participants' answers to the rst part of the survey

Table B.2: Participants' answers to the second part of the survey

Table B.3: Participants' answers to the first part of the survey

Final section: Working practices around the KPIs and targets

Questions	Participants #							
	1	2	3	4	5	6	7	8
	Municipalities sector	**Other sector**	**Financial sector**	**Service sector**	**Other sector**	**Other sector**	**Financial sector**	**Public sector**
10. Are the service agents aware of KPIs and targets (yes/no)?	Yes	Yes	Yes	Yes	Yes	-	Yes	Yes
10.a. If yes, how is the training or teaching arranged?	• Discussed monthly • Daily morning meetings where they are also discussed	• Discussed with employees • Measureable data used to report performance	• The situation is reviewed at meetings and/or person to person	• Weekly information e-mail with the main service aspects of answering calls and e-mails.	• Some KPIs and goals are discussed • Difficult now during COVID-19	-	• Total tutorial on our system • Training in meetings • Regularly review of the measures and how we intend to achieve our targets	• Statistics about the past week are sent out every Monday • Every other week there is a meeting, where we review how things are going and what we can do better
11. Do you measure customer satisfaction in the service center (yes/no)?	No, we do not have a system that keeps track of it	Yes	Yes	Yes	Yes	-	Yes	No, but it stands to sent out a survey at the end of May
11.a. If yes, how often and how do you do it?	-	• Digital service survey is sent by e-mail three days after service provided	• Varies	• Circa monthly • Using a research and information company to measure it	• Varies	-	• Digital service survey is sent twice a year	-
11.b. If yes, do you see the satisfaction linked with the set targets? If so, how?	-	-	• Happier customers when targets are achieved	• Not strong connection there based on the data • Can be difficult to measure without the cost of implementation is too expensive	• Yes, and it also helps follow the training and other things	-	• Yes, we see a connection to having a high level of service and achieving set targets	-
12. On average, how often do managers review the KPIs (several times a day, daily, weekly, monthly, quarterly)?	• Monthly	• Some daily (follow-up on service surveys, performance, and how calls are distributed) • Another monthly (response rate, waiting time, etc.)	• Daily	• Weekly at board meetings	• Daily • Some weekly • Other monthly	-	• Daily from a dashboard • Weekly and monthly in a report form	• Daily (the customer experience manager) • Weekly (with the management team)
13. Is the service center's performance reviewed with the employees regularly (yes/no)?	Yes and no	Yes	Yes	Yes	Yes	Yes	Yes	Yes
13.a. If yes, how is it done and how often?	• Monthly meetings (as the response rate is over 91% and waiting time around 6-7 sec, and therefore within set targets)	• Accessible in real-time, centrally online • On a screen in the service center	• Regularly on a meetings • Information is received by e-mail • Employees also have access to a dashboard, and there they can see the number of calls per employee and the registration of errands	• Weekly information e-mail to service agents	• Fairly regularly (but special time now because of COVID-19)	• The communication services, response and handling/registration/ processing of errands are reviewed regularly	• On a screen in the service center • Monthly feedback	• This service is bought from a third party, so not sure how often
14. When determining the targets for the KPIs, what weighted heavier:								
14.a. Customer satisfaction		Customer satisfaction	Customer satisfaction		Customer satisfaction	-	Customer satisfaction	
14.b. Operating cost of the service center						-		
14.c. Equal weight	Equal weight			Equal weight		-		Equal weight

hyphen-minus (-) meaning not applicable and/or participant did not answer this question or the questionnaire subquestion.

Appendix C

Low-Fidelity Prototype

Part of the design of the dashboards was a paper prototype, also known as a low-fidelity prototype. Figure C.1 shows one example of a paper prototype made in the final stage of dashboard design.

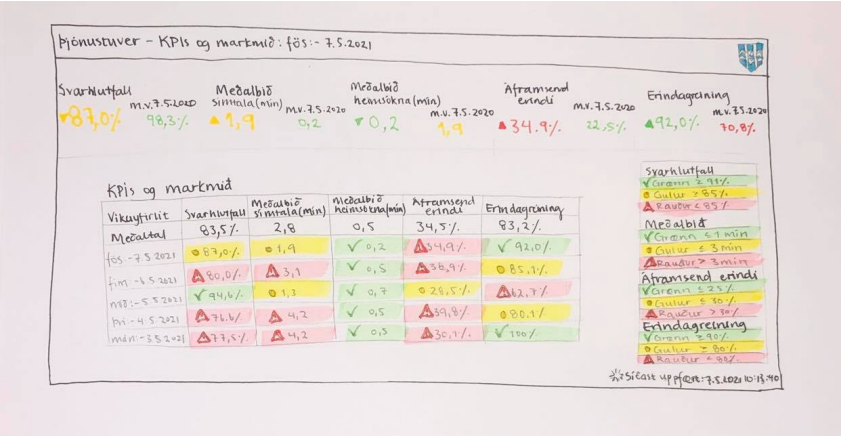

Figure C.1: Low-fidelity prototype at the final stages of the design

Appendix D

Code

The code below illustrates the data processing in R, which includes data cleaning and interpretation for the visits. In addition, R was used to processing data from all the other service channels by the researcher (that is, for the tips, phone calls, and errands).

```
# Bæti við pökkum sem þarf
library(dbplyr)
library(tidyverse)
library(bit64)
library(dplyr)
library(keyring)
library(ggbump)
library(lubridate)
library(ggplot2)
library(odbc)
library(DBI)
library(anytime)
library(fastDummies)
library(ggrepel)
library(reshape2)
library(openxlsx)
library(readxl)
library(directlabels)

# TENGING VIÐ MIÐAGÖGN  ------------------------------------------------
con <- DBI::dbConnect(odbc::odbc())

# Sæki dim og fact töflur í gagnagrunninn
dim_table_names <- tbl(con, in_schema("INFORMATION_SCHEMA", "TABLES")) %>%
    collect() %>%
    filter(str_detect(TABLE_NAME, "dim_")) %>%
    pull(TABLE_NAME)

dims <- map(.x = dim_table_names,
            .f = ~tbl(con, in_schema("stat", .x))) %>%
        map(~collect(.)) %>%
        set_names(dim_table_names)

# TENGI FACT_VISIT_EVENT TÖFLUR SAMAN ----------------------------------
fact_visit_events <- tbl(con, in_schema("stat",
                         table = "fact_visit_events"))

fact_visit_events_1 <- fact_visit_events %>%
    select(1:33) %>%
    collect()

fact_visit_events_2 <- fact_visit_events %>%
    select(34:42) %>%
    collect()

fact <- bind_cols(fact_visit_events_1, fact_visit_events_2) %>%
    mutate_if(is.integer64,
            as.numeric)
```

```
hreinsa_int <- function(.data) {
    .data %>%
    mutate_if(is.integer64,
              as.numeric)
}

dims <- dims %>%
    map(~hreinsa_int(.))

# TENGI SAMAN DIM OG FACT TÖFLUR -------------------------------------
# key í fact töflunni tengist id í dim töflunum
midar <- fact %>%
    left_join(dims$dim_staff, by = c("staff_key" = "id"),
            suffix = c("", "_staff")) %>%
    left_join(dims$dim_branch, by = c("branch_key" = "id"),
            suffix = c("", "_branch")) %>%
    left_join(dims$dim_visit, by = c("visit_key" = "id"),
            suffix = c("", "_visit")) %>%
    left_join(dims$dim_service, by = c("service_key" = "id"),
            suffix = c("", "_service")) %>%
    left_join(dims$dim_delivered_service, by = c("delivered_service_key" = "id"),
            suffix = c("", "_delivered_service")) %>%
    left_join(dims$dim_service_point, by = c("service_point_key" = "id"),
            suffix = c("", "_service_point")) %>%
    left_join(dims$dim_work_profile, by = c("work_profile_key" = "id"),
            suffix = c("", "_work_profile")) %>%
    left_join(dims$dim_visit_call_type, by = c("visit_call_type_key" = "id"),
            suffix = c("", "_visit_call_type")) %>%
    left_join(dims$dim_visit_event_type, by = c("visit_event_type_key" = "id"),
            suffix = c("", "_visit_event_type"))

# midar2 -TAFLA HREINSUÐ BARA FYRIR HÖFÐATORG ----------------------------
# hreinsa óþarfa dálka
midar2 <- midar %>%
    select(c(id, date_key, event_timestamp, visit_event_type_key, branch_key,
            branch_origin_id, visit_key, service_key, delivered_service_key,
            service_point_key, staff_key, visit_call_type_key, origin_id, name,
            first_name, last_name, name_branch, origin_id_visit, ticket_id,
            origin_id_service, name_service, origin_id_delivered_service,
            name_delivered_service, origin_id_service_point, name_service_point,
            origin_id_work_profile, name_work_profile, name_visit_event_type))


# Bý til sameiginlega tímadálka milli service-a og filtera bara fyrir Höfðatorg
midar2 <- midar2 %>%
    filter(name_branch == "Höfðatorg") %>%
    mutate(ar = year(event_timestamp),
            manudur = month(event_timestamp),
            dagur = day(event_timestamp),
            vikudagur = wday(event_timestamp),
            vikudagur_nafn = weekdays(event_timestamp),
            manudur_nafn = month.abb[manudur],
            klst = hour(event_timestamp),
            dagsetning = as.Date(as.POSIXct(event_timestamp)))

# Raða vikudögum og mánuðum í rétta tímaröð
midar2$vikudagur_nafn <- factor(midar2$vikudagur_nafn,
                                levels = c("Monday", "Tuesday", "Wednesday",
                                           "Thursday", "Friday"))

midar2$manudur_nafn <- factor(midar2$manudur_nafn,
                                levels = c("Jan", "Feb", "Mar", "Apr", "May",
                                           "Jun", "Jul", "Aug", "Sep", "Oct",
                                           "Nov", "Dec"))

# Endurskýra vikudaga á íslensku fyrir QS appið
levels(midar2$vikudagur_nafn) <- c("Mánudagur", "Þriðjudagur","Miðvikudagur",
                                   "Fimmtudagur", "Föstudagur")

# Hver miði (visit_key) verður bara ein lína, transpose-a name_visit_event_type
# til að geta reiknað biðtíma og lengd heimsókna ------------------------------

# midar3 bætir við nýjum dálk sem sýnir afgreiðslu heimsókna
midar3 <- midar2 %>%
```

```
    group_by(visit_key) %>%
    mutate(afgreidsla = as.difftime(max(event_timestamp) - min(event_timestamp)))

# nytt = hver heimsókn bara ein lína
nytt <- midar3 %>%
    arrange(-desc(visit_key))

# name_visit_event_type dálkur transpose-aður til að reikna biðtíma og heildartíma
nytt <- nytt %>%
    dummy_cols(select_columns = "name_visit_event_type") %>%
    select(event_timestamp, visit_key,
        name_visit_event_type_ADD_DELIVERED_SERVICE:
        name_visit_event_type_VISIT_TRANSFER_TO_USER_POOL)

# Bý til fall sem breytir tíma í sekúndur
time_to_sec <- function(x) {
    x <- sum(hour(x)*3600, minute(x)*60,floor(second(x)))
    return(x)
}

# event_timestamp í sek til að reikna bið- og heildartíma
nytt <- nytt %>%
    mutate(event_timestamp = map(event_timestamp, time_to_sec))

# transpose-uðu dálkarnir settir í sek til að geta reiknað biðtíma og heildartíma
nytt <- nytt %>%
    mutate(name_visit_event_type_VISIT_CREATE =
        as.numeric(case_when(name_visit_event_type_VISIT_CREATE != 0 ~
        event_timestamp, TRUE ~ list(0)))) %>%
    mutate(name_visit_event_type_ADD_DELIVERED_SERVICE =
        as.numeric(case_when(name_visit_event_type_ADD_DELIVERED_SERVICE != 0 ~
        event_timestamp, TRUE ~ list(0)))) %>%
    mutate(name_visit_event_type_VISIT_NEXT =
        as.numeric(case_when(name_visit_event_type_VISIT_NEXT != 0 ~
        event_timestamp, TRUE ~ list(0)))) %>%
    mutate(name_visit_event_type_VISIT_CALL =
        as.numeric(case_when(name_visit_event_type_VISIT_CALL != 0 ~
        event_timestamp, TRUE ~ list(0)))) %>%
     mutate(name_visit_event_type_VISIT_TRANSFER_TO_QUEUE =
        as.numeric(case_when(name_visit_event_type_VISIT_TRANSFER_TO_QUEUE != 0 ~
        event_timestamp, TRUE ~ list(0)))) %>%
    mutate(name_visit_event_type_VISIT_TRANSFER_TO_USER_POOL =
        as.numeric(case_when(name_visit_event_type_VISIT_TRANSFER_TO_USER_POOL != 0 ~
        event_timestamp, TRUE ~ list(0)))) %>%
    mutate(name_visit_event_type_VISIT_END =
        as.numeric(case_when(name_visit_event_type_VISIT_END != 0 ~
        event_timestamp, TRUE ~ list(0)))) %>%
    mutate(name_visit_event_type_VISIT_NOSHOW =
        as.numeric(case_when(name_visit_event_type_VISIT_NOSHOW != 0 ~
        event_timestamp, TRUE ~ list(0)))) %>%
    mutate(name_visit_event_type_VISIT_REMOVE =
        as.numeric(case_when(name_visit_event_type_VISIT_REMOVE != 0 ~
        event_timestamp, TRUE ~ list(0)))) %>%
    mutate(name_visit_event_type_VISIT_END_TRANSACTION =
        as.numeric(case_when(name_visit_event_type_VISIT_END_TRANSACTION != 0 ~
        event_timestamp, TRUE ~ list(0)))) %>%
    mutate(name_visit_event_type_VISIT_TRANSFER_FROM_QUEUE =
        as.numeric(case_when(name_visit_event_type_VISIT_TRANSFER_FROM_QUEUE != 0 ~
        event_timestamp, TRUE ~ list(0)))) %>%
    mutate(name_visit_event_type_START_DELIVERED_SERVICE_TRANSACTION =
        as.numeric(case_when(name_visit_event_type_START_DELIVERED_SERVICE_TRANSACTION != 0 ~
        event_timestamp, TRUE ~ list(0))))

# Reiknað biðtími og heildartími afgreiðslu í sekúndum
# bid = biðin í sek frá því að viðskiptvinur tekur miða þar til afgreiðsla hefst
# lengd = heildartími afgreiðslu í sek (frá því að tekinn er miði þar til afgreiðslu lýkur)
nytt <- nytt %>%
    select(-event_timestamp) %>%
    group_by(visit_key) %>%
    summarise(name_visit_event_type_VISIT_CREATE = max(name_visit_event_type_VISIT_CREATE),
            name_visit_event_type_ADD_DELIVERED_SERVICE =
            max(name_visit_event_type_ADD_DELIVERED_SERVICE),
            name_visit_event_type_VISIT_CALL = max(name_visit_event_type_VISIT_CALL),
            name_visit_event_type_VISIT_NEXT = max(name_visit_event_type_VISIT_NEXT),
```

```
            name_visit_event_type_VISIT_END = max(name_visit_event_type_VISIT_END),
            name_visit_event_type_START_DELIVERED_SERVICE_TRANSACTION =
            max(name_visit_event_type_START_DELIVERED_SERVICE_TRANSACTION),
            name_visit_event_type_VISIT_NOSHOW = max(name_visit_event_type_VISIT_NOSHOW),
            name_visit_event_type_VISIT_REMOVE = max(name_visit_event_type_VISIT_REMOVE),
            name_visit_event_type_VISIT_END_TRANSACTION =
            max(name_visit_event_type_VISIT_END_TRANSACTION),
            name_visit_event_type_VISIT_TRANSFER_TO_QUEUE =
            max(name_visit_event_type_VISIT_TRANSFER_TO_QUEUE),
            name_visit_event_type_VISIT_TRANSFER_TO_USER_POOL =
            max(name_visit_event_type_VISIT_TRANSFER_TO_USER_POOL),
            name_visit_event_type_VISIT_TRANSFER_FROM_QUEUE =
            max(name_visit_event_type_VISIT_TRANSFER_FROM_QUEUE)) %>%
    mutate(bid = name_visit_event_type_VISIT_NEXT - name_visit_event_type_VISIT_CREATE) %>%
    mutate(lengd = name_visit_event_type_VISIT_END - name_visit_event_type_VISIT_CREATE) %>%
    mutate(bid = replace(bid, which(bid < 0), NA)) %>%
    mutate(lengd = replace(lengd, which(lengd < 0), NA)) %>%
    select(visit_key, name_visit_event_type_VISIT_CREATE,
            name_visit_event_type_ADD_DELIVERED_SERVICE, name_visit_event_type_VISIT_CALL,
            name_visit_event_type_VISIT_NEXT, name_visit_event_type_VISIT_END,
            name_visit_event_type_START_DELIVERED_SERVICE_TRANSACTION,
            name_visit_event_type_VISIT_NOSHOW, name_visit_event_type_VISIT_REMOVE,
            name_visit_event_type_VISIT_END_TRANSACTION, name_visit_event_type_VISIT_TRANSFER_TO_QUEUE,
            name_visit_event_type_VISIT_TRANSFER_TO_USER_POOL,
            name_visit_event_type_VISIT_TRANSFER_FROM_QUEUE, bid, lengd)

#  ------------------------------------------------------------

# Bæti við svið og þjónustu
nytt2 <- midar3 %>%
    filter(name_visit_event_type == "ADD_DELIVERED_SERVICE") %>%
    select(visit_key, name_delivered_service)

# slice(2) því slice(1) gefur ekki upp nafn á starfsmanni
# (bara anonymous þegar tekinn er miði)
# bæti við nýju transpose-uðu dálkunum, sem og sviði og þjónustu
midar4 <- midar3 %>%
    select(-name_delivered_service) %>%
    group_by(visit_key) %>%
    slice(2) %>%
    left_join(nytt) %>%
    left_join(nytt2)

# Breyti tímanum úr sek í period
midar4 <- midar4 %>%
    ungroup() %>%
    mutate(name_visit_event_type_VISIT_CREATE =
            lubridate::seconds_to_period(name_visit_event_type_VISIT_CREATE)) %>%
    mutate(name_visit_event_type_VISIT_CALL =
            lubridate::seconds_to_period(name_visit_event_type_VISIT_CALL)) %>%
    mutate(name_visit_event_type_VISIT_NEXT =
            lubridate::seconds_to_period(name_visit_event_type_VISIT_NEXT)) %>%
    mutate(name_visit_event_type_VISIT_END =
            lubridate::seconds_to_period(name_visit_event_type_VISIT_END)) %>%
    mutate(name_visit_event_type_ADD_DELIVERED_SERVICE =
            lubridate::seconds_to_period(name_visit_event_type_ADD_DELIVERED_SERVICE)) %>%
    mutate(name_visit_event_type_START_DELIVERED_SERVICE_TRANSACTION =
            lubridate::seconds_to_period(name_visit_event_type_ADD_DELIVERED_SERVICE)) %>%
    mutate(name_visit_event_type_VISIT_NOSHOW =
            lubridate::seconds_to_period(name_visit_event_type_VISIT_NOSHOW)) %>%
    mutate(name_visit_event_type_VISIT_REMOVE =
            lubridate::seconds_to_period(name_visit_event_type_VISIT_REMOVE)) %>%
    mutate(name_visit_event_type_VISIT_END_TRANSACTION =
            lubridate::seconds_to_period(name_visit_event_type_VISIT_END_TRANSACTION)) %>%
    mutate(name_visit_event_type_VISIT_TRANSFER_FROM_QUEUE =
            lubridate::seconds_to_period(name_visit_event_type_VISIT_TRANSFER_FROM_QUEUE)) %>%
    mutate(name_visit_event_type_VISIT_TRANSFER_TO_QUEUE =
            lubridate::seconds_to_period(name_visit_event_type_VISIT_TRANSFER_TO_QUEUE)) %>%
    mutate(name_visit_event_type_VISIT_TRANSFER_TO_USER_POOL =
            lubridate::seconds_to_period(name_visit_event_type_VISIT_TRANSFER_TO_USER_POOL)) %>%
    mutate(name_visit_event_type_VISIT_TRANSFER_FROM_QUEUE =
            lubridate::seconds_to_period(name_visit_event_type_VISIT_TRANSFER_FROM_QUEUE))

# Sameiginleg svið milli service-a
```

```
midar4 <- midar4 %>%
    mutate(sameiginleg_svid = case_when(
        name_delivered_service %in% c("Barnavernd","Velferðarsvið")
            ~ "VEL - Velferðarsvið",
        name_delivered_service %in% c("USK - heilbrigðiseftirlit, hundaeftirlit fl.",
        "Bílastæðasjóður", "Byggingarfulltrúi", "Skipulagsfulltrúi")
            ~ "USK - Umhverfis- og skipulagssvið",
        name_delivered_service %in% c("Fjármálasvið", "Innkaupaskrifstofa", "Kjaradeild")
            ~ "FÁST - Fjármála- og áhættustýringarsvið",
        name_delivered_service == "Íþrótta og tómstundasvið"
            ~ "ÍTR - Íþrótta- og tómstundasvið",
        name_delivered_service == "Rafræn Reykjavík"
            ~ "ÞON - Þjónustu- og nýsköpunarsvið",
        name_delivered_service == "Skóla og frístundasvið"
            ~ "SFS - Skóla- og frístundasvið",
        name_delivered_service == "Önnur svið og deildir"
            ~ "Önnur svið",
        is.na(name_delivered_service)
            ~ "Ekki skráð",
        name_delivered_service == "Miðlæg stjórnsýsla"
            ~ "Miðlæg stjórnsýsla",
        name_delivered_service == "Menningar- og ferðamálasvið"
            ~ "MOF - Menningar- og ferðamálasvið")
    )


# Tek út óþarfa dálka fyrir QS appið
midar5 <- midar4 %>%
    select(-c(id, date_key, visit_event_type_key, branch_key, branch_origin_id,
            service_key,delivered_service_key, service_point_key, visit_call_type_key,
            origin_id, name, first_name, last_name, name_branch, origin_id_visit, ticket_id,
            origin_id_service, origin_id_delivered_service, origin_id_service_point,
            name_service_point, origin_id_work_profile, name_visit_event_type, name_work_profile,
            name_visit_event_type_ADD_DELIVERED_SERVICE, name_visit_event_type_VISIT_CREATE,
            name_visit_event_type_VISIT_CALL, name_visit_event_type_VISIT_NEXT,
            name_visit_event_type_VISIT_END,
            name_visit_event_type_START_DELIVERED_SERVICE_TRANSACTION,
            name_visit_event_type_VISIT_NOSHOW, name_visit_event_type_VISIT_REMOVE,
            name_visit_event_type_VISIT_END_TRANSACTION, name_visit_event_type_VISIT_TRANSFER_TO_QUEUE,
            name_visit_event_type_VISIT_TRANSFER_TO_USER_POOL,
            name_visit_event_type_VISIT_TRANSFER_FROM_QUEUE, ar, manudur, vikudagur
    ))
```

Appendix E

System Usability Score (SUS)

Figure E.1 shows the SUS questionnaire sent to dashboard users after the usability testing. Along with other factors, the SUS score was used to evaluate the dashboard usability.

System Usability Scale (SUS)

This is a standard questionnaire that measures the overall usability of a system. Please select the answer that best expresses how you feel about each statement after using the dashboard today.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I think I would like to use this tool frequently.	□	□	□	□	□
2. I found the tool unnecessarily complex.	□	□	□	□	□
3. I thought the tool was easy to use.	□	□	□	□	□
4. I think that I would need the support of a technical person to be able to use this system.	□	□	□	□	□
5. I found the various functions in this tool were well integrated.	□	□	□	□	□
6. I thought there was too much inconsistency in this tool.	□	□	□	□	□
7. I would imagine that most people would learn to use this tool very quickly.	□	□	□	□	□
8. I found the tool very cumbersome to use.	□	□	□	□	□
9. I felt very confident using the tool.	□	□	□	□	□
10. I needed to learn a lot of things before I could get going with this tool.	□	□	□	□	□

Figure E.1: System usability score (SUS) questionnaire [63]

Appendix F

The Tactical Dashboard

Figure F.1 provides an overview of the first eight sheets of the city service tactical dashboard. Besides, Figure F.2 illustrates the last twelve sheets of the dashboard. The figures are shown in the same order as they appear on the dashboard, a total of twenty sheets. A closer inspection of the figures reveals the overview is on the first three dashboard sheets containing the integrated service channels. It may be noted that information about each service channel following comprises four sheets, except one sheet that contains both errands and phone calls.

Figure F.1: The first eight sheets of the tactical dashboard

Figure F.2: The last twelve sheets of the tactical dashboard