Degree Project in Technology, Work and Health

Second cycle 30 credits

"One Dashboard does not fit all"

Promoting User Engagement through Dashboard Design in an Energy Monitoring Platform

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Abstract

A dashboard can be described as a compact first impression of a digital product or service. In any organization, a well-designed and user-centered dashboard can be a powerful tool to engage users in the organization's processes and goals. In this study, a dashboard of an energy monitoring platform has been examined. This dashboard is used by a wide array of people working in different facility management organizations. The defined problem is the dashboard's shortness of engagement with the users. The study's purpose is to examine how to increase engagement with the users in the dashboard view. This has been done by applying practices and methods of User Experience (UX) and User-centered design. With the Double Diamond Design Process (DDDP) as an outset, user needs and goals in relation to the dashboard has been explored. Data collection has been done with a mixed method design, consisting of a pre-study, user interviews and a survey. An inductive data analysis has led to three key themes being identified: Deviations, Context and Customization. These themes represent the three main sources of potential for a more engaging dashboard on a user level. What was concluded by this was that the dashboard must resonate with the individual user on a level more closely related to the user's organizational role and goals, needs. By adapting to the user context, making deviations prominent in the visual field, and allowing for customization of features, an engaging dashboard can be developed in any organizational context.

Keywords

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List of Abbreviations

BI	Business Intelligence
CFT	Cognitive Fit Theory
CX	Customer Experience
DDDP	Double Diamond Design Process
DM	Digitalization Manager
EC	Energy Coordinator
E/SM	Energy/Sustainability Manager
EUI	Energy Use Intensity
KPI	Key Performance Indicator
PO	Property Operation
SA	Situation Awareness
SM	Sustainability Manager
SUS	System Usability Scale
TA	Technical Administrator
TM	Technical Manager
UE	User Engagement
UI	User Interface
UX	User Experience

1 Introduction

The energy sector is a major source contributing to emissions worldwide. It is therefore also crucial in the response to climate change. The emphasis on energy as a global denominator to combat climate change is also apparent in UN's 17 global sustainable development goals. In particular, Goal 7 emphasizes ensuring access to affordable, reliable, sustainable, and modern energy (United Nations, n.d.). To reach this goal in the long run, energy use must decrease as well as become more efficient (Energinyheter, 2020). In Sweden, almost 40% of energy use is allocated to heating up and cooling down properties (2020). This means, the property sector presents a great opportunity to vastly impact the energy use in Sweden, by creating awareness about property owners' energy usage. To make an impact, there must be a behavioral change is in the real estate field about energy use.

Design can be a powerful means of encouraging sustainable behavior, which have been utilized in various ways by different organizations offering digital solutions aiming at solving sustainability issues. This study includes one such organization and it examines how to create engagement in energy consumption through understanding the users in their unique needs and goals. At the center of this study is the stakeholder providing the challenge. To fully understand the challenge, the context in terms of the stakeholder and the product they provide will be explained.

1.1 Background

The stakeholder company in this thesis work provides real estate owners with a cloud-based platform for energy monitoring. Through the platform, energy data is collected, stored, analyzed, and visualized for the users to access in a quick and easy way. In Figure 1, a general depiction of the platform's structure can be found. Customers (property owners) use the platform to look at the energy consumption. The customer usually has some interest of looking into a few properties. These properties sometimes consist of smaller buildings (for example apartments in an apartment complex) and each of these buildings have gauges where the data in the platform originates. This data refers to electricity use, heating, cold water use and data coverage. Data coverage refers to what percentage the gauges have been able to read the data and report it to the platform. If the platform receives a data value from the gauges every hour every day, the data coverage is 100%. If the data coverage is low, it indicates a poorly informed system, and reason to distrust the reliability of the measures. This information is relevant to most users of the platform. Some key indicators include energy use (kWh) in total and energy use per square meter (kWh/m²). When comparing different building's energy use and the buildings are varied in size, they are prone to differ in total energy use. In cases like this the kWh/m² metric is useful. The energy use is often compared to the last 12 months, so a key question users want to know the answer to through the platform is: has the energy use gone up or down since last year?

Throughout the report, the client in this study will be referred to as "the stakeholder company".

Figure 1: Depiction of the platform structure, derived from Stakeholder source

| Kund | Fastighet | Byggnad | Mätare |
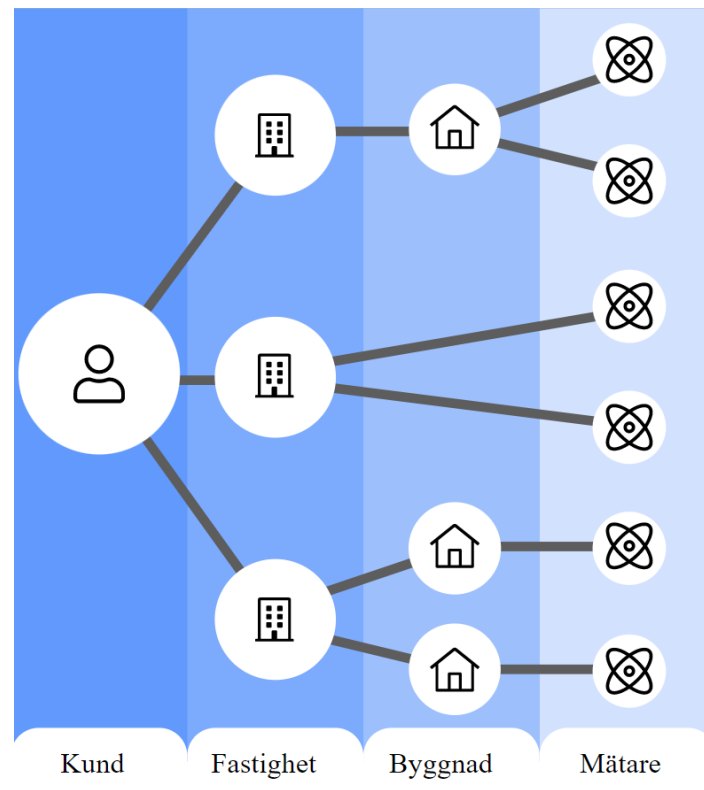
1.2 Problem

The problem at hand in this study is that the dashboard view in the platform is lacking engagement and interest among the users. The users are using the platform in general, but the dashboard view is not engaging with the users on an individual level. The dashboard is what the user first sees when logging into the platform, making it the user's first impression of the platform. Therefore, it is important that this part is engaging. This makes the dashboard view a relevant focal point to the current study.

The relevant questions related to the problem are:

- *How does the dashboard relate to different users in the organizations?*

- *How can different users' engagement be improved by the design of the dashboard?*

In summarization of these questions, the problem statement is the following:

- *How can one evoke user engagement for the dashboard view, based on different organizational roles and needs?*

1.3 Aim

The aim of this study is to examine how to increase engagement with the users in the dashboard view of the energy monitoring platform. Engagement, in the context of the study, refers to being satisfied with the dashboard while using it. Ultimately, the goal would be to encourage users to partake in the energy consumption data, so that the expenditure could decrease long-term. But

for the sake of this study, the aim is for the users to find value and interest in using the dashboard in their work activities.

1.4 Objectives

To achieve the study aim, the following actions will be performed:

- A pre-study will be conducted. Data will be collected through interviews with stakeholder representatives directly linked to the end-users.

- Both quantitative and qualitative data collection methods will be utilized. Data sets will be gathered through questionnaires answered by end-users, as well as a few in-depth interviews with end-users.

- The data from both interviews and questionnaires will be synthesized to form an affinity diagram with themes and sub-themes.

1.5 Delimitations

Although this study aims to encourage sustainable behavior through its efforts, it is also important to note how the scope of the study only covers the situation at hand. The study is limited to the evaluation of the current dashboard design and how they could be improved through participatory design efforts. While energy conserving user behavior would be a long-term goal for the aim of the study, it is not something that can be measured during the time in which the study takes place.

While the study follows the Double Diamond design process (DDDP), which is an iterative process (further explained in section 2.6) it was a deliberate decision not to include it in its entirety. The DDDP normally includes idea generation of numerous concepts and potential design solutions, after the problem has been defined (Norman, 2013). After deciding on the best idea, something tangible and testable can be designed. A limited amount of design proposals was developed based on the findings, to provide the stakeholder with some tangible recommendations for a future dashboard design. They are however not included here. This decision was based on the limited time frame and scope of the study.

In the following chapter, the theoretical framework will be presented.

2 Theoretical Framework

The following theoretical framework is the result of a literature search process. The literature search was conducted through the database Primo provided by KTH library, as well as through Google Scholar. In addition, Diva portal was used to research student theses on similar subjects and scope.

At the center of this study is the exploration of how to create engagement through dashboard design. The following section will therefore explain the term and define the characteristics of dashboards in an organizational context, including the the organizational perspective, cognition, user experience and engagement, design principles and the design process.

2.1 Organizational Dashboards

According to the definition made by Steven Few "*A dashboard is a visual display of the most important information needed to achieve one or more objectives that has been consolidated on a single computer screen so it can be monitored at glance*" (Few, 2013, p. 26). The information on a dashboard is often represented through graphical means, such as graphs, tables, and diagrams. Dashboards need to display relevant information through a limited, concise, direct, and clear space so that the information can be perceived by the user at-glance (Few, 2013).

Figure 1 is a depiction of a generic dashboard design, adapted from Oparenko (2016).

Figure 2: Typical Dashboard design, adapted from Oparenko (2016)

Organizational dashboards specifically, monitor and measure performance in an organization. Companies utilize dashboard displays to effectively understand their progress and operations, on wider company level as well as on department level (Eckerson, 2010). Often displayed on an organizational dashboard are so-called key performance indicators (KPIs). A KPI is typically represented as a ratio, that relates to a specific objective or process (Rasmussen, Bansal, &

Chen, 2009). KPIs help organizations focus on important activities related to performance. (Rasmussen, Bansal, & Chen, 2009). By monitoring performance (how it is going in relation to the goal) one maintain awareness and can use that awareness to act if needed (Few, 2013). Usually, KPIs are displayed as or accompanied by a graphic such as a symbol or an icon.

In terms of organizational levels, the dashboard display is governed by the level of decision-making in which the user needs support. The design of the dashboard therefore demonstrates different attributes depending on the type of decision they support (Sarikaya, Correll, Bartram, Tory, & Fisher, 2019). Which KPIs to preferably display is often based on what organizational level the user operates (Tokola, Gröger, Järvenpää, & Niemi, 2016). In management, the levels of organizational decisions and processes are often described at three levels: *strategic* (long term, company-wide impact), *operational* (impact on daily operations and function) and *tactical* (how to realize and implement action plans, policies and procedures) (Harrington & Ottenbacher, 2009). Organizational dashboards are often divided into these levels. Operational dashboards have more emphasis on the actual monitoring, enabling front-line workers to access operational processes with detailed data that is frequently refreshed (Eckerson, 2010). Tactical dashboards are to monitor and manage departmental processes and functions. Executives use them to review and benchmark performance of their departments, while managers use them to monitor and optimize different processes. Here there are more focus on analysis. Lastly, strategic dashboards monitor how strategic objectives are executed (Eckerson, 2010). Usually, they are used by executives to review performance and communicate strategy. Here there is more emphasis on management (Eckerson, 2010). A summarizing description of the different types of dashboard levels and what properties they are often associated with are described in Table 1.

Type of dashboard:	Properties:	Used mainly by:	Emphasizes:
Strategic	Execution of strategic objectives	Executives	Management
Tactical	Departmental processes and projects	Executives and managers	Analysis
Operational	Operational processes, frequently refreshed	Front-line workers	Monitoring

Table 1: Description of the types of dashboards, derived from descriptions by Eckerson, 2010

Multiple sources describe the purpose of dashboards to augment human cognitive abilities and aid in decision-making (Choudhury, 2014; Few, 2013; Yigitbasioglu & Velcu, 2012; Vázquez-Ingelmo et al., 2019). Through dashboards, users can attain insights on specific datasets and use that insight to support their decision-making (Vázquez-Ingelmo, García-Peñalvo, & Theron, 2019). To understand what this means, it is important to understand the cognitive abilities that form the base of human decision-making. This will be discussed in the following section.

2.2   Cognition

The field of cognitive science has generated varied insights about the processes and mechanisms of the mind and how we perceive and understand our surroundings. How we

interpret data, what attentive prerequisites we have, and what we need to make decisions. This can provide valuable cues on how to design well-measured dashboards (Choudhury, 2014). The following section will outline some cognitive functions and concepts that are of relevance when designing dashboards based on what cognitive abilities and limitations people have.

2.2.1 Perception

One of the core functions of cognition is perception. Perception can be described as a collection of mental processes, making people organize, recognize, and understand their surrounding stimuli. In other words, how we make sense of what we see (Sternberg & Sternberg, 2012). Perception encapsules stimuli in all kinds of forms, whether it be auditive, tactile, visual or other. In terms of the current study, what is of highest relevance is specifically visual perception, working memory and decision-making.

2.2.1.1 *Gestalt principles*

Foundational for visual perception are the gestalt principles. They represent the human ability to group similar objects, to create coherence in visual stimuli (Sternberg & Sternberg, 2012). The underlying concept that encapsulates this ability is the law of Prägnanz, which states that we tend to perceive visual stimuli in ways that different elements are organized into stable and coherent forms. The brain "fills in the blanks" to make sense of otherwise unintelligible visuals. The Gestalt principles include figure-ground perception, proximity, similarity, continuity, closure and symmetry. Figure-ground perception refers to our tendency to perceive different objects to be in the foreground and others to form the background in a visual field. The proximity principle refers to how we group objects that are closer to each other when presented with an array of objects. The similarity principle refers to how we usually group objects that are like each other. The continuity principle refers to how we often perceive continuous shapes and forms rather than abrupted stimuli. The closure principle refers to how we often fill in disruptions in stimuli with our mind to create closure. The symmetry principle lastly, refers to how we perceive symmetry in stimuli, looking for assortments (Sternberg & Sternberg, 2012)

Designers can utilize the gestalt principles when designing interfaces, by aligning with them in their design choices. They generate great insight on how we perceive forms and patterns (Few, 2013), something that can carry over to how elements in the design look.

2.2.1.2 *Situation awareness*

Situation awareness (SA) refers to being aware of what is happening in one's surroundings, as well as understanding this as a way of assessing the situation for future outcomes (Endsley, Bolte, & Jones, 2003). Few (2013) describes how SA works on three levels: 1) perception of the elements in the environment, 2) comprehension of the current situation and 3) projection of future status. These levels mirrors assessing a situation and action upon the information gathered. Dashboards can be likened to information displays with the aim of helping the users maintain their SA (Few, 2013). The mental models of users in this case, include monitoring information related to their work. The process of monitoring performance consists of four stages, according to Few (2013, p. 32):

1. Update situation awareness.
2. Identify and focus on particular items that need attention:

      a. Update awareness of this item in greater detail.
      b. Determine whether action is required.
3. If action is required, access additional information necessary, to determine an appropriate action.
4. Take action.

For a dashboard to be considered successful, it must support this process (Few, 2013). Through the dashboard, the users are updated on what is going on with the workflow, supporting their SA (Few, 2013). The data presented through the dashboards provide quick updates on performance status, and therefore augment understanding of the situation and how to proceed.

2.2.2 Memory

There are many well-renowned theories and models on memory, but in broad terms memory can be described as the ways in which we draw on our knowledge of the past to use in the present (Sternberg & Sternberg, 2012). When referring to memory, most researchers use the concepts of long-term, short-term, and working memory, although specifics often vary (Sternberg & Sternberg, 2012). Stored in long-term memory is substantial information that stays with us for a long time (Sternberg & Sternberg, 2012). Short-term memory stores items for about 30 seconds and include information that is of relevance at the given moment (Sternberg & Sternberg, 2012). While short-term memory forms quickly, it also has a limited capacity to hold a larger amount of information. According to one well-renowned theory on short-term memory, originally presented by Miller (1956), the average number of elements that a human short-term memory can hold at a time is 7 ± 2. Numbers, words, or other symbols are also easier to remember when grouped together into meaningful parts (Sternberg & Sternberg, 2012). Lastly, a model of memory most cognitive psychologist uses today is the concept of working memory (Sternberg & Sternberg, 2012). According to this model, working memory is limited to storing only the most recently activated portion of long-term memory. These activated elements are transported by working memory into and out of short-term memory based on relevance at that given moment (Sternberg & Sternberg, 2012).

While the specific definitions of long-term, short-term, and working memory are varied across the field of cognitive science, the concepts function as overarching means of explaining the limitations of memory. It is a cognitive factor that is crucial to assess when designing for any human performance. When designing dashboards, the memory limitations are important to consider (Few, 2013). For example, one could represent data over time with a line diagram, to quick and easy identify trends and disruptions in the data.

2.2.3 Mental workload

To be able to make decisions within a reasonable time frame, we need to reduce the available information to a manageable amount (Sternberg & Sternberg, 2012). Therefore, it is important to know how to avoid overload when designing dashboards. Given the number of stimuli surrounding us is infinite, people tend to use mental shortcuts (heuristics) to easier guide decisions and actions (Sternberg & Sternberg, 2012). Going for a decision based on what we already are familiar with is one of those heuristics often used called availability heuristic.

When designed well, dashboards can remedy the information overload by providing the data in concise, clear, and helpful ways.

Now that the cognitive prerequisites that determine people's abilities and limitations have been explained and put into the context of the current study, the concepts of User Experience and User Engagement will be explained.

2.3   User Experience & User Engagement

The concept of User Experience (UX) is of relevance in any given situation where an artefact is used by people. According to de definition by Norman and Nielsen (n.d.), UX encompasses all aspects of a user's interaction with a product, it's services and the company providing them. Furthermore, the International Standard of Ergonomics of human-system interaction (2018) defines UX as user's perceptions and responses resulting from using a product, a system, or a service. It encapsules users' emotions, beliefs, behaviors, preferences, psychological and physical responses related to use of the product in question (ISO, 2018).

While UX is the more holistic term, User Engagement (UE) more specifically refer to the quality of the interactive experience itself (Sutcliffe, 2016). In many descriptions of engagement, there are two underlying fundamentals mentioned: attentional and emotional involvement (Peters, Castellano, & de Freitas, 2009). A stimulus that requires a quick glance might only require brief selective attention, and therefore only be engaging for a short period; while being emotionally involved in a stimulus can evoke more sustained attention and a stronger engagement (Peters, Castellano, & de Freitas, 2009).

Similarly, O'Brien, Cairns and Hall (2018) argue that UE goes beyond simply satisfaction with the digital system which one interacting with; instead, it's characterized by the depth of interest a user has in the interaction. Effective UE draws people to using interactive products and explains how and why some applications attract people to use them more than others (Sutcliffe, 2016). If UE is established and sustained with the system, there are vast opportunities for positive outcomes to follow (O'Brien, Cairns, & Hall, 2018).

What makes a design, platform or tool engaging? The answer to this question does not have one single answer. UE is sometimes viewed as a quite abstract construct, making it hard to define, design and evaluate (O'Brien, Cairns, & Hall, 2018). Fundamentally, the user must find the artefact interesting and immersive to some degree (Peters, Castellano, & de Freitas, 2009). Therefore, the content must relate to the interests of the user in some regard. According to Sutcliffe (2016), if content and functionality of the platform are closely matched to the user's interests and goals, they are more likely to be engaging. In a widely used product or interface, the ability for the user to adapt the functions according to their individual needs can generate a feeling of ownership over the domain, which can contribute to engagement with the domain (Sutcliffe, 2016).

More on how UE can be conveyed through design will be discussed in the subsequent section.

2.4 Designing Dashboards

It is crucial to understand the unique context in which the dashboard will be used, to design its interface engaging. As aforementioned, dashboards require a lot of data being compressed and visualized in a limited space. Related to this, Few lists two main challenges designers are faced with when designing dashboards as *1) making the most important data stand out from the rest*, and *2) arranging what is often a lot of disparate information so it makes sense and supports perceptive abilities* (2013, p. 91).

Few compiles a list of requirements for dashboards that can be used as guidelines. Based on this, well-designed dashboards deliver information that is:

- Very well-organized,
- Condensed, based in summaries,
- Specific to the task at hand and customized to communicate clearly to those who will use it,
- Displayed using concise and often small media that communicate the information in the clearest and most direct way possible (Few, 2013, p. 94).

This is in-line with what was described by Yigitbasioglu and Velco (2012), who parallel the dashboard to a data-driven support system, providing information in a specific format to the decision-maker (the user). Therefore, they need to be viewed and evaluated based on their design features and how users interact with them. A well-designed dashboard screen should provide the user with the information they need to monitor their area of use and responsibility. A dashboard without context is not very usable, which is why information should be conveyed through multiple visuals (Few, 2013). Examples of this are text in combination with visualizations, graphs and icons. When this is done successfully, problems or outliers can be discovered quicker, and follow-ups are easier to access (Rasmussen, Bansal, & Chen, 2009).

Additionally, Choudhury (2014) states four guidelines derived from studies on human cognition that are applicable for designing readable, effective, and user-friendly information dashboards. These guidelines are also supported by other researchers.

- *Emphasize readability*. This means that the interface should support and not contradict natural visual processing. Too many details and different stimuli, like text on top of pictures, can make the dashboard cluttered and difficult to decipher. By presenting text aligned according to priority, with proper contrast between text and background, this can be avoided. This point is demonstrated in

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- Figure 3, derived from Few (2013, p. 108). The greatest emphasis is located at the top left area, which is linked to western written language being read from left to right and

top to bottom. This is why, Few recommends placing information of the greatest importance in the top left region of the dashboard.

Emphasized	Neither emphasized nor de-emphasized
Neither emphasized nor de-emphasized	De-emphasized

- *Minimize cognitive load.* The dashboard should provide all the information that the user needs for a specific analysis in a clear way, in order to reduce the load on short-term memory. Given the previously mentioned limitations on working memory, it is important to keep information that belong together in the same dashboards (Few, 2013). Information should be presented in a way that allows for chunking. An example of this being multiple numerical values being represented by a graph; it eliminates the cognitive load of keeping track of multiple numbers without context (Few, 2013).

- *Use graphical representation.* Since we are wired to see patterns and mental connections through stimuli, it is useful to use graphical representations of concepts to support our mental models (Choudhury, 2014). Icons, images and drawing objects can be powerful tools of communicating effectively with the dashboard user (Few, 2013). Given the fact that dashboards need to compress a lot of (sometimes complex) information in a limited space, simple graphical representations can support our mental models while being limited to a small space. The use of an upward arrow to communicate a rising trend, a green check mark to communicate a success, or a red X to communicate an aversion from protocol, provide information about a situation without needing a lot of contexts. This can also be far more engaging to look at compared to myriads of data points and text (Few, 2013).

Another aspect of graphical representation that is relevant for dashboards is when using charts for data visualization. For example, when wanting to compare a small number of entities based on their size or amount, a pie chart is suitable (Fard, 2021). When wanting to show comparisons between categories, Fard (2021) recommends a stacked column. Lastly when presenting a series of values, a line diagram is a good choice. What type of data it is and what it will be measured based on are key factors that contribute to the choice of graphical representation.

- *Follow the Gestalt laws*. The gestalt laws are, as previously mentioned in section 2.2.1.1, substantial for our visual perception. What entities in the dashboard belong together, and what should be set apart? This can be directly applied to the dashboard by tying data points together by making them visually similar or close to each other, setting other data points apart through space and appearance, or make some data stand out distinctively, by having a different color or shape than the rest (Choudhury, 2014) (Few, 2013).

2.4.1 Customization

Much of the literature connected to dashboards in this study include the aspect of customization. What drives the design choices and functional affordances are what intended use that dashboard has (Sarikaya et al., 2019). Different users in an organization need to view and use different functionalities and therefore have different prioritizations in their dashboard (Tokola et al., 2016). As has been described in section 2.10, dashboards can serve different purposes depending on the organizational role of the user. Enabling users to customize the features of the dashboard can be very valuable, since it can then provide useful support for specific goals at the target user's level (Vázquez-Ingelmo, García-Peñalvo, & Theron, 2019). This was highlighted in a study by Filonik et al. (2013) where they explored the opportunities and challenges of deploying a customizable dashboard system in a real-life setting with users. Their aim was to test the assumption that participants, having control over their dashboard configuration, would engage, and remain engaged, with their energy feedback throughout the trial. What they concluded was that many of their users appreciated the dashboard being customizable to their specific needs. Users also wished for wider widget selection, specifically providing deeper data related to relationships and correlations.

But since dashboards can support a broad selection of monitoring needs, tasks and performance indicators, there are multiple features that might need customization to the individual user. How many users will share the platform, what level of expertise they each have, what data type they want to see and on what type of platform they will see it all have influence on the possibilities of customization. When the same information is monitored for the same purpose, users still might differ in expertise. The trade-off here is to either design different versions of the dashboard for the different levels of expertise, or to design a single dashboard that have relevancies for all levels but is compromised in its ability to work on individual level (Few, 2013). When the users conversely want to view the same type of performance monitoring but operate on different geographical regions, only being concerned with data of their specific region for example, other predicaments ensue. In instances like this, the same dashboard could be used, but some filtering option must be available to sort out the regions that are not relevant to that specific user. The predicament in that case would be how to include filtering options without taking up valuable space in the limited dashboard view (Few, 2013).

Furthermore, different time frames are of relevance on the different levels (Few, 2013). Is the user a front-line worker, an operational dashboard is more relevant, where daily processes are displayed and frequently refreshed. Is the user an executive they might need a strategic dashboard instead, where they can assess and review performance over months or even years (Eckerson, 2010). The same goes for different levels of precision (Few, 2013). For someone

involved with energy consumption first-hand, it might be relevant to display numbers specifically, down to every data point. But for an executive, the overall number rounded to the hundred thousand might be better suited to get an overview of energy consumption.

Important to bear in mind is what level of customization is appropriate for the situation at hand. While customization can provide a more stimulating user experience, with tasks and functions better fit to the individual user, to what extent it is engaging also depends on the user's commitment to the product (Sutcliffe, 2016). Few (2013) emphasizes the importance of "knowing your audience" when determining what and how information should be displayed and communicated in dashboards. Some users might be satisfied with spending very little time interacting with the dashboard, only interested in getting a brief general overview. In cases like this customization, in-depth customization could be redundant and even annoying to the user. Excessive variations of filtering would not be necessary to a surface-level user.

To conclude, there are many considerations to assess when the aim is to customize a dashboard appropriately. The next section will further build on this notion as well as review previous work with dashboard development for engagement.

2.5   Related work

In terms of related work, there are several studies made on dashboard design in an organizational context. Some of the most relevant ones to the current study will be described below. These will also serve as inspiration to the current study in terms of study design, methods used, and framework.

In a study by Salmon et al. (2016), they developed a map-based dashboard showing data for buildings on a large university campus. Their prototype also displayed the metric Energy Use Intensity (EUI), a measure of a building's energy use normalized by its square footage. What became apparent through multiple iterations of the design with user research and feedback incorporated, was that data visualized through the map version was interpreted as more interesting and preferrable to the bar chart version. The EUI metric was also appreciated by the users, although the four-point colored scale created erroneous implications. Furthermore, users expressed interest in more contextual data about building types, supporting the claim that users wanted transparency and contextual information to what the dashboards showed.

In another study, by Yun et al (2013), they developed dashboard to enable office workers to control their energy-using components. Based on findings from research and a pilot study, they designed a web-based dashboard with features identified to motivate behavior change. The features included in their dashboards had a chart displaying both historic data and real-time data in different intervals (day, week, month, year) and chart types (bar, area, line); a comparison section which provided average consumption; -recommendations for how to reduce energy consumption both on short-term (to turn off idle devices) and long-term (suggestions on switching to a more energy-efficient-device); and lastly personal reports on user performance with chances to get rewards for being energy-efficient. What they found through implementing the dashboard with the office workers, was that energy savings were significant, proving potential influence over energy consumption through dashboard design.

In another study, by Tokola et al. (2016), the importance of different dashboards for different users was examined. They wanted to know how functions and features of dashboards in the manufacturing industry could differ based on the users' role in the company. The companies' employees answered a survey regarding which KPIs they wanted to see in their dashboards and how they used dashboards in their own work. The results of the survey generated a new design of three dashboards representative of different levels within the manufacturing organization, guided by the preferences expressed in the surveys. The first one, the operational dashboard, was designed for workers and focused on the status of the machines and job queue. Colors were used to indicate status of the machines quickly, and time was displayed one a minute-hour scale. The second one, a tactical dashboard, was designed for managers and focused on showing status details of machines, production lead times, line efficiency and delivery reliabilities. The time period was day-week. These design decisions were also done based on the survey answers from the managers. Lastly, a strategy dashboard was designed for executives. The difference being showing employee related KPIs, sales data, costs, and inventory details relevant on a higher executive level. The time frame was also the widest in this dashboard, showing monthly progress (Tokola, Gröger, Järvenpää, & Niemi, 2016). This research supports the need for different dashboard design based on organizational level and helps motivate the aim of the current study.

Furthermore, regarding the organizational context in which dashboards are used, Cahyadi and Prananto (2015) highlight what's important to consider when designing dashboards from an organizational standpoint. In their research, they emphasized the importance of aligning the design of the dashboards with the visions and goals of the organization; to create a more convincing rationale for adoption with the users (Cahyadi & Prananto, 2015). Verhulsdonck and Shah (2022) also emphasize how organizational goals have an impact on dashboard design, based on what user goals there are at what level. If the goal is strategic (overall strategy in the organization as a whole), tactical (midlevel strategy realization) or operational (on the work floor) it has great effect on how the dashboard's information is consumed and what actions can be made (Verhulsdonck & Shah, 2022). Strategic goals on upper management level are often not as immediate as operational goals at floor level (Verhulsdonck & Shah, 2022). It is therefore reasonable that these goals are of varied importance depending on what lever the user at hand is operating. In another article by Anderson et al. (2014) they had students using a digital learning platform to measure engagement. They identified several patterns of behavior in different types of users, which demonstrated how users have varied goals, needs, ambitions and interest in the platform. What they found was that the design of the platform had different importance based on users that were not involved (strictly observing), periodically involved (viewing and sometimes solving tasks), and involved (solving tasks and watching lectures). And although their study had a different context, studying students' engagement in education platform, their conclusions are of interest to the topic at hand.

These research findings support the idea that the appropriate amount of detail that is relevant varies in between levels in the organization.

In the next section theories forming the method and analysis will be discussed.

2.6 Design process

Since this study aims to examine how to increase engagement with the users in the dashboard view, the methodology used followed established models and recommendations for user-centered design. One model that is broadly used in design projects is the Double Diamond Design Process (DDDP). The DDDP depicts the two main activities of design work: finding the right problem and fulfilling the human needs (Norman, 2013). This is conducted through a process of phases, called the Discover phase, the Define phase, the Develop phase and the Deliver phase.

In the Discover phase, the practitioner starts with an idea, which is explored and expanded through initial design research. After this the practitioner can converge into the define phase, by defining the underlying core problem. Then, by using design research tool can the practitioner explore a wide variety of possible solutions to the problem in the Develop phase. Convergence once again occurs in the Deliver phase, when the practitioner narrows down the selection to the best possible solution to the core problem. The DDDP is depicted in Figure 4.

Figure 4: DDDP, adapted from Norman (2013, p. 220)
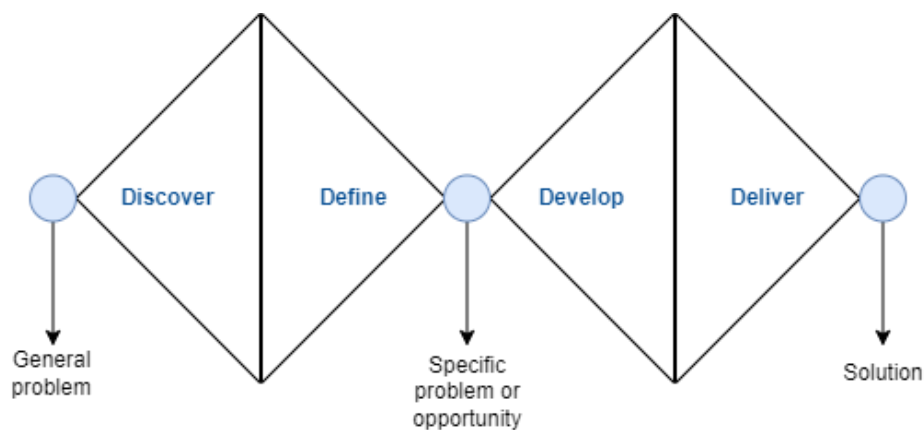
Now that the framework for the study has been defined and explained, the following section will describe the method and the procedure in more detail.

3 Method

Here, the methods used in the degree project are described, including references to the literature on which the methodology is based. The data collection is described, as well as the unique conditions that existed during the study period.

3.1 Study design

The study was conducted as a mixed method design, meaning qualitative and quantitative data were collected concurrently and used to complement each other. According to Driscoll et al. (2007) qualitative data can generate a deeper understanding of questionnaire responses, while quantitative data can provide detailed assessment of patterns of interview responses. The mixed methods can be employed to validate one form of data with the other form, to transform the data for comparison, or to address different types of questions (Driscoll et al., 2007). Given the nature of the current study, with what was aimed to examine, this mixed method was chosen.

3.2 Pre-study

Before the actual study began, a pre-study was conducted. The pre-study consisted of preparatory measures to get to know the user-group and the unique context from an informed source. The informed source in this case consisted of employees at the stakeholder company, with various roles including one CX worker, one Customer support worker and one UX worker. The employees' accounts were complemented by historical and current raw data from the user demographics, provided by the stakeholder. The pre-study helped guide the data collection methods, which started with a questionnaire being sent out to the user group.

3.3 Data collection

3.3.1 Survey

The quantitative data was collected through an online survey. Based on the recommendations stated by Tomitsch et al. (2020), the survey begun with some demographic questions regarding the respondent's age and occupational role, followed by some multiple-choice questions regarding what main purpose the user had of the platform in general. The next portion of the questionnaire adopted a modified version of the System Usability Scale (SUS). SUS was originally created by Brooke (1996) and is a well-known tool to evaluate the usability of almost any kind of system. In the SUS, a statement is self-assessed according to a Likert scale that measure in increments and range from 1-5 in disagreement-agreement. Participants were instructed to rate their level of agreement towards a statement about the dashboard on a 1-5 scale. The last portion of the survey was dedicated to some open-ended questions for exploratory purposes.

3.3.2 Interviews

In parallel with the survey being sent out and answered, in-depths interviews were held. Interviews are useful when the goal is to discern background information about a problem area, gain insights into users' opinions and experiences, and to develop empathy for the user (Tomitsch, et al., 2020). There are three types of interviews: structured interviews, which follows a fixed predefined script; unstructured interviews, which use mostly open-ended

questions spurring from the interview being held; and semi-structured interviews, which use a combination of fixed script questions and open-ended questions (Tomitsch, et al., 2020). In the current study, the interviews were semi-structured and supplemented by a pre-defined interview guide (see Appendix C: Interview guide).

The interview guide included questions derived from the recommendations made by Few (2013, p. 60), when assessing a client's dashboard needs. Additionally, some questions were also derived from the article by Nguyen (2019) where she proposes several questions used for user research for dashboard design projects. These questions are designed to uncover four areas: User goals, Context of use, Timeliness, and Interactivity (Nguyen, 2019)..

3.4 Participants

The participants in the study were customer representatives within the real estate field that used the stakeholder platform in their workplace. The participants that answered the questionnaire were recruited via voluntary response, meaning they were included in the sample since they themselves chose to answer the survey send-out. The participants partaking in the interview were recruited via referral sampling, meaning that the stakeholder connected the researcher to the participants. In addition, some of the interviewees were recruited from the surveys, where they had expressed an interest in participating in a follow-up interview. Out of 450 customers, 29 responded to the survey, and seven were interviewed.

3.5 Procedure

3.5.1 Participant recruitment

First, the survey was sent out via the stakeholder contact to approximately 450 customers. While waiting for the survey answers, the researcher contacted participants for the interview. After confirming with them that they were still interested, the researcher booked a time slot and sent them a document with information about the study (see Appendix A: Information sheet), as well as an informed consent form (see Appendix B: Consent form).

3.5.2 Questionnaire data collection

The questionnaire was created with Google Forms. The data from the questionnaire was stored in a Google Sheet document. From here the researcher could access an overview and easily quantify the quantitative data. The main question categories were Basic user demographics, Usage of the portal in general, Statements about the dashboard, and Open feedback and opinions (see Appendix G: Survey questions).

3.5.3 Interview data collection

Six out of seven interviews were held online, via Google Meet or Microsoft Teams. One interview was held in person at the office of the interviewee. The interviews were audio recorded on a smartphone. On average, each interview lasted for approximately 20 minutes. The main question categories were Personal use of the dashboard, Use of dashboard on organizational level, Interactivity, Time frame and Final reflections (see Appendix C: Interview guide).

3.5.4 Questionnaire analysis

The portion of the questionnaire that was quantitative, namely close-ended statements and nominal survey responses, were assessed by statistical analysis. This meaning the basic descriptive such as age groups, occupational roles, and dashboard usage were quantified by frequency. The close-ended statements that were on a Likert scale were quantified based on median and mean values to gain statistical scores. The quantitative data was not further analyzed beyond basic descriptives, since this data was only meant to provide basic information and understanding of the participants and to support the qualitative findings.

3.5.5 Interview analysis

After all the interviews were complete, the recorded data was transcribed. This was done by uploading the audio files to Word's transcribe feature. When the upload was complete, the researcher listened to the audio recordings and corrected any mistakes made by the transcription. Thereafter, the researcher systematically went through the interview data answers and identified specific problems and observations. All content that was deemed important was thereafter combined in the triangulation interpretation, which will be described in the following section.

3.5.6 Triangulation Interpretation

The qualitative data from both interviews and questionnaire was analyzed through triangulation, meaning combining results from different methods of data collection in the analysis (Nightingale, 2020). This was expressed through affinity diagramming, which is a method for processing qualitative data, by breaking it down to then be able to form a coherent whole of the parts (Tomitsch, et al., 2020). The identified problems and observations from the interview data and open-ended survey answers were documented on digital sticky notes in the online program Miro. The sticky notes were initially grouped based on occupational roles, as well as on method of data collection (See Appendix D: Voluntary survey quotes sorted according to occupational title and Appendix F: Key quotations from interviews, sorted into colored categories based on occupational role). These aspects were important to keep in mind to understand the source of the data and what it entailed for the results. The notes were thereafter grouped into sub-themes-based resemblance. These sub-themes were expressed as "I want"-statements in the affinity diagram, to allow for better readability and coherency. Further abstraction and grouping of the sub-themes led to a small number of main themes. The statements, sub-themes, and main themes were thereafter categorically colored (see Figure 5: Affinity diagram).

4 Results

In the following sections, the results from the survey and the interviews will be presented respectively. Followed by the individual results, some overarching conclusions will be presented, based on the combined data from the survey and the interviews. Some of the data will be in Swedish, since the participants gave their answers in Swedish. Selected parts have been translated to English.

4.1 Quantitative results

There was a total of 29 respondents to the survey. A majority of these, 19 people were in the age group 30-49, while 9 people were in the age group 50-69, and 1 person was in the age group 18-29.

There were many different occupational roles represented in the survey. However, the most occurring job titles in the survey answers were technical administration (7 users), technical manager (TM) (5 users), property operations (PO) (4 users), and managers within energy and sustainability (E/SM) (5 users).

According to the survey answers, 51,7% of the participants had use of the dashboard in their work, while almosy as many participants (48,3%) stated that they did not use the dashboard view at all. Among the ones that did use the dashboard, most users (48,3%) spent approximately 5-10 minutes on the dashboard view, while 3,4% spent 30 minutes on it.

Table 2 depicts the mean and median score on each of the SUS statements from the survey, where the answer 5 corresponds with "strongly agree", and 1 corresponds with "strongly disagree".

Statement	Mean score (1-5)	Median score (1-5)
I think the dashboard view is intuitive and easy to understand.	3.7	4
I feel that the dashboard view is adapted to me and my needs.	2.5	3
I think that many of the functions in the dashboard view are irrelevant for me.	2.7	2.5
I have easy access to the information that I need from the dashboard view.	3.6	3.5
I feel involved in my business' energy consumption when I use the Platform.	4.25	4.5

Table 2: Mean and Median scores on SUS statements from survey

4.2 Qualitative results

For the qualitative portion of the survey, the responding was voluntary. The respondents could fill in their own responses if they wished, but it was not a requirement to partake in the survey. A compilation of these answers can be found in

Appendix D: Voluntary survey quotes sorted according to occupational title. Additionally, a full summary of the survey questions and answers, can be found in

Appendix E: Additional survey questions and answers and Appendix G: Survey questions

Out of the seven participants in the interviews, three worked in technical administration (TA), one was an energy coordinator (EC), one a technical manager (TM), one a sustainability manager (SM), and one a digitalization manager (DM).

Based on the combined qualitative data sets from the survey and the interviews, three main themes were identified: ***Deviations***, ***Context*** and ***Customization***. These three themes stemmed from eight sub-themes that were identified based of participants' most occurrent quotes and statements. The sub-themes were expressed as "I want"-statements, and were the following:

- *I want to be informed of deviations*

- *I want to know why and when deviations have occurred*

- *I want to be able to compare data to a reference value*

- *I want anyone to be able to understand the dashboard*

- *I want to see data relevant to me in the dashboard*

- *I want to pick time frame for the data*

- *I want to be able to adapt the dashboard view for myself*

- *I want new features added to the dashboard*

Table 3 represents the results of the data analysis. The left column shows the three main themes, and it represents highest level of abstraction in the analysis. The middle column shows the sub-themes, categorized into the different main themes based on their similar nature. Each sub-theme is presented with some exemplifying statements in the right column. The statements represent the most concrete level of data. They depict a refined version of the original transcribed quotes, where redundant content (such as grammatical errors and unfinished sentences) has been corrected or removed, to make for an easier and cohesive statement, than the original wordy transcriptions. The statements in the table are only a fraction of the total transcribed material that came to shape the analysis.

Theme	Sub-theme	Statement (summarized and translated from Swedish)
Deviations	I want to be informed of deviations	*I want to quickly assess if energy consumption has increased or decreased, expressed in KWh/m2*
		I want to see quickly where it differs a lot
		I want to be able to detect deviances quickly
		I want to be alerted if a meter has stopped working or if the consumption is higher than normal
		I want to be assured that when values are missing, the platform lets you know
	I want to know why and when	*I want to know should we have deviations or that one has missed, and that the system has missed and received data, otherwise it will be wrong*

	deviations have occurred	I want to know during what month the data coverage fluctuated	
		I want to see what specific meter that deviates, not just the building	
		I want to know when and where data coverage lapses have occurred	
		I want to see what has gone up/down when I'm in the dashboard view	
		I want to see a compilation of meters that deviate a certain number of percent from normal consumption. As a top 10 ranking list but for all meters, sorting by largest deviation in kWh or %	
Context	I want to be able to compare data to a reference value	I want to be able to choose between 2-3 different numbers to compare the energy data to	
		I want to see a comparative number for the properties with highest energy consumption	
		I want to compare the energy data to a goal number	
		I want to see that the data coverage goes towards the reference period, some kind of indication that you compare the difference against or the trend against year-round values	
		I want to compare different time periods	
		I want to compare the data against last year's goal	
		I want an indication of the properties where energy use deviates the most, ie worst and best performers	
	I want anyone to be able to understand the dashboard	I want novice users to still understand the data	
		I want to see Data coverage on measurement data, absolutely most important to know a little about the numbers.	
		I want to be able to trust the data that I'm shown, so that any user can trust it without any further knowledge of energy	
		I want to get a feel for whether we are doing a good job or not	
		I want the dashboard to give tips	
	I want to see data relevant to me in the dashboard	I want to see the details on each property, I have no use of the overarching information	
		I want to see more detailed data	
		I want to see the property with the highest energy consumption	
		I have a need to see each unique property	
		I want to view separate regions, not all the properties at once	
		I want to see comprehensive information, as well as digging down to the details, I have use of them both	
Customization	I want to pick time frame for the data	I want to see another time frame than the latest 12 months	
		I want a longer time frame than the last 12 months	
		I want to see the trend month by month, because it can differ depending on what season it is	
		I want to be able to pick time period myself	
		I want to be able to choose which scale, year, month, week, day, or hour I want to see consumption of	
		I want to be able to adapt the dashboard view, change the time span for example	
	I want to be able to adapt the dashboard view for myself	I want consumption to be pre-set on monthly values, but that you have the opportunity to choose. Because sometimes you want to be able to deep-dive a little	
		I want the dashboard to allow me to choose what KPIs I want to see	
		I want the dashboard to work more with widgets, where I can add and delete widgets how I want	
		I want to be able to hide the filter/grid, if I wish	

		I want a customizable dashboard view where I can choose what I want to show from different reports, like an "action pad"
	I want new features added to the dashboard	I want to see a nice graph with the energy declaration in the dashboard view
		I would like to see a compilation of the energy declaration in the dashboard view
		I want to see our goals/budget for the properties with the values for the last 12 months
		I want a button for creating PDF reports directly from the dashboard view
		I want to see key figures per a-temp in the dashboard view
		I want a "to do list" for operations technicians where the deviations are shown

Table 3: Results from qualitative data analysis, expressed in themes, sub-themes and participant quotes

Fel! Hittar inte referenskälla. depicts the results in an affinity diagram. The figure is intended to provide the schematic overview, of the result presented in Table 3. The affinity diagram includes the identified themes and sub-themes, as well as how the different themes relate to each other. Some of the sub-themes overlapped into two of the three main themes, something that can be seen in **Fel! Hittar inte referenskälla.** as well.

Figure 5: Affinity diagram
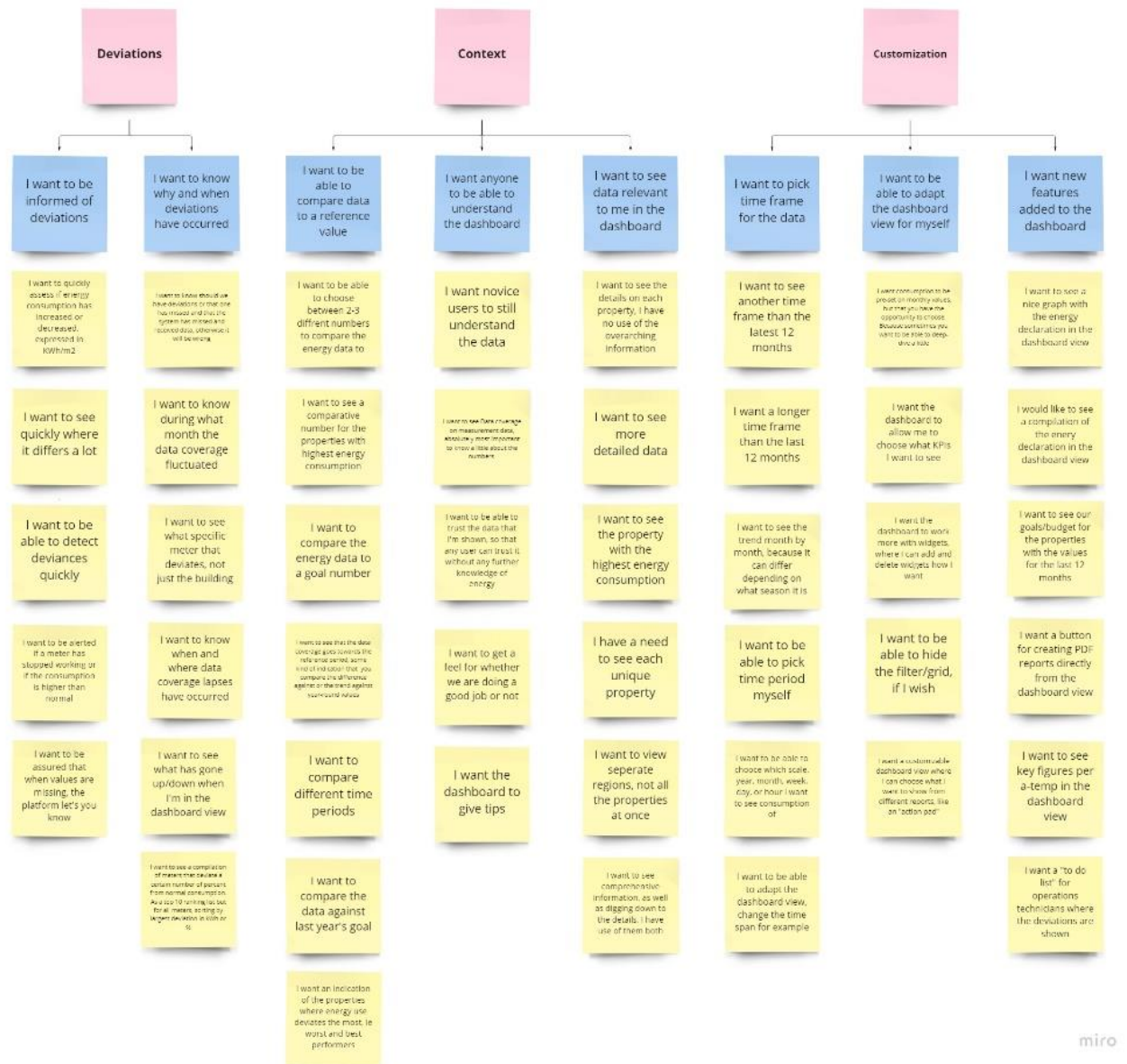
In the next section, the results are explained, with the help of quotes from the participants' interviews. The three main themes are explained and justified, together with their sub-themes. The findings are also put into the context of the theoretical framework established and conveyed in the theoretical framework (Section 0).

5 Triangulated interpretation

The following sections considers each of the identified themes accompanied by descriptive quotes from participants. The interpretations made will also be directly linked to the contents from the theoretical framework. Since the occupational roles of the participants have relevance, the quotes will be followed by an abbreviation of the job title the participant in question had. The job titles are Energy coordinator (EC), Technical administrator (TA), Technical Manager (TM), Digitalization manager (DA), Energy/Sustainability manager (E/SM) and Property operations (PO).

5.1 Deviation

The theme of deviation represents the need for a clear signaling of irregularities in the dashboard view. One of the sub-themes out of this theme is that the users want to be informed of the deviations in the dashboard. Deviations in this case refer to any unusual values in the data, such as unusually high usage in electricity, water, or heating. It is important for the users to quickly know if their energy use is deviating from normal values, so that they can act on that information.

"[…] where it differs a lot, you want to see quickly." [TA]

As mentioned before, the purpose of a dashboard is to augment human cognitive abilities and aid in decision-making (Choudhury, 2014; Few, 2013; Yigitbasioglu & Velcu, 2012; Vázquez-Ingelmo et al., 2019). Through dashboards, users can attain insights on specific datasets and use that insight to support their decision-making (Vázquez-Ingelmo, García-Peñalvo, & Theron, 2019). Companies utilize dashboard displays to effectively understand their progress and operations, on wider company level as well as on department level (Eckerson, 2010). This can be linked to what has been said by Few (2013), that the dashboard should update its users on what is happening. For the dashboard to be considered successful, it must provide users a quick intel on performance status, and thereby augment understanding of the situation and how to proceed. This was demonstrated by quotes like the one below.

"[…] An indication of the properties where energy use deviates the most, ie worst and best performers." [E/SM].

A deviation could also be unusually low percentage of data coverage. If the data coverage is low, it indicates a poorly informed system, and reason to distrust the reliability of the measures. Therefore, it is important for the dashboard to clearly display if data coverage is deviating abnormally.

"[…] should we have deviations or that one has missed, and that the system has failed to receive data, then we must know that, otherwise it will be wrong. So that's an important point to make." [EC]

This relates to the second sub-theme that users want to know why and when deviations have occurred. Not only is the notifying of the deviation important, but the conditions behind the deviation.

"Not only do I want to see that there is a deviation in the building, but what specific gauge that deviates." [TA]

"I think it's interesting to know when. Not only that there is 97% data coverage over 12 months. But where have we missed these 3 percentages?" [SM]

In other words, to properly address the deviation, the situation around it must be revealed. If the data coverage has been 3% in the last year, that has another meaning than if it has happened in the last month. Just as with the study by Salmon et al. (2016), users want more transparency to their deviating data. If the displaying of deviations were supported by a combination of text, graphs, and icons, as was the learning made by Rasmussen, Bansal, and Chen (2009), the outliers could be discovered quicker and understood better. This leads into the theme of context, which will be discussed in the upcoming section.

5.2   Context

It's been established already, that a dashboard not providing context is not very usable (Few, 2013). Being one of the three main themes identified in the results, context was proven to be an important aspect of designing an engaging energy dashboard. A recurring need expressed by many participants, was for the dashboard to provide them with a quick feeling of the state of things. This was demonstrated in the sub-theme of users wanting to be able to compare data to a reference value, exemplified with user quotes like this:

"It would be good if you could see the data coverage compared to a reference period [..] some type of indication that you are comparing the difference (or trend) against actual full year values." [DM]

Comparing the current values to a baseline, whether it being the goal value, past year's value, or a normal value, is a solid measurement of performance. As stated before, monitoring performance allows for maintained awareness of the situation and an opportunity to act upon the situation accordingly (Few, 2013). Knowing the trend was of particularly high importance to participants with a managerial role, exemplified by the quotes from the digitalization manager.

"To get a sense of whether we are doing a good job, the trend is great." [DM]

But users working more hands on with the properties also wished for the data to be shown in a comparable context:

"And say if you could have either a reference value to or if you could change it so that it is a percentage of total consumption. That's what's really interesting when we compare for month by month or year by year." [TA]

These results share resemblance with the results from Filonik et al. (2013), where users wanted to be provided with deeper data related to relations and correlations in their dashboard.

The need for comparing and having a reference also connects to the next sub-theme of context, namely that anyone should be able to understand the dashboard. Not only will users include experienced managers and administrators from the organization. The participants presented examples of situations when less frequent users of the platform in the organization would

benefit from the information in the dashboard. The sustainability manager for example, viewed it as a way of introducing novice users to important key numbers in the energy usage:

"[…] you could use it to present something for the managers. Those who might not want to go deeper in the platform." [SM]

Since the dashboard is the first introduction to the platform and the first thing a user sees when logging in, it is reasonable to request that it is easy to understand by anyone. Participants with varied occupational responsibilities agreed on this matter. A technical manager pointed out the need for trust in the data that the dashboards show. This is extra important when unexperienced users are looking at the dashboard:

"You've got to be able to trust that the data is correct and comparable so that novice users also can make use of it." [TM]

Novice users or users with limited knowledge of the subject matter in general, must be able to trust that the information they are seeing is correct and reliable. Not knowing the context for why something is measuring the way it does, does not guide the user to take appropriate action. For example, when data coverage is low, this must be shown and given context, since it gives reason to distrust the reliability of the measures. Wanting more context about the data coverage, specifically when an encoding has failed, is important both for novice users same as experienced:

"It does not tell me much to know that it has been 92% data coverage for the last 12 months, it would have been a good indication to know what it's been the last month." [TA]

Another sub-theme of context was based on users wanting to see data relevant to them specifically in the dashboard. This correlates with the survey results. The statement "I feel that the dashboard view is adapted to me and my needs" got a mean score of 2.5 out of 5, which can be interpreted as users not experiencing the dashboard as sufficiently relevant to them. Furthermore, the fact that 48% of the participants stated that they did not use the dashboard at all, supports this conclusion. In the interview data, there was proof of this as well. For example, the sustainability manager said he had no use the dashboard for his own work at present since it did not display any information relevant to him.

"I don't use it for anything." [SM]

The that the dashboard's information was irrelevant was also shared between the organizational levels in the sample group, as can be shown by these quotes from users working within property operations:

"I don't use the dashboard view" [PO]

"I use other pages" [PO]

The users wished for more information specific to them and their unique needs, which was expressed by this quote by one of the energy coordinators:

"I'm not looking for such general information, I'm interested in detailed information in the properties." [EC]

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The dashboard does not contain detailed information as of now, which understandable, since a dashboard is meant to display information perceivable for the user at-glance (Few, 2013). The at-glance requirement can also be linked to the human cognitive tendency to look for and recognize patterns in our surroundings. The users' need for context mirrors how Sternberg and Sternberg described the human ability to group similar objects, to create coherence in visual stimuli (2012). Just like the law of Prägnanz and the gestalt principles demonstrate does the users of the dashboard crave their perceived data to be organized into stable and coherent forms for their understanding.

However, Few also expresses that the information in the dashboard must be relevant for the user. In this case, many users are more interested in the details, rather than some overarching KPIs. This can also be exemplified from this quote from a technical manager:

"I don't use it that much. But that might be because it doesn't give much. And that is tricky for sure. I'm mostly in and looking at details more." [TM]

As earlier stated, the design of the dashboard should display different attributes depending on the type of decision they support (Sarikaya et al., 2019). If the data in the dashboard is not of relevant detail for the user, the user will not spend time on the dashboard.

"Let's say our CEO or our sustainability manager who don't work in the system that much would go in here and look once a month. What they need to see then, compilations of our trends, we make manually for it to be comparable." [TM]

As discussed in section 2.1, organizational goals have an impact on dashboard design, based on what user goals there are at what level (Eckerson, 2010). Whether the user operates on a strategic level (overall strategy in the organization as a whole), tactical level (midlevel strategy realization) or operational level (on the work floor) it has a great effect on how the dashboard's information is consumed and what actions can be made. A user working within property operations might have more use of an operational dashboard, while a CEO might have more use of a strategic dashboard.

Furthermore, challenges also arise when a user is operating on multiple organizational levels. As discussed in section 2.1, what KPIs that are of relevance is often based on what organizational level the user operates (Tokola, et al., 2016). But in some organizations, the divisions and responsibilities are not so clearly defined. This was the case with one of the technical administrators, who said he had use of both high and low levels of data:

"I think everyone works at different levels and I work a little in between the levels, both high and low. And then it is very good that I can get this overview of energy usage, then can pick out reports that I can forward to either it's the board or my boss." [TA]

This leads into the next main theme: customization, and how to implement it in the dashboard appropriately. This will be discussed in depth in the next section.

5.3 Customization

Customization encapsules the recurring theme of the user having more room to modify the dashboard according to one's personal needs. This is key in the current situation, since the

platform has a broad variance of users. Having many different roles focusing on different things in the organization presents quite a challenge for the dashboard usability, as is exemplified by this quote by the technical manager:

"Yes, it's not easy. There are many different types of users. Most users, those who are with us in any case, they are technical administrators, then we have managers who are also interested, both in capturing trends and so on, but also in seeing statistics and comparing."
[TM]

It has already been established that the levels of organizational decisions and processes in management often are described at three levels: strategic, operational, and tactical (Harrington & Ottenbacher, 2009). Strategic, tactical, and operational goals are of varied importance depending on what lever the user at hand is operating (Verhulsdonck & Shah, 2022). A case can therefore be made that the dashboard should emphasize different attributes and functions depending on if a sustainability manager or a technical administrator is logged in. The results of the data collection therefore support what previous research on the subject concludes, namely that the level of decision-making that the user needs support in, should govern the attributes of the dashboard (Sarikaya et al., 2019). A case for a customizable dashboard can thereby be made.

The need for customization was also apparent in the views on the static time frame shown on the dashboard. The aspect of time preferences in the dashboard was so frequently mentioned by participants that it formed its own sub-theme: users wanting to pick time period themselves. As of now, the dashboard always displays the trend based on the latest 12 months, something that was mentioned as an inconvenience by multiple users.

"I do not really think that the long perspective (12 months) is suitable for the dashboard. It is relatively static and gives me no current overview." [E/SM]

While most users agreed that the latest 12 months' time frame was irrelevant, what time frame they preferred instead differed based on their occupational role. One user working in technical management wanted a shorter time frame since he wanted the context of what season the trend was differing:

"I'm more interested of seeing the trend month by month, since it can differ a lot depending on what season it is." [TM]

The request for a shorter time period was also represented within the technical administration role. Many users said that for TA's, data coverage context is of importance, and if there is a deviation in coverage in the last year it does not provide them with the specific information, they need to examine the specific time of the deviation:

"For data coverage, it only says that in the last 12 months I have a 92% data coverage rate, but it would have been a good proof to know that it is the last month." [TA]

Concurrently, a longer time frame was of more interest for the managerial roles working with digitalization, energy, and sustainability:

"What I like to do mostly in the platform is to compare periods, and that I can choose what period. But in the dashboard view it's always the latest 12 months." [SM]

"Right now, it's the latest 12 and it could have been useful to have it for a longer period of time." [DM]

These results correspond with Few's accounts that different time frames are of relevance on the different organizational levels (2013). Is the user a front-line worker like a PO or a TA, an operational dashboard is more relevant, where daily processes are displayed and frequently refreshed. Is the user an executive like a DM or SM, they might need a strategic dashboard instead, where they can assess and review performance over months or even years (Eckerson, 2010).

Supported by the literature, customization can have positive impact on user engagement. As previously said, the ability for the user to adapt the functions in a widely used product or interface, according to their individual needs can generate a feeling of ownership over the domain, which can contribute to engagement with the domain (Sutcliffe, 2016). This was also apparent with the participants in the study, where they indeed showed great interest in influencing the dashboard view with their ideas. The sustainability manager for example, expressed a wish for a more personal experience in the dashboard, with customizable features:

"I think like this if you can build yourself, ie a dashboard page, make it personal. Say you have, the first time you log in: maybe you have some selected functions such that this is a compilation we see as most important, ie the ranking of properties, data coverage and perhaps the distribution of electric heating and cooling. Since you can filter as you want, there may be other KPIs that you want to include. And then maybe there is such a box like this report, or such setting looks then that is in use. And so you can turn off and on various KPIs as well. Because then you become more personal." [SM]

Furthermore, a technical administrator proposed having two versions of the dashboard, where the user could activate and deactivate different features:

"Maybe you could have 2 types of views that you can easily switch between [...] because if it's up to the user, then it will be such a hassle. It is probably better that we are there and that you choose to activate by dragging it left or right." [TA]

Not only were the participants positive towards customizing the dashboard more, but they also had requests on new features that suited them better. This shaped the next sub-theme: wanting new features added to the dashboard. This sub-theme demonstrates the opportunities the stakeholder must improve on their dashboard view, by adding new features completely. These features have been suggested directly by users of the platform, and therefore presents a unique chance to adapt to the users' needs. These needs were of course different depending on user. For example, one of the Energy/Sustainability managers wanted to see goals and budget for the properties shown with the energy values. This information would naturally be more relevant to a user with this type of role, since it is included in their occupational responsibilities:

"I want our goals / budget for the properties to be shown together with the values for the last 12 months, easier to get an overview then. Now I have with the goals on the side to be able to compare." [E/SM]

The users also had specific suggestions for what features they wanted added to the dashboard:

"I want a button for creating PDF reports directly from the dashboard view." [TA]

The features that were requested varied from role to role, understandably. For example, users working with sustainability specifically wished to see the energy declaration integrated in their dashboard:

"[…] but one would also like to see a compilation of the energy declaration there." [SM]

"Would be perfect with info about the energy declarations there! Kind of a nice graph. In the dashboard view, certain information from the sustainability side could also be added."
[E/SM]

While users having a broader usage of the platform wished for other features, like having the data expressed in a different unit.

"KWh / m2 would give a better picture of whether consumption has increased or decreased."
[TA]

"What you could do is also get key figures in the dashboard view per a-temp, for example."
[DM]

The findings in this sub-theme can also be linked to the conclusions by Sutcliffe (2016), that content and functionality of the platform that are closely matched to the user's interests and goals, are more likely to be engaging. It also shares connections with the results from the study by Filonik et al. (2013), that users appreciated the dashboard being customizable to their specific needs. By allowing users to customize the features of the dashboard useful support for specific goals at the target user's level can be provided (Vázquez-Ingelmo et al., 2019).

One could argue how much a general user of the platform would *actually* want to customize the dashboard. Since the users that participated in the study were quite invested in the platform already, the level of customization that ought to be implemented can be discussed. It has already been established by previously mentioned researchers that the level of customization appropriate for the situation at hand is important to keep in mind. While customization can provide a more stimulating user experience, with tasks and functions better fit to the individual user, to what extent it is engaging also depends on the user's commitment to the product (Sutcliffe, 2016). The importance of "knowing your audience" becomes apparent when determining what and how information should be displayed and communicated in dashboards (Few, 2013). Some users might be satisfied with brief and broad interactions with the dashboard. For users like this, in-depth customization could be redundant, even annoying. Excessive variations of filtering would not be necessary to a surface-level user. And while the users represented in the data were generally positive towards customizing more, it is important to keep in mind not all users want or need to have too many options.

To conclude, the results from the data collection support a more interactive, flexible, and personalized dashboard. This is also supported by previous research and literature.

6 Discussion

The following sections critically reviews the method, as well as make suggestions for how the study could have been done differently.

6.1 Method discussion

The choice of methods was based on gathering a varied selection of data from a broad user group. With the mixed method design, qualitative and quantitative data were collected concurrently and used to complement each other. By utilizing both interview data and survey data, more users could partake with less time and effort than if only one method was used. This also meant the study had enough data to reach theoretical saturation and a high reliability. However, combining qualitative and quantitative data can be a time-consuming process (Driscoll, Appiah-Yeboah, Salib, & Rupert, 2007). In cases like this there is a risk of having to make compromises to finish the study on time, like limiting the interview time or reducing the sample size (Driscoll el al., 2007). Driscoll et al. (2007) recommended this study design when the research being conducted does not require either extensive deep analysis of qualitative data or multivariate analysis of qualitative data. In the current study, the focus was mainly on the qualitative data, while the quantitative data served as a way of validating the qualitative analysis. By combining the two, patterns and context could be sufficiently provided, which was the reason to use them both.

The data in this study was to a larger extent based on user accounts and statements. The respondents were asked to self-assess their experience with the dashboard based on different statements in the survey. This is of course a subjective measurement. But when the thing that is being examined regards peoples' personal experiences, attitudes or perspectives, subjectivity is hard to exclude. One could argue that the data could have been collected differently, for example through user tests or think-aloud method. In the case of this study, user testing was not possible due to the participants being spread out in the country. Think-aloud method could have been conducted through video call, however due to the nature of the study, the accounts collected through interviews and the survey were deemed as fitting for the purpose.

Something that would have been preferred, when adopting the DDDP, would be to include the entire process of all the phases. The study put emphasis on the earlier phases of the DDDP, namely discovering the research area and defining the underlying core problems. The design solutions usually explored in the develop phase were limited to a few wireframes, which were developed in agreement with the stakeholder outside the scope of the thesis work. And due to time constraint, user testing was not possible. These limitations were expected and explained in section 1.5. However, going through each phase of the DDDP in its entirety would most likely generate even more interesting insights to the study.

The analysis was mainly based on subjective interpretations of the results, which runs the risk of information bias (Statswork, 2020). The researcher performed the data collection and analysis in solitude, meaning that recording and data handling were done by the same person. This poses a risk of missing or wrongfully handling the data. Additionally, the transcriptions were also translated from Swedish to English, creating some risk of something getting lost or misinterpreted in the translation. Furthermore, that the analysis was subjective also poses a risk

of wrongful classification of the different themes. These themes connect closely to each other and sometimes overlap, which may be interpreted as confusing. The way these potential biases were handled was by using multiple sources of data collection, including using standard measurements like questionnaires, and by using instruments for recording the interviews.

Another potential aspect affecting the results is the sample. Almost all the participants in the study had some responsibility over the platform within their own organization. It is safe to assume that they were already invested in the platform. If the data set included more from less invested and casual users of the platform, the results might have looked different. Now, a lot of the assumptions about the casual users are made based on accounts by the more invested users that partook in the study. More invested users might be more inclined to have more freedom and customizable features in the dashboard, than a casual user.

One could also argue that the answers to the survey questions were a bit skewed. The questions that were voluntary were mainly answered by middle and top managers, rather than people working in operations and administration. Therefore, the workers of those occupational roles did not have as much input into the data analysis. However, one could counterargue that at least the technical administrators were represented enough through the interviews, given the fact that three of them participated. Nevertheless, having more operators represented in the data would have been optimal.

6.2 Future work

There are great opportunities to further the work done on this topic. The study constitutes an initiation for an improved dashboard design of the stakeholder platform. Based on this, some wireframes for a future version were developed by the researcher and stakeholder in collaboration. These wireframes provided a starting-off point for the stakeholder to redesign the dashboard based on the findings made int this study. The next step would be to develop high fidelity prototypes and evaluate them with the end-users on a larger scale. This would employ the full DDDP with the develop phase and the deliver phase included. This is ongoing work as part of the next phase that occurs outside of the thesis work. The recommendations, while being applied to a unique context, could also be adapted to other organizations, and used as guidelines for dashboard design across a wide user group.

7 Conclusions

The aim of this study was to examine how to increase engagement with the users in the dashboard view of an energy monitoring platform. This aim was contextualized with the following research questions:

- *How does the dashboard relate to different users in the organizations?*

- *How can different users' engagement be improved by the design of the dashboard?*

Which were further condensed by the following problem statement:

- *How can one evoke user engagement for the dashboard view, based on different organizational roles and needs?*

The results indicates that the users are missing some key features and functionalities in the dashboard. By conducting and analyzing data from interviews and a survey answered by end-users, three key themes were identified: Deviations, Context and Customization. These themes were deemed to represent what was identified as the three main sources of potential for a more engaging dashboard on a user level. What was concluded by this was that the dashboard must resonate with the individual user on a level more closely related to the user's organizational role and goals, needs. By adapting to the user context, making deviations prominent in the visual field, and allowing for customization of features, an engaging dashboard can be developed in any organizational context.

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Appendices

Appendix A: Information sheet

Informationsblad till deltagare

Studien är del av ett examensarbete om hur användarvänligheten på Uppdragsvigarens plattforms översiktsvy kan förbättras genom att ta hänsyn till användarnas unika roll och behov. Detta dokument innehåller information om studien och vad deltagande innebär. Läs gärna igenom detta noggrant om du önskar delta. Vid vidare frågor så kan du kontakta: **ERIKA VEDIN**, evedin@kth.se

Vad går intervjun ut på?

Intervjun är del av ett examensarbete på Masterprogrammet i Teknik Arbete Hälsa. Det är ett samarbete mellan intervjuaren (Erika Vedin) och Uppdragsgivaren. Syftet är att skapa mer engagemang hos användarna av Plattformen för översiktsvyn, baserat på en skräddarsydd lösning baserat på användarens unika professionella roll och behov.

Deltagandet i denna intervju är helt och hållet **frivilligt**. Du kan när som under deltagandets gång be om förtydliganden eller information om något känns oklart. Du kan också dra dig ur när som helst före, under och upp till två veckor efter intervjun. Du behöver inte ge en anledning. All information som samlas in från dig kommer efter studiens fullföljande att förstöras. Innan intervjun påbörjas kommer du att bli ombedd att underteckna ett samtyckesformulär för att bekräfta att du har tagit emot och läst detta informationsblad och att du är villig att delta i studien.

Vad sker med informationen jag ger ut?

All information som delas kommer behandlas med omsorg. I enlighet med EUs GDPR-lag så kommer all personlig information lagras på en säker, lösenordsskyddad dator vilken den också kommer krypteras. Kontaktuppgifter kommer behållas utifall uppföljning av intervjun skulle önskas i framtiden. Intervjun kommer att spelas in i syfte att kunna analyseras korrekt i efterhand. Inspelningarna kommer att raderas efter det att studien är avklarad.

Rådata och transskript kommer att behandlas med konfidentialitet och endast vara tillgängliga för intervjuaren under studiens livstid. All information som kan anses som personlig (det vill säga ditt namn och andras namn du kan nämna) kommer att anonymiseras. Övriga identifierade aspekter som intervjun genererar kommer också ändras för att förbli anonyma. Anonymiserad information kan komma att användas i studiens publicering, presentationer och lärandemoment. Detta kan innefatta citat från vad du har sagt i intervjun. Dessa kommer anonymiseras.

Vad är riskerna och fördelarna med att delta?

Det finns en liten risk att de som känner dig personligen kan gissa din identitet från anonymiserade uttalanden, om de ser dig delta i studien. Om så är fallet kommer inverkan på dig sannolikt att bli försumbar eftersom studien inte syftar till att utforska några särskilt känsliga ämnen. Om du känner att några aspekter av intervjun är obekväma behöver du inte ge något svar. Du kan också välja att avbryta ditt deltagande när som helst. De direkta fördelarna du får genom att delta är att du bidrar till att förbättra en plattform som du och din verksamhet använder i arbetet.

Appendix B: Consent form

Informerat samtyckesblad för deltagare

Genom att signera detta t samtyckesblad godkänner du ditt deltagande i följande studie: Masteruppsats i programmet Teknik, Arbete, Hälsa. Utfört av Erika Vedin, master student på Kungliga Tekniska Högskolan. I samarbete med Uppdragsgivaren.

Underteckna varje box med dina initialer:

☐

- Jag har läst och förstått informationsbladet om att delta i denna studie

☐

- Intervjuaren har besvarat de frågor som jag hade / Jag har inga vidare frågor

☐

- Jag förstår att jag kommer intervjuas och att intervjun kan komma att spelas in

☐

- Jag förstår att all data som insamlas för denna intervju kommer förvaras på ett säkert ställe

☐

- Jag förstår att data insamlad om mig i denna intervju endast kommer att användas i forskningssyfte

☐

- Jag förstår att jag inte kommer att nämnas vid namn i några dokument eller presentationer av studien

☐

- Jag förstår att jag kan dra tillbaka mitt deltagande i studien när jag vill utan att behöva ge en förklaring

Deltagarens signatur……………………………………………… Namn(textat)

…………………………………… Datum……………………

Intervjuarens signatur…………………………………………

Namn(textat)……………………………………………

Datum………………………

ERIKA VEDIN

evedin@kth.se

Appendix C: Interview guide

Intervjuguide

Inledning

Först och främst välkommen och tack för att du tagit dig tid att vara med på den här intervjun.

Mitt namn är då Erika och jag skriver mitt examensarbete för Uppdragsgivaren. Jag går sista året på masterprogrammet i Teknik, Arbete, Hälsa på KTH. Den här intervjun är en del av en användarundersökning där jag granskar hur Uppdragsgivarens plattforms översiktsvy används och upplevs av användarna (dvs du bland annat), samt hur den skulle kunna förbättras för varje unik användare/kund. Jag kommer ställa en serie frågor som du gärna får svara så utförligt som möjligt på. Har du några frågor till mig innan vi kör igång?

Det personliga användandet av översiktsvyn

- Kan du berätta hur en vanlig arbetsdag ser ut för dig? Från början till slut.

- Hur använder du dig av Plattformens översiktsvy i dagsläget?

- I vilka sammanhang tittar du på översiktsvyn?

    - Hur kommer det sig?

- Vad för syfte har översiktsvyn för dig i din roll?

    - Hur kommer det sig?

    - Varför är det viktigt för dig att ha just denna information/dessa mätvärden i

        översiktsvyn?

- Hur har denna information som du har tillgång till via översiktsvyn hjälpt dig i din

    roll/i att uppnå dina mål?

Användandet av översiktsvyn på organisationsnivå

- Vilka är det som använder översiktsvyn? Flera personer på olika avdelningar?

- Vad används översiktsvyn för att monitorera, och vilka objektiv stödjer den?

- Vilka frågor bör översiktsvyn besvara? Vilka handlingar tas i respons till dessa svar?

Typ av data i översiktsvyn

- Vad för data ska visas på översiktsvyn?

- Vad menas med datan och varför är den viktig?

  ○ För dig

  ○ För andra medarbetare

- På vilken nivå av sammanfattning/detalj ska informationen uttryckas för att ge den snabba överblick som behövs?

  ○ Tror du att detaljnivån skiljer sig beroende på vem i din organisation som tittar på dashboarden?

- Finns det några logiska grupperingar för att organisera datan/informationen på översiktsvyn?

Interaktivitet

- När du ser datan i översiktsvyn, hur agerar du? Vad gör du härnäst med informationen?

- Vad jämför du informationen mot? (historisk data, medelvärden, företaget, områden..)

- Delar du denna information med andra? Isåfall, hur?

Tidsram

- Vad för information behöver du för att se data som mäter trender, respektive en datapunkt mätt för tillfället? Varför är de viktiga?

- Hur ofta tycker du att informationen på översiktsvyn ska uppdateras?

Avrundning

- Innan vi rundar av, har du några frågor till mig? Eller finns det något annat som du inte fått chansen att säga ännu som du vill säga nu?

Appendix D: Voluntary survey quotes sorted according to occupational title

Technical administration (7 st)

Snabb överblick, KWh/m2 skulle ge en bättre bild av om förbrukning ökat eller minskat

Snabb överblick samt till grund för egna månadsrapporter

Jag vill se Datatäckning på mätdata, absolut viktigast att kunna lite på siffrorna.

Technical management (5 st)

Jag skulle hellre se an anpassningsbar översiktsvy där jag kan välja vad jag vill visa av olika rapporter. typ "action pad"

...ser över våra ...oner separat ...ch inte alla ...heter samtidigt ...n översiktsvyn ..., då den visar ...vårt bestånd

Översiktsvyn är inst... rullande 12 månade... mål är satt innevara... jmf föregående år ... har således ingen n... rullande 12 mån ... uppföljning

Jag söker inte så översiktlig information. jag har intresse av detaljerad information i fastigheterna.

Jag tycker att avnvändningra pporten, den säger mer för min del

Property operations (4 st)

Använder andra sidor

...bättre känsla över fastigheterna en och en men det ändras förstås ju fler fastigheter vi får in.

...jag använder mig inte av översiktsvyn

Energy/sustainability manager (5 st)

Jag vill ha ökat fokus på drifttopp... vilket framförallt har ett unæ... tidsperspektiv. Hur ser trenc... senaste månaden istället för se... Jag saknar också en sammanstä... mätare som avviker att vises... procent från normal förbruknin... topp 10 rankinglista men för al... sortering på störst avvikelse i... %. Tidsperspektivet skulle he... månad, men gärna valbart. Lite... "att göra-lista" för driftteknik... "underssök dessa".

Jag tycker inte riktigt att det långa perspektivet (12 månader) passar för översikten. Den är relativt statisk och ger mig ingen aktuell överblick.

Larm, kanske se om någon har ovanligt hög förbrukning exempelvis denna månad (från de normala) både fjv, el och vatten. Eller om mätare slutat fungera/hämta på x antal dagar.

...indikering på ...astigheter där ...rgianvändning ...avviker mest ...s worst och ...t performers

Den är på ... så stort bestånd så ... tittar gärna ... lägre nivåe...

Vill att våra mål/budget för fastigheterna ska visas tillsammans med R12 värdena lättare att få överblick då nu sitter jag med målen på sidan om för att kunna jämföra.

Skulle vara perfekt med info om energideklarationerna där! Typ någon snygg graf. I översiktsvyn kunde också viss information från hållbarhetssidan adderas.

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Appendix E: Additional survey questions and answers

Om nej, varför använder du inte översiktsvyn?
Känner att jag får bättre känsla över fastigheterna en och en men det ändras förstås ju fler fastigheter vi får in.
För mitt behov passar det bättre att dyka direkt in i de undermenyer som jag söker info i
Använder andra sidor
Den är på ett så stort bestånd så jag tittar gärna på lägre nivåer.
I min roll är jag mer intresserad av funktionerna användning och datatäckning, så jag uppehåller mig sällan på översiktsvyn - men den kan vara värdefull i vissa möten eller presentationer när jag snabbt ska beskriva läget i portföljen.
Ser över våra regioner separat och inte alla fastigheter samtidigt som vyn visar, då den visar hela vårt bestånd
Ger inte någon bra bild av våra fastigheters förbrukningar. Det saknas ibland jämförbar data då vi köpt/sålt fastigheter vilket gör att siffrorna inte stämmer
Jag tycker inte riktigt att det långa perspektivet (12 månader) passar för översikten. Den är relativt statisk och ger mig ingen aktuell överblick.
Jag jobbar med 1 fastigheter med 15-20 byggnader blir svårt att urskilja i den vyn. Jag behöver gå in i byggnad för byggnad.
Inte relevant data för mig
Tittar men mer sällan, ger inte så mycket info om ex. ytan ändrats så påverkar det resultatet
Jag vill oftast ha mer och specifik information
Mer koncentrerad på mitt bestånd, använder rankingen mer för snabbanalys på fler fastigheter
Energifördelningsgrafen är inte intressant för mig och rankingdelen visar inget.
Den ger mig inte den information jag söker.

Vad tycker du funkar bra/mindre med översiktsvyn i dagsläget? Finns det något du saknar?
Översiktsvyn är inställd på rullande 12 månader, våra mål är satt innevarande år jmf föregående år och vi har således ingen nytta av rullande 12 mån i vår uppföljning
Jag saknar inget i översikten för tillfället, däremot så vet jag inte riktigt vad det är som plockas upp, men det är ju min kunskapslucka. Jag tänker på vilka ytor osv som används så att det är helt jämförbart.
Vill att våra mål/budget för fastigheterna ska visas tillsammans med R12 värdena lättare att få överblick då nu sitter jag med målen på sidan om för att kunna jämföra.
Skulle vara perfekt med info om energideklarationerna där! Typ någon snygg graf. I översiktsvyn kunde också viss information från hållbarhetssidan adderas.
Larm, kanske se om någon har ovanligt hög förbrukning exempelvis denna månad (från de normala) både fjv, el och vatten. Eller om mätare slutat fungera/hämta på x antal dagar.
Vårt problem är eftersläpningen i inläsningen (ej Plattformens fel) vilket medför att översikten sällan har mer än 11 mån inläst och således får en lägre förbrukning gentemot verkligheten.
Det som presenteras ska vara jämförbart mot tidigare år
Jag vill ha ökat fokus på driftoptimering, vilket framförallt har ett snabbare tidsperspektiv. Hur ser trenden ut senaste månaden istället för senaste 12? Jag saknar också en sammanställning av mätare som avviker ett visst antal procent från normal förbrukning. Som en topp 10 ranglista men för alla mätare, sortering på störst avvikelse i kWh eller %. Tidsperspektivet skulle helst vara månad, men gärna valbart. Lite som en "att göra-lista" för drifttekniker, "undersök dessa".
Det skulle också vara fint om man kan välja t ex per kvadratmeter i användningswidgeten - så att man kan

utesluta att ökning/minskning beror på fler/färre fastigheter.

En indikation på hur vi ligger till mot uppsatta mål skulle också vara bra. Det frågas det ofta om. (här är 12 månaders-perspektivet rimligt)
Vi har iofs inte fått till att lägga in våra mål i plattformen än, för jag vet inte om jag kan göra det på ett smidigt sätt.

Det känns som en översikt för tekniskt bevandrade personer. Oklart vad som presenteras och hur jag ska tolka informationen

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Plattformen blir ett trubbigt verktyg utan timvärden. Man borde kunna välja i vilken skala man vill se förbrukning vilket era konkurrenter kan presentera(tim,dag,vecka,månad,år). Man kan sortera på procentuell förändring under Ranking men inte procent efter förbrukning, det saknar jag. Likaså trender. Saknar också en knapp för att slå på och av AI för den egna användaren. Där systemet analyserar och presenterar själv. Att sätta larm kräver mycket tid av användaren och känns inte så användbart som en ensam funktion.

Jag tycker att avnvändningrapporten säger mer för min del

Vi har även Plattformen PM och vill se den från samma portal

Snabb överblick, KWh/m2 skulle ge en bättre bild av om förbrukning ökat eller minskat

---

Jag är nöjd i dagsläget

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förbrukning per A-temp är ett bra jämförelsetal, men där kan en liten fastighet med låg energiförbrukning hamna högt upp, mer informativt med layouten i ranking-funktionen. mest för att få ett begrepp om var insatserna med att spara energi är som störst, 2% besparing på en större fastighet med hög energiförbrukning slår bättre på totalen.

Uppstart tar tid

Lagom

Behöver möjlighet att exportera data. Underlättar registervård bl.a. Som det är nu kan man inte få ut mätdata på mätarnivå för flera fastigheter. Det innebär mycket extra administration. De funktioner som finns ex.vis jämföra förbrukning mellan fastigheter är mindre användbara.

En indikering på de fastigheter där energianvändningen avviker mest dvs worst och best performers

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Jag söker inte så översiktlig information. jag har intresse av detaljerad information i fastigheterna.

Appendix F: Key quotations from interviews, sorted into colored categories based on occupational role

Appendix G: Survey questions

Vi vill ha din åsikt! 🌱 Översikt & användbarhet

Som trogen användare av våra produkter värdesätter vi din feedback och åsikter. Just nu ser vi på hur vi ytterligare kan göra både Översikten och Användbarheten a ▓▓▓ ännu smidigare för dig att använda i ditt arbete.

Tanken är att de svar du bidrar med kommer ligga till grund för en uppdatering av designen, med syftet att göra det enklare för både nya och gamla användare a ▓▓▓ av navigera i vårt universum.

Stort tack för din hjälp! 🙏
Energirika hälsningar,
▓▓▓

*Obligatorisk

Några snabba om dig — Först kommer några allmänna frågor om dig som användare

1. Vilket företag jobbar du på? *

   _____

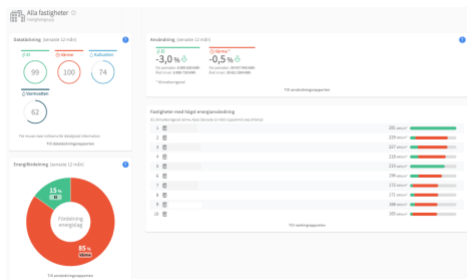2. Vilken tjänst har du? *

   _____

3. Hur gammal är du? *

   Markera endast en oval.

   ◯ 18-29
   ◯ 30-49
   ◯ 50-69

Hur använder du ▓▓▓ — Nu kommer några generella frågor om hur du använder plattformen

4. Hur ofta använder du dig a ▓▓▓ i genomsnitt under året? *

   Markera endast en oval.

   ◯ Varje dag
   ◯ 1 gång i veckan
   ◯ 1 gång i månaden
   ◯ 1 gång om året

5. Det är enkelt att förstå och använda ▓▓▓ *

   Markera endast en oval.

	1	2	3	4	5	
Instämmer inte alls	◯	◯	◯	◯	◯	Instämmer helt

6. Jag upplever att jag måste anstränga mig onödigt mycket för att hitta den information jag behöver ▓▓▓ *

   Markera endast en oval.

	1	2	3	4	5	
Instämmer inte alls	◯	◯	◯	◯	◯	Instämmer helt

7. Jag känner mig engagerad i min verksamhets energikonsumption när jag använde ▓▓▓ *

   Markera endast en oval.

	1	2	3	4	5	
Instämmer inte alls	◯	◯	◯	◯	◯	Instämmer helt

Påståenden om "Översikt" i ▓▓▓ — Hur upplever den? Här kommer några frågor om just översikten.

Med översiktsvyn menas denna sida

8. Använder du dig av översiktsvyn? *

   Markera endast en oval.

   ◯ Ja
   ◯ Nej

9. Om ja, i vilket huvudsakligt syfte använder du översiktsvyn?

   _____
   _____
   _____
   _____

10. Om nej, varför använder du inte översiktsvyn?

    _____
    _____
    _____
    _____
    _____

11. När du loggar in ▓▓▓ hur lång tid spenderar du generellt på översiktsvyn? *

    Markera endast en oval.

    ◯ 5-10 min
    ◯ 30 min
    ◯ >30 min
    ◯ Jag använder mig inte av översiktsvyn

12. Jag tycker att översikten är intuitiv och lätt att förstå *

    Markera endast en oval.

	1	2	3	4	5	
Instämmer inte alls	◯	◯	◯	◯	◯	Instämmer helt

13. Jag tror jag skulle behöva support från en teknisk person för att kunna förstå och använda mig av översiktsvyn *

    Markera endast en oval.

	1	2	3	4	5	
Instämmer inte alls	◯	◯	◯	◯	◯	Instämmer helt

14. Jag tycker flera funktioner i översiktsvyn är irrelevanta för mig *

Markera endast en oval.

	1	2	3	4	5	
Instämmer inte alls	◯	◯	◯	◯	◯	Instämmer helt

15. Jag upplever att översiktsvyn är anpassad efter mig och mina behov *

Markera endast en oval.

	1	2	3	4	5	
Instämmer inte alls	◯	◯	◯	◯	◯	Instämmer helt

16. Informationen jag vill komma åt är lättillgänglig från startsidan ▨▨▨▨ *

Markera endast en oval.

	1	2	3	4	5	
Instämmer inte alls	◯	◯	◯	◯	◯	Instämmer helt

Vad tycker du, egentligen?

Här har du möjlighet att ge egen feedback på Mestro Portals översiktsvy och dess utbud av funktioner.

17. Vad tycker du funkar bra/mindre med översiktsvyn i dagsläget? Finns det något du saknar?

_____
_____
_____
_____
_____

18. Finns det något annat om ▨▨▨▨ översiktsvy/startsida som du vill ta upp?

_____
_____
_____
_____
_____

19. Om du har mer att dela och skulle vilja delta mer aktivt i undersökningen, så kan vi kontakta dig gällande en intervju. Isåfall, skriv gärna din mail nedan så hör vi av oss!

_____
_____
_____
_____

Stort tack för dina svar! 🙌

Vi ser fram emot att läsa igenom dem och att kunna leverera en ännu mer dynamisk upplevelse inom kort.
Tack för att du tog dig tid! 🙏