Cognitive Work Analysis: Investigating Social Aspects of Work with a Decision Support System

Marcus Henricsson
Abstract

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Despite the widespread use of digital technologies in the workplace, there is little known about how social aspects and contextual influences affect the usage. As digital technologies get more integrated in work duties it creates new possibilities for how work can be conducted, however, the integration also induce new demands and expectations. This thesis takes an exploratory approach to study social aspects and contextual influences, and how these affect the usage of a decision support system.

The theoretical framework, cognitive work analysis, was adopted to conduct a work domain analysis, and a social organization and cooperation analysis. Interviews, observations and an online questionnaire were used with the cognitive work analysis framework to study the social aspects and contextual influences.

The results of this thesis can be boiled down into the following outcomes: a model of the work domain where the system is used; eight themes that were identified as the main source of influence on the users' attitudes and motivations toward the system; a social organization and cooperation analysis that tie together the previously outlined results, this to provide three scenarios that illustrate social aspects of work with the system.

Keywords: cognitive work analysis, work domain analysis, social organization and cooperation analysis, knowledge workers, care organizers.
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1 Introduction

A distinguishing feature for knowledge workers is their high degrees of expertise, experience or education, and their job involves creation, distribution or application of their knowledge in ways to solve problems. Workers of this type engage in a variety of activities on a daily basis, and many of these are performed with help of digital technologies. As digital technologies get more integrated in work duties it creates new possibilities for how work can be conducted, but the integration also induce new demands and expectations.

Moreover, digital technologies are many times introduced in complex environments where variables that can be hard to predict and control exist. An example of an unpredictable variable that is hard to control is the social situation where the digital technology is used. Variables that are hard to predict and control also affect how work activities can be carried out. Therefore it is necessary to look beyond the digital technologies, and study aspects such as the milieu where the technology is used, but also the underlying motivations and attitudes of its users, this in order to facilitate the process of creating digital technologies that are geared toward the conditions the knowledge workers are exposed to.

Studies of knowledge workers in the field of human-computer interaction include countless of studies that focus on efficiency and productivity, which primarily aim to map out the usage of digital technologies, and from that conclude and suggest implications for design or potential ways of improving the technology for the user.

However, focusing primarily on mapping out the usage of digital technologies can lead to a distorted view of how and why something is used in practice. As argued for by Dourish, the environment in where something is used is always changing and is renegotiated by the course of action taken by a knowledge worker, and it is through this constant change that actions performed can become intelligible and meaningful to each other. Through a better understanding of the various constraints (may it be social or physical) that are affecting digital technologies, it can facilitate the process of developing technologies that take into account the factors induced by the social and physical reality, and thus increase that chance of creating something that better support knowledge workers in their daily activities.

1.1 Objectives and Research Questions

In this thesis an exploratory approach was adopted to studying contextual influences, motivations and attitudes toward an information technology system, this to better understand how these aspects might affect the usage of the system itself. The studied system is named ABS, and it is an internal information technology system used by specialized care organizers in Sweden’s public employment agency, Arbetsförmedlingen. ABS provide care organizers with decision support while they are working with specialized errands (ABS is described in more detail in section 2).

The objective with this thesis is twofold: (1) map out the work domain where ABS is used through conducting a work domain analysis, (2) conduct a type of social and organizational analysis of the users of the system, with focus on softer aspects, as motivations and attitudes. These objectives shaped the following research questions:
• How is the work domain where ABS is used structured?

• What are the contextual influences that affect the usage of ABS?

• What perceptions do users of ABS have that can affect the motivations and attitudes toward the system?

• What implications can be drawn from the thematic analysis, and the work domain analysis that can help widen the application of the social organization and cooperation layer of the cognitive work analysis framework?

1.2 Purpose and Delimitations

Through conducting a work domain analysis on a system, it can help reveal different kinds of constraints that affect it. More specifically, this means that the work domain analysis provides a model that gives an overview of the work domain where the system operates (a more detailed explanation of the work domain analysis is given in section 3.2). However, this thesis does not just aim to provide a model of the work domain, but instead use it in the light of interpreting other qualitative data, this to ultimately be able to provide suggestions on both short- and long-term actions that can be taken in the development of ABS (e.g. in terms of either future research, incremental or radical changes).

In this thesis, the theoretical framework cognitive work analysis was adopted (described more in chapter 3). The cognitive work analysis framework consists of five layers: work domain; control tasks; strategies, social and organizational; and worker competencies. This thesis will focus on the work domain, and the social and organizational part of the cognitive work analysis framework.

The objective of this thesis might seem like a rather broad task, which is why several delimitations has intentionally been made. Firstly, the focus of this thesis is on care organizers that handle certain errands in ABS (which is explained in more detail in section 2.1.2). Secondly, this thesis will focus on how the contextual influences, motivations and attitudes of the care organizers might affect the usage of ABS. However, the studied aspects are terms that are loosely defined and depend on the situation being studied. Therefore a brief description will follow on each of these terms in order to clarify how they are used in this thesis.

1.2.1 Context Definition

The term context is often associated with the environment of which an individual is situated, and have been defined as such by various authors [27, 36, 37]. However, in this thesis another approach to the term context is adopted, namely the one introduced by Axelsson [5]. Axelsson argues for that context should be seen as an analytical term, where the individual (problem-solver) is mentally constructing it on their own [5]. In other words, context is not something an individual is part of, but instead something that is created mentally in relation to a specific goal. This implies that the users of ABS are in this case constructing their own context (i.e. physical and social reality), which justifies for a qualitative research approach when trying to understand how the contextual influences, and the users motivations and attitudes might affect the usage of the system.
1.2.2 Motivation Definition

The term motivation refers to factors that initiate, direct, and maintain certain goal-oriented behaviors [32]. In other words, motivation can be simplified to describe why a person does something. Motivation involves many forces (e.g. cognitive, emotional and social) that activate behavior, and researchers have proposed a variety of theories of motivation [9, 26, 16]. However, for this thesis it is enough to settle with the simplified definition of motivation previously outlined.

1.2.3 Attitude Definition

In the field of psychology, an attitude is referred to as a psychological construct, which can be defined as a mental and emotional entity that characterizes or inheres in a person [34]. The formation of attitudes is rather complex, but simplified it can be described as something that is an acquired state through experiences [2]. In other words, what partly influences an individual’s attitude about something is based on some kind of experience that shaped the individuals state of mind (which could happen through a previous experience of something, or by mentally constructing something that has not necessarily taken place).

1.2.4 Summary and Research Implications

The previously outlined terms (i.e. context, motivation and attitude) are simplified because they could easily on their own be a dissertation, as can be seen in the work of Axelsson [5]. The introduction of these terms are twofold: (1) clarify on a rather high level what definitions and assumptions that are used in this thesis, (2) provide a particular perspective (lens) that the studied topic will be examined through. The latter means more specifically that the methods used to gather empirical data in this thesis will adopt the definitions of these terms, this in order to narrow and focus the investigation (the methodological approach is discussed more in section 5).

In summary, the result of this thesis will be the output from a work domain analysis, which can help management and developers of ABS understand the various constraints that exist, and thus help in the future development of the system. Moreover, a type of social and organizational analysis of ABS will be carried out, with the purpose of better understanding how the users motivations and attitudes could have an affect on the usage of ABS. Lastly, the objective is to identify implications that could potentially help widen the application of the fourth layer (i.e social and organizational) of the cognitive work analysis framework (explained in more detail in section 3). In other words, this thesis will provide practical insights that can facilitate the process of developing ABS in ways that it is more geared toward the conditions of what the workers are exposed to, but also provide the academic audience with insights about a practical study that explored a rather uncharted domain.

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1 This term will be used for the remaining part of this thesis when referring to the users of ABS, and it should be interpreted with the connotations associated with the previously outlined terms knowledge worker and care organizer.
1.3 Thesis Structure

The present thesis consists of several chapters that each cover different aspects of the research conducted. A brief description will follow on each chapter (except the introduction chapter), which serves the purpose of providing sufficient information to navigate this thesis.

Chapter 2 (Background) introduces the studied system ABS, and the agency where the system is used. Moreover, the researchers previous work experience in the agency is presented.

Chapter 3 (Theory) outlines the theoretical framework adopted in this thesis, namely the cognitive work analysis framework.

Chapter 4 (Applications of the cognitive work analysis framework) introduces related literature to the research conducted, and explains how it helped to pin down and inform the research conducted in this thesis.

Chapter 5 (Method and material) outlines the methodological approach. Moreover, this chapter reasons about the adopted methods, and explicitly clarify how the methods informed each other, but also how they fit into the lager purpose of the study.

Chapter 6 (Results) presents the findings from the research conducted. More specifically, this means the results from the work domain analysis, thematic analysis, and the results from the online questionnaire will be presented. At the end of the chapter the results from the work domain analysis and thematic analysis will be synthesized and used in a social organization and cooperation analysis of ABS.

Chapter 7 (Discussion) reflects on the research conducted, which means that various aspects in the thesis are discussed.

Chapter 8 (Conclusion) conclude this thesis by highlighting the most significant parts, and presents these insights at a general level.

Chapter 9 (Future Work) will present suggestions on future research. More specifically, this chapter will present insights that have aroused from the process of conducting the research, but also from the results obtained.

1.4 Glossary

A glossary explaining each abbreviation and other words of importance can be found after the list of references. Each abbreviation and word that appear in the glossary has been marked with an italic style in the thesis. However, important to emphasize is that each italicized term has only been marked once, and that is at the first occasion that it gets a central significant meaning.
2 Background

This chapter will lay a foundation that the rest of the thesis will build on. More specifically, this means introducing the studied system ABS, and the agency Arbetsförmedlingen where the system is used. Moreover, this section will provide information about the researchers previous work experience in the agency.

2.1 ABS

This section serves the purpose of introducing the studied system ABS, and briefly the workers that use it, which is done to provide foundational knowledge that is necessary to understand in order to appreciate and get the most out of this thesis. The studied system in this thesis is named ABS, and it is a system that provides decision support to workers when they are handling certain errands. More specifically, the system handle three type of errands that are shown in Table 1.

Table 1: The table gives an overview of the type of errands handled by ABS. Moreover, the geographical location, amount of users and errands are displayed for each errand type.

<table>
<thead>
<tr>
<th>Type of errand</th>
<th>Amount of users</th>
<th>Amount of errands**</th>
<th>Geographical location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary means</td>
<td>24</td>
<td>500</td>
<td>Umeå</td>
</tr>
<tr>
<td>(Hjälpmedelsärenden)*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanction</td>
<td>40</td>
<td>22 000</td>
<td>Östersund</td>
</tr>
<tr>
<td>(Sanktionsärenden)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reassessment</td>
<td>14</td>
<td>500</td>
<td>Östersund</td>
</tr>
<tr>
<td>(Omrövningsärenden)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* part of the system being scrutinized  
** amount of errands handled by ABS each month

As outlined in Table 1, there are three different errand types: auxiliary means; sanction; reassessment. However, the focus in this thesis is on studying one specific errand type handled in ABS, namely the one concerning auxiliary means.

Before elaborating on the auxiliary means errand type handled by ABS, a brief introduction to Arbetsförmedlingen is given. Also, a short historical view on ABS is outlined in order to provide the reader with a sense of where ABS fits into the larger organizational structure of Arbetsförmedlingen. However, important to emphasize is that the following information is simplified, and based on publicized sources, organizational documentation (see Table 4) and unstructured interviews conducted with a product manager and a requirement engineer (both involved in the development of ABS), see Table 2. Even though the information presented is simplified, it will provide a base that will connect the details of the system with the larger perspective of where it fits into the larger organizational structure of Arbetsförmedlingen.
2.1.1 Arbetsförmedlingen

As previously mentioned, Arbetsförmedlingen is Sweden’s public employment agency, which provide employment services to both jobseekers and employers [3]. The agency works to improve the functioning of the labour market in Sweden, and this should be done by efficiently consolidate the people searching for work with employers searching for labour [35]. Moreover, the agency should prioritize people that are far away from the labour market, and also contribute with an increased employment rate in the long term [35].

Arbetsförmedlingen has local offices spread out through Sweden, and in these there are a variety of people with various competencies that work. The people working in these local offices span from specialized personnel (e.g. psychologists and occupational therapists) to management and administrative personnel. A variety of errands are handled by various roles working at Arbetsförmedlingen, and many times different roles need to collaborate in order to be able to make decisions (e.g. a specialists might need to consult about a jobseekers rights, and see if he or she is qualified to get a certain service provided).

When consulting, reviewing or handling errands the personnel at Arbetsförmedlingen make use of a variety of information technology systems. These information technology systems are used for different reasons and purposes, and they are often intertwined and depended on each other which is necessary to provide the information infrastructure needed by the people working at the agency.

One of the many systems used within Arbetsförmedlingen today is named ABS, which is the one being scrutinized in this thesis. ABS is fairly new and was introduced in Mars 2015, and it serves the purpose of providing decision support to workers when they are handling the errands presented in Table 1.

What partly makes the system ABS interesting to study is the organizational change it had led to in Arbetsförmedlingen. Before ABS was introduced in March 2015, the various errand types presented in Table 1 were handled by the local offices spread out in Sweden. More specifically, this means that the process of handling the errand types were decentralized, see Figure 1 and to put it loosely, the local offices had their own way of handling the matter.
After introducing ABS in Mars 2015 the process of handling the errand types successively moved from a decentralized structure to a centralized one, see Figure 2. The new organizational structure meant that each errand type had an assigned office in a geographical location in Sweden, and that all the errand types connected to that specific geographical location were handled through that particular office, see the geographical location connected to the specific errand type in Table 1.
2.1.2 Auxiliary Means

The information presented in this section is based on the pre-study (see section 5.2), but also from the actual study conducted in-situ (see section 5.3). The purpose of this section is to briefly introduce the particular errand type that the study focused on.

As previously outlined, ABS has three different errand types (see Table 1), and auxiliary means is one of the errand types handled. Workers that handle errands related to auxiliary means are located in Umeå, at a department that specifically work with this errand type. At the department, which is named Hjälpmedel there are in total 24 users of ABS, and they handle around 500 auxiliary means errands each month.

A person working with auxiliary means errands in ABS are responsible for deciding if someone is entitled an auxiliary mean or not. The main tasks when working with auxiliary means errands is administrative work in ABS, but collaboration with colleagues internally, and actors externally are necessary in order to carry out the work.

An auxiliary mean errand could involve many different tasks, from adjustments of something that are already in place in an office, to reparation and transport of something. However, the most common task is to decide if a person is entitled to an auxiliary mean or not.

During the process of handling auxiliary mean errands ABS provide support in various ways. ABS enables workers to keep track of errands over time. Moreover, it gathers information in one place, such as information about the particular errand and other related resources (e.g. documents and personal information) that are necessary to work with the errand.

ABS is dependent and connected to other information technology systems in Arbetsförmedlingen, where it gathers information from to be able to provide the decision support. However, not all information is directly accessible from ABS, which force the workers to simultaneously work with other information technology systems. In other words, ABS is the main supportive tool to the workers, but they still are dependent on other information technology systems in order to perform their work.

2.2 Previous Work Experience

The researcher conducting this study had previously worked at Arbetsförmedlingen. More specifically, the researcher had around seven months of work experience within the agency (three months as a full-time employee, and employed by the hour for four months). There are both potential benefits and drawbacks with this from a scientific perspective. Advantages with the previous experience include for example that the researcher could easier distil, comprehend and put the information obtained into a larger perspective, and in that way it facilitated the process of making decisions during the thesis work, which facilitated the process of focusing the study in order to provide more actionable results. However, a potential drawback with the previous work experience of the researcher is for example that it could affect the way data is interpreted, and in that way bias the results of the study. What is important to emphasize is that the researcher had no previous experience with the particular system (i.e. ABS) being scrutinized in this study.
3 Theory

This chapter will introduce the cognitive work analysis framework, which was adopted in this thesis to study the system ABS. However, the focus of this chapter will be on the work domain, and the social and organizational part of the cognitive work analysis framework.

3.1 Cognitive Work Analysis

In this section, the cognitive work analysis framework is outlined, which was adopted in order to conduct the work domain analysis, and the social and organizational analysis of ABS. The cognitive work analysis is a framework intended to be used to inform the design of systems [42]. More specifically, the framework is used to identify environmental and cognitive constraints in order to inform the design of systems [42]. However, the cognitive work analysis is not a strict framework, but should be seen as a framework that is flexible and can be adapted to the research being conducted [42]. The cognitive work analysis framework consists of five layers: work domain; control tasks; strategies; social and organizational; and worker competencies.

In this thesis, the cognitive work analysis framework was modified to serve the purpose of studying the work domain, and parts of the social and organizational structure of ABS. Therefore was the first and fourth layer of the framework adopted, see Figure 3. Important to emphasize is that the different layers in the cognitive work analysis framework partly interleave and affect each other [42], therefore is the whole framework and all its layers briefly introduced in this section, which serves the purpose of providing an overview of the framework, and in that way show how it has been used to inform the particular research conducted in this thesis.

As previously mentioned, the cognitive work analysis framework include an analysis of both environmental and cognitive constraints. More specifically, this means that the framework is based on behaviour-shaping constraints, which can be used to generate models that inform design of systems [42].

The cognitive work analysis framework starts with an ecological approach to work analysis, and therefore gives priority to the environmental constraints compared to the cognitive constraints (i.e. why the layers in Figure 3 are organized in that particular order). In other words, one could say that
the cognitive work analysis framework move from the ecological constraints (i.e. the environmental constraints on the system) towards the cognitive constraints (work demands associated with cognitive characteristics). The different layers of the cognitive work analysis framework are briefly described below.

**Work Domain** – represents the physical or other intentional constraints that determine what can be accomplished by the system [8]. A work domain can be thought of as a map in the way it shows the constraints of the land (e.g. the mountains, lakes and forest), and this information is always shown, independently on any activity that can be taken, which means that the map (i.e. the work domain) shows what actions that are possible to take based on the constraints.

**Control Tasks** – addresses the constraints on an activity in a specific situation. Control tasks are used to understand the activities and identify what needs to be done; this means specifying the input and end goal of an activity without focusing on explicitly describing the actual procedure of how it is done [20].

**Strategies** – a control task can often be performed in many ways, and the strategy layer addresses the constraints influencing the way an activity can be performed [20]. In other words, it fills in the previously excluded procedure left out in the control tasks analysis, which means that the strategy layer looks at different ways of carrying out the same task.

**Social and Organizational** – this layer addresses the constraints imposed by the organizational structure, and the workers of the system [20]. More specially, this means that this layer focus on investigating how tasks are distributed among the available resources, and how workers cooperates and communicate [20].

**Worker Competencies** – the previously mentioned constraints determine the environmental, perceptual and cognitive demands on the workers of the system. However, the workers must be able to meet those demands. An analysis of the workers competencies can guide the design of the system or for example help create support tools or training programs [8]. This layer investigates the behavior required by the workers to complete tasks within the system [20].
3.2 Work Domain Analysis

Work domain analysis is the initial phase of the cognitive work analysis framework, and as previously outlined it provides a description of the functional structure of the work domain [42]. This section will introduce the abstraction hierarchy and the abstraction decomposition space, which are used to conduct a work domain analysis.

The model used in this thesis to provide a description of the work domain is the abstraction hierarchy, which acts as a tool that can be used to structure information necessary to understand the work domain [42]. Moreover, the abstraction hierarchy helps to structure the analysis process, and facilitate the search for underlying functionalities in the studied system. In Figure 4, an example of how the abstraction hierarchy could look like is shown (without any information added in the components).

As can be seen in Figure 4, the abstraction hierarchy consist of five levels of abstraction, and range from the physical form to the more abstract level of functional purpose. The different levels of abstraction are explained after Figure 4.

![Abstraction Hierarchy Diagram](image)

**Figure 4:** Illustration of the different levels of the abstraction hierarchy. Moreover, it display components (without information) at the different levels of the hierarchy, which are connected with means-ends links. Adapted from Vicente [42].
**Functional Purpose** – components displayed at this level of abstraction correspond to the work domain purpose \[42\]. In other words, it represents why the system exists.

**Abstract Function** – at this level the functions that can be used to assess how well the system is performing its domain purpose are shown \[42\].

**Generalized Function** – lists all the functions that can be performed by the system \[42\].

**Physical Function** – at this level the physical functions which the objects or resources enables are shown \[42\].

**Physical Form** – at this level of abstraction the physical objects and resources are shown \[42\].

The previously outlined five levels make up the abstraction hierarchy, but what makes this particular model valuable is the connections between the different components, which are connected by so called means-ends links. With help of the means-ends links it is possible to model how individual components affect each other in the system \[42\]. In Figure 4, the questions why, what and how have been added to the abstraction hierarchy, which show how the means-ends-links can be followed in the hierarchy to see how components affect each other.

### 3.2.1 Abstraction Decomposition Space

The output of a the abstraction hierarchy can be synthesized in form of an abstraction decomposition space, which is a two-dimensional matrix that distribute functions across the levels of abstraction previously outlined \[20\].

As can be seen in Figure 5, the abstraction is represented on the vertical dimension and the decomposition on the horizontal. Each component in Figure 5 represents a function or constraint in a system, and the name of the decomposition categories helps to create distinct groups of the components.
3.2.2 Why Conduct a Work Domain Analysis?

A work domain analysis is not an end in itself, rather it should be seen as something that can be helpful to derive implications for design [42]. However, it is important to clarify the value of it, without doing it, the work domain analysis could be perceived to be something rather abstract and wasteful to do. As previously outlined, a work domain analysis can provide models that gives an overview of the work domain where a system is used. However, a work domain analysis is valuable only to the extent it can provide insights into how to create systems that are geared toward human work. Therefore is the discussion (see section 7) part of this thesis extensive in the way it reflects upon the implications for design based on the models used and created in this thesis. With a discussion and reflection tightly connected to the analysis of the work domain it will provide insights about the value of adopting this approach.
3.3 Social Organization and Cooperation Analysis

The social organization and cooperation analysis of the cognitive work analysis framework address constraints imposed by the organizational structure, and by workers of the system [20]. More specifically, this means that social organization and cooperation analysis is concerned with investigating how tasks are distributed among the available resources in the system, and how workers of the system cooperate and communicate. The main objective with conducting a social organization and cooperation analysis is to determine how the technical and social factors in a system can work together to enhance the performance [20].

A social organization and cooperation analysis can make use of the previously outlined abstraction decomposition space (created from the work domain analysis) to map out roles and responsibilities, this in order to better understand the cooperation and communication between workers. As illustrated in Figure 6, each worker has been assigned with a colour, and by mapping the worker’s tasks on the abstraction decomposition space it is possible to see where and how they might need to cooperate and communicate with each other. Moreover, it is possible to chart out scenario trajectories by adopting the abstraction decomposition space, as can be seen in Figure 7.

![Abstraction Decomposition Diagram](image-url)

**Figure 6:** Each colour represents a worker within the system being studied. A component with mixed colors in the abstraction decomposition space indicate that the workers need to communicate and/or cooperate with something. Modified and adapted from Jenkins [20].
3.3.1 Why Conduct a Social Organization and Cooperation Analysis?

A social organization and cooperation analysis allows the constraints affecting the allocation of resources to be modeled [20], two examples are shown in Figure 6 and 7. By conducting a social organization and cooperation analysis it is possible to map workers onto the representations created in the work domain analysis (e.g. the abstraction decomposition space), which help to visualize where workers have an influence on different parts of the system. Through mapping out the workers on the abstraction decomposition space it allows the analyst (i.e. the researcher in this case) to get a graphical representation of the constraints present, which makes it possible to see who has the capability of doing what in the system. Moreover, it is possible to use the abstraction decomposition space as a foundation to build scenario trajectories on, which helps to mediate realistic scenarios of how workers interact with different parts of the system. As with the work domain analysis, the value of conducting a social organization and cooperation analysis will be elaborated more on in chapter 7.
4 Applications of the Cognitive Work Analysis Framework

The purpose of this chapter is to introduce central areas related to the research being conducted in this thesis. Moreover, this chapter will explain how the literature helped pin down and inform the research.

4.1 Social Organization and Cooperation Analysis

As previously outlined, social organization and cooperation analysis address the social and organizational aspects of work in a system (e.g. how resources are distributed among workers, and how workers communicate and cooperate with each other). The main objective with conducting a social organization and cooperation analysis is to determine how the social and technical factors in a system can work together in order to enhance the performance [15]. However, enhancing the so-called performance of a system can be perceived as a vague or rather provocative statement, which partly is because of all the variables that affect a system (e.g. the users, environment and other more subtle factors such as the social reality).

This section will discuss how previous research have approached researching the social organization and cooperation analysis part of the cognitive work analysis framework, this in order to understand how other researcher have interpreted and conducted research on this particular part of the cognitive work analysis framework.

4.1.1 An Examination of the Concepts of the Five Phases of Cognitive Work Analysis with Examples from a Familiar System

A paper written by Naikar examines the concept of all five phases of the cognitive analysis framework [31]. In the paper written by Naikar a home is the system being examined. Moreover, the paper focus on concepts that have direct implications for analysis and design, and it gives more emphasis to the later part of the cognitive analysis framework, with the argument that a lot of work is already available on work domain analysis.

Naikar presents social organization and cooperation analysis in a way that it is relevant to adopt when redesigning new organizational structures [31]. More specifically, four main points are discussed regarding the social organization and cooperation analysis, and they are briefly described below.

- Firstly, the analysis is concerned with identifying criteria’s that may govern or shape how work might be allocated across workers.
- Secondly, the analysis involves examining how work demands of a system may be allocated and distributed across workers.
- Thirdly, the analysis is concerned with the form of communication and the social organization of work.
- Lastly, the analysis recognizes that structures within an organization are often generated in real time by various, cooperating workers that respond to the local situation at hand.
The article written by Naikar investigates several aspects of how social organization and cooperation analysis can be applied when a system is studied. However, the article does not provide a detailed analysis using the social organization and cooperation analysis. Instead, the article takes a rather high-level view on the social and organizational analysis, and provides practical examples of where, why and how the framework could be applied.

4.1.2 Sources of Influence on Beliefs about Information Technology Use: An Empirical Study of Knowledge Workers

William Lewis et al. have written a paper on sources of influences on beliefs about information technology use [25]. More specifically, this paper investigated sources that influence individual beliefs about technology use. In the paper, it is argued for that individuals form beliefs about their use of information technologies within a broad milieu of influences. It is argued for that the influences emerge from the individual, institutional and the social situation where one interacts with the information technology. Also, the findings suggest that beliefs about technologies can be influenced by the attitude that top management have toward it, and the individual factors of innovativeness and self-efficacy showed to be important. The method adopted to gather empirical data in this research was a questionnaire.

The article written by William Lewis et al. confirms the theory (presented in section 3.3) related to understanding the importance of the social setting where the information technology is used. However, the methodological approach (i.e. questionnaire) that was used in the research to understand sources of influences felt more like it should be combined with other methodologies in order to get more profound insights.

4.1.3 Combining Network Analysis with Cognitive Work Analysis: Insights Into Social Organizational and Cooperation Analysis

Robert Houghton et al. have written a paper on how it is possible to combine network analysis with cognitive work analysis [19]. The purpose of the research conducted in this paper was to provide insights into the social organizational and cooperation analysis part of the cognitive work analysis framework. In the paper a technique for building social network diagrams from the cognitive work analysis framework is presented. The technique outlined is illustrated through a case study of a military team, where the workers of the system are mapped out in a fashion that allows to produce different metrics of the team structure (under various operating conditions). In order to identify the resources (type of workers, activities performed and the situation) to base the models on Robert Houghton et al. conducted observations and interviews.

The research conducted by Robert Houghton et al. stress the importance of understanding the social and team perspective of work, and provides a way to model it in a systematic fashion, which makes it possible to explore and analyze weaknesses and strengths with different team configurations. However, the method outlined might be a suitable tool for understanding complex team constellations, but it is hard to see the use cases of this method, if it is not made for the sole purpose of understanding the efficiency of communication between different workers in complex teams. However, investigating only the so called efficiency in communication is rarely the only objective when performing a social organizational and cooperation analysis, especially in the
4.1.4 Using Cognitive Work Analysis to Explore Activity Allocation within Military Domains

A paper written by Jenkins et al. describes an approach for investigating how constraints affect the distribution of work within a military context [21]. The paper focuses on the social organization and cooperation analysis part of the cognitive work analysis framework. Through adopting the approach proposed in the paper, it was shown that it could provide a unique perspective on the factors that influence the social organization of work.

The paper written by Jenkins et al. introduces several potential benefits of exploring the social organization and cooperation analysis part of the cognitive analysis framework. The approach proposed in the paper is based on two of the layers of the cognitive work analysis framework (work domain and control tasks). By starting with the ecological constraints (work domain), it was easier to put the social and organizational aspects of work more into context, and understand the various constraints the workers were exposed to, also it was helpful to understand the different responsibilities of the workers using the system (e.g. types of activities carried out).

4.2 Work Domain Analysis

This section will discuss how previous research has approached researching the work domain part of the cognitive analysis framework. However, as argued by Naikar there is a lot of work available on work domain analysis [31], and since the unique part of this thesis work is mainly on the social organization and cooperation analysis layer of the cognitive analysis framework this review will not be exhaustive. Instead this review serves the purpose of finding inspiration of how various work domains have been analyzed, and how it could help in the research conducted in this thesis.

4.2.1 Systems Change in Transport Control: Applications of Cognitive Work Analysis

Laura Miller et al. have written a paper that presents the application of the cognitive analysis framework in an industrial context [28]. The paper focuses on the two top layers of the cognitive analysis framework, namely the layers concerning work domain and control tasks. The main purpose of writing the paper, according to the authors, was to show what type of analyses that exists, and how they can be useful to system designers and operation managers.

By using practical examples from an industrial context this article illustrate the value of conducting a work domain analysis. Moreover, the article examined how it is possible to transfer the application of the cognitive analysis framework in other domains, which helps people that are unfamiliar with the analysis techniques, but also makes it possible to identify possible patterns across work domains, which can help in the work domain analysis.

4.2.2 Beyond Interface Design: Further Applications of Cognitive Work Analysis

Naikar has written a paper that explains how cognitive work analysis can be applied in a variety of applications [30]. It is demonstrated in the paper how the cognitive work analysis framework
can be used to identify for example training needs, evaluate alternative system design proposals, and develop design solutions suitable for complex teams. The practical examples outlined in the paper are connected to the Australian Department of Defence, and therefore demonstrates how the cognitive analysis framework can be used to produce outcomes that help develop complex systems.

4.2.3 Work Domain Analysis for Air Traffic Controller Weather Displays

A paper written by Ahlstrom outlines the use of the cognitive work analysis framework for mapping out weather information needs for terminal controllers [1]. More specifically, it is described how the modeling tools (e.g. work domain analysis) in the cognitive work analysis framework helped reveal various constraints in the terminal domain. The results obtained from the analysis helped in the development of various weather display concepts.

This article illustrates how different models in the cognitive analysis framework can be combined and helpful when generating new design concepts (in this case for the weather display). By adopting the cognitive analysis framework, it helped the researcher to generate realistic concepts within the constraints of the work domain.

4.3 Summary and Precision of Research Objective

This chapter has outlined several articles that have informed the research conducted in this thesis. The articles presented have focused on two layers of the cognitive analysis framework, namely the work domain and the social and organizational. The purpose of this chapter has been to provide information about what kind of previous research that have been conducted in the work domain, and social and organizational part of the cognitive analysis framework.

The previous research outlined have inspired the methodological approach (see chapter 5) of this thesis, and it also provided a practical foundation to work from. Moreover, the articles showed the value of combining different models in the cognitive analysis framework, and demonstrated the flexibility of the framework and how it could be applied in various work domains.

As previously outlined, the research objective of this thesis is twofold: (1) map out the work domain in where ABS is used through conducting a work domain analysis, (2) conduct a type of social and organizational analysis of ABS. The next chapter will outline the methodological approach adopted in this thesis.
5 Method and Material

In order to answer the research questions and achieve the overall objective with this thesis, several methods were adopted in order to generate both qualitative and quantitative data. Throughout this chapter the methods and material used will be described. Moreover, the reasoning behind adopting the methods will be argued for, and presented in a way that clarify how they fit into the larger purpose of the study.

5.1 An Overview of the Methodological Approach

Before diving into the details of the methods and material used in this thesis, an overview of the methodological approach is given. The overview will make it easier to understand the reasoning behind certain methodological decisions, and also provide the reader with a sense of direction for how the study was executed.

The study can be divided into three phases; preparation and pre-study, data gathering, and the data analysis phase. Each of these phases build on each other, which means that information gathered and material created in one phase are used in the subsequent phase. The thesis process and how each phase informs the other is visualized in Figure 8. In the following subsections, the different phases shown in Figure 8 will be described in more detail.

**Figure 8:** A schematic illustration of the methodological approach is shown in the figure. Overlap of different activities can be seen in the different phases of the study, which indicates that they have been allowed to inform and affect each other.
5.2 Preparation and Pre-study

The preparation and pre-study phase of the study involved reading related literature, and review organizational documentation of ABS. Moreover, in this phase unstructured interviews were conducted. The main purpose of conducting the pre-study was to learn more about ABS, which then helped to prepare and refine the methods and material used in this thesis. By performing a pre-study, it provides foundational information about the researched domain [4], which often academic literature does not capture and provide. Therefore, the pre-study was adopted in order to inform the methodological decisions, shape the creation of the field material, and help focus the research.

5.2.1 Unstructured Interviews

In the beginning of the study the researcher had no knowledge about ABS. In order to both get an understanding of ABS, and prepare the practical parts (i.e. observational study, semi-structured interviews and online questionnaire) of the study, five unstructured interviews were conducted, see Table 2 for demographic information of the participants. The unstructured format allowed for flexible diversions in the discussion, this since it is an approach that is not following any strict framework [29]. Adopting this exploratory approach early in the study helped to understand ABS and the workers that use it, which facilitated the process of structuring the up-coming parts of the research.

The recruitment of participants for the unstructured interviews was done in assistance with a supervisor at Arbetsförmedlingen. As can be seen in Table 2 the participants were either working with ABS or in some way connected to the development of it.

<table>
<thead>
<tr>
<th>Interview #</th>
<th>Gender</th>
<th>Role</th>
<th>ABS**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Female</td>
<td>Product manager</td>
<td>N/A</td>
</tr>
<tr>
<td>2</td>
<td>Male</td>
<td>Requirement engineer</td>
<td>N/A</td>
</tr>
<tr>
<td>3</td>
<td>Female</td>
<td>Care organizer*</td>
<td>10 months</td>
</tr>
<tr>
<td>4</td>
<td>Female</td>
<td>Care organizer*</td>
<td>8 months</td>
</tr>
<tr>
<td>5</td>
<td>Female</td>
<td>Care organizer*</td>
<td>1 month</td>
</tr>
</tbody>
</table>

* user of ABS

** work experience with ABS (auxiliary means)
The interviews with the participants that worked with ABS were done remotely at this stage of the study, partly because of the geographical distance between the researcher and the workers that use ABS, but also because of the resources and time allocated for this thesis. However, at this stage of the study it was decided that conducting interviews remotely would still satisfy the purpose (i.e. learn more about the system, and gain insights that could help create material and an appropriate structural approach for the observational study).

The topics discussed during the unstructured interviews can be seen in Table 3 (see Appendix A for the real field guide used, only available in Swedish). However, important to emphasize is that the interview did not strictly follow the structure outlined in Table 3, instead these questions and themes were adapted to the situation at hand to make the interview exploratory and foster a natural conversation.

Before the unstructured interviews were conducted, an email containing an attached information letter was sent out to the participants, which informed about the general purpose, objective, participant rights and how the information obtained should be used. The information letter can be seen in Appendix B (only available in Swedish).
Table 3: A compromised version of the field guide used during the unstructured interviews in the pre-study (see Appendix A for the original Swedish version of the field guide).

<table>
<thead>
<tr>
<th>Themes</th>
<th>Interview questions*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>What is your role?</td>
</tr>
<tr>
<td></td>
<td>How long have you been working on the unit?</td>
</tr>
<tr>
<td></td>
<td>What is your previous work experience/background?</td>
</tr>
<tr>
<td>Ordinary day with ABS</td>
<td>How does a typical day look like for you?</td>
</tr>
<tr>
<td></td>
<td>How much time (in hours) are you approximately spending using ABS each day?</td>
</tr>
<tr>
<td></td>
<td>Are you performing any other work duties that is not related to ABS?</td>
</tr>
<tr>
<td>Colleagues and physical work environment</td>
<td>How are you working on the unit today? (e.g. individually or in teams)</td>
</tr>
<tr>
<td></td>
<td>How would you describe the physical environment on the unit you are working on?</td>
</tr>
<tr>
<td></td>
<td>Are you collaborating anything with the errands connected to auxiliary means in ABS?</td>
</tr>
<tr>
<td></td>
<td>What competency exists on the unit today? (e.g. type of specialists, roles etc.)</td>
</tr>
<tr>
<td></td>
<td>How is the competency distributed on the unit?</td>
</tr>
<tr>
<td>General information about ABS</td>
<td>How long have you been a user of ABS?</td>
</tr>
<tr>
<td></td>
<td>Which are the most common type of errands handled in ABS?</td>
</tr>
<tr>
<td></td>
<td>How are the errands distributed among people working at the unit?</td>
</tr>
<tr>
<td></td>
<td>Are you dependent on any other people when making decisions in ABS? (e.g. specialists)</td>
</tr>
<tr>
<td></td>
<td>What tools are you using to get in contact with other specialists?</td>
</tr>
<tr>
<td>Case</td>
<td>I would like you to go through the normal process of handling an errand related to auxiliary means in ABS (i.e. from an errand is coming in, until it gets completed).</td>
</tr>
<tr>
<td></td>
<td>What criteria’s are you following in the decision making process?</td>
</tr>
<tr>
<td></td>
<td>What information do you base your justification on in the decision making process?</td>
</tr>
<tr>
<td></td>
<td>How is the final motivation for the errand compiled? Is it done throughout the process or at the end?</td>
</tr>
</tbody>
</table>

* the interviews did not strictly follow these questions, instead they acted as a source of reference and guidance to steer the discussion
Table 3: Continuation on Table 3. A compromised version of the field guide used during the unstructured interviews in the pre-study (see Appendix A for the original Swedish version of the field guide).

<table>
<thead>
<tr>
<th>Themes</th>
<th>Interview questions*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edge cases</td>
<td>Are there errands that ABS is not supporting? If so, how are you working around it? (e.g. using other systems)</td>
</tr>
<tr>
<td></td>
<td>Do you have any possibility to consult anyone when handling errands? If so, how are you doing it?</td>
</tr>
<tr>
<td></td>
<td>Is there any time you need to reach out to any external support? If so, how are you doing it?</td>
</tr>
<tr>
<td>Organizational change</td>
<td>How have you experienced the centralization of the errands?</td>
</tr>
<tr>
<td>(centralizing decisions)</td>
<td>Do you see any benefits respectively drawbacks with the centralization of the errands?</td>
</tr>
<tr>
<td></td>
<td>Can you see any challenges in the future (based on your expertise and experience) with ABS?</td>
</tr>
<tr>
<td>Winding up</td>
<td>Are there anything else you would like to add?</td>
</tr>
</tbody>
</table>

* the interviews did not strictly follow these questions, instead they acted as a source of reference and guidance to steer the discussion

5.2.2 Organizational Documentation

In order to learn more about the studied system ABS, organizational documentation was reviewed. Information obtained from these documents helped to understand ABS better, and in that way it also helped to formulate more relevant interview questions and steer the focus of the data gathering phase. Moreover, the documentation helped with the preparation of the material for the observational study, in the way it gave an overview of the functionality of ABS. Lastly, the organizational documentation acted as a reference (e.g. for the terminology used) and made it easier to interpret for example comments expressed by the participants throughout the study.

In Table 4 the organizational documents reviewed in the pre-study and preparation phase of the study are briefly described.
### Table 4: Description of the organizational documents reviewed in the pre-study.

<table>
<thead>
<tr>
<th>Type of document</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vision of the system ABS</td>
<td>This document gave an explanation of why the system ABS is needed in the organization. The focus is on the stakeholders, customers and clients needs, but also why these needs exist.</td>
</tr>
<tr>
<td>Description of the user interface</td>
<td>A document describing an earlier version of the user interface of ABS. Although it was an earlier version of ABS it provided information about the general structure of the system, which helped the researcher familiarize with the system being studied.</td>
</tr>
</tbody>
</table>

#### 5.2.3 Interview Guide

Based on the previous activities (i.e. the unstructured interviews, review of literature and organizational documentation) were the interview guide for the data gathering phase created, which was used when conducting the semi-structured interviews with the users of ABS (conducted after each observational session, which is explained in more detail in section 5.3).

An interview guide consist of the most central themes and questions that cover the most important areas of the study [29]. Therefore was the development of the interview guide always connected to the overarching goal and purpose of the study. Moreover, the interview guide was pilot tested during the development process in order to refine both the structure and questions [33], which increased the chance of gathering data connected to the purpose of the inquiry. The final version of the field guide used in the semi-structured interviews can be seen in Appendix C.

#### 5.3 Data Gathering Phase

This section covers the data gathering phase, which involves as the name implies how the raw data was collected. More specifically, this section treats the three different methods that was used to collect data, namely the observational study, semi-structured interviews, and the online questionnaire.

In total 7 people participated in the primary data gathering phase of the study (i.e observational study and semi-structured interviews, see section 5.3.3 regarding the participants of the online questionnaire), out of these were 6 females and 1 male. All the participants had varied experience with ABS, spanning from 1 month up to 11 months, with an average of 7 months. The age varied from 35 to 57 years, with an average of 47.57. Details regarding the participants in the study can be seen in Table 6. As can be seen in Table 6, each participant has been assigned a unique identifier in order to preserve anonymity.
Table 5: Participant demographics.

<table>
<thead>
<tr>
<th>Participant #</th>
<th>Gender</th>
<th>Experience with ABS*</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Female</td>
<td>8 months</td>
<td>47</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>6 months</td>
<td>57</td>
</tr>
<tr>
<td>3</td>
<td>Female</td>
<td>5 months</td>
<td>47</td>
</tr>
<tr>
<td>4</td>
<td>Female</td>
<td>8 months</td>
<td>49</td>
</tr>
<tr>
<td>5</td>
<td>Male</td>
<td>11 months</td>
<td>48</td>
</tr>
<tr>
<td>6</td>
<td>Female</td>
<td>10 months</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>Female</td>
<td>1 month</td>
<td>35</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Females:</strong></td>
<td>6</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Males:</strong></td>
<td>1</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td></td>
<td>N/A</td>
<td>47.57</td>
</tr>
</tbody>
</table>

* previous experience with ABS (auxiliary means)

5.3.1 Observational Study

Observational research was adopted to collect qualitative data in order to uncover characteristics of the work domain that is more diffuse, such as the contextual influences, values and behaviors of the workers, and the interaction and communication patterns.

The participant observation approach was adopted to conduct the observational research. A participant observation is a research method in which the researcher takes part in the daily activities of a group of people, this in order to learn the tacit and explicit aspects of their life, routines and their culture [12]. In this study, the people studied were the workers that use ABS (see Table 5).

The observational study was conducted over two days in the natural environment of where the workers that use ABS are located (see Appendix D for the schedule of the observational study). As previously outlined, 7 people participated in the observational study. Each observational session was scheduled for 90 minutes, and included a walkthrough of ABS, the observational session itself, and a follow-up interview that was semi-structured. In table 6, activities performed in each session of the observational study are explained in more detail.
Table 6: Activities in the observational study.

<table>
<thead>
<tr>
<th>Activities</th>
<th>Procedure</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walkthrough of ABS</td>
<td>The observational study started with a walkthrough of ABS, which included an interview with the worker about the usage and functionality of ABS. The questions and topics discussed during this walkthrough can be seen in Appendix F (only available in Swedish).</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Observational session</td>
<td>After the walkthrough of ABS, an observational session was conducted with the participant in order to learn more about the actual usage of ABS.</td>
<td>40 minutes</td>
</tr>
<tr>
<td>Follow-up interview</td>
<td>Lastly, a follow-up interview was conducted with the participant, with the purpose of follow up on what was observed in the observational session, but also to learn more about how the workers perceive ABS. The interview guide used in the follow-up interview can be seen in Table 2 and 7 (see Appendix C for the original version, only available in Swedish).</td>
<td>30 minutes</td>
</tr>
</tbody>
</table>

During the observational sessions were field notes written, which were later used in the analysis process. Field notes can be defined as notes about the field made by the researcher with the purpose of creating an empirical foundation in order to aid the analysis process [4], this to ultimately be able to answer the research questions. More specifically, the field notes describe what is happening in the studied situation, who is doing what, in what situation it happens, and how the environment is and the different impressions experienced by the researcher [4].

The field notes recorded the studied situation generally, but also focused on the specific purpose of the study. In other words, the field notes provided the researcher with both depth and an overview of the studied situation. By obtaining a holistic understanding of the studied situation could the researcher combine different events that happened in the different observational session to understand why they occurred. Even though the events happened at different times and places, the field notes with both detailed and more general information provided the researcher with material to interpret the information to see patterns, and understand why and how certain events are associated.
5.3.2 Semi-structured Interviews

After each observational session a follow-up interview was conducted. The interviews followed a semi-structured format, which means that it is not structured around a set of rigorous questions, but instead it is a more open framework that allows the participants to express their ideas and perspectives more freely [29]. In order for the interview to not deviate from the topic, an interview guide was used to keep the interview on track and relevant to answering the research questions. In Table 7, a compromised version of the field guide can be seen, it has been translated from Swedish to English (the original Swedish version can be seen in Appendix C).

In total were 7 interviews conducted, and each follow-up interview took approximately 30 minutes. All the informants were the same that participated in the observational study, see Table 5. Moreover, the interviews were recorded in order to facilitate the analysis process (discussed in section 5.4.1). The consent form used to get acceptance to record the interviews can be seen in Appendix E. Ethical considerations are discussed more in section 5.7.
Table 7: Interview guide used in the follow-up interview (translated from Swedish to English, see Appendix C for the Swedish version).

<table>
<thead>
<tr>
<th>Themes</th>
<th>Interview questions*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous experience</td>
<td>How long have you been working on the unit?</td>
</tr>
<tr>
<td></td>
<td>What is your previous work experience / background?</td>
</tr>
<tr>
<td></td>
<td>How long have you been a user of ABS?</td>
</tr>
<tr>
<td></td>
<td>How did you learn to use ABS? (e.g. education, colleges or self-taught)</td>
</tr>
<tr>
<td></td>
<td>Do you have any previous experience with working with similar system as ABS? If so, please describe some similarities and differences.</td>
</tr>
<tr>
<td>General information about ABS</td>
<td>How do you experience that ABS interoperate with other information technology systems in the agency?</td>
</tr>
<tr>
<td></td>
<td>How do you experience the support ABS provide you in your daily work activities?</td>
</tr>
<tr>
<td></td>
<td>Do you see any limitations with the system today? (based on your previous experience)</td>
</tr>
<tr>
<td></td>
<td>Do ABS provide you with the information you expect? If not, what is missing and why?</td>
</tr>
<tr>
<td></td>
<td>Have you experienced any situation were the usage of ABS has affected your work in a negative manner? If so, please explain what happen and what it meant for you.</td>
</tr>
<tr>
<td></td>
<td>What do you think about the security and reliability aspects in ABS?</td>
</tr>
<tr>
<td></td>
<td>What are you doing if a problem occurs in the system and you cannot solve it by yourself?</td>
</tr>
<tr>
<td></td>
<td>Have you ever lost any critical information in your work using ABS?</td>
</tr>
<tr>
<td></td>
<td>What does a decision support system that is uniform and legally secure mean for you?</td>
</tr>
<tr>
<td>Social influences</td>
<td>How is the cooperation between colleagues working on the unit?</td>
</tr>
<tr>
<td></td>
<td>What is your organizational structure on the unit? Who is responsible for making decisions in the work group?</td>
</tr>
<tr>
<td></td>
<td>What is your perception of what other people on the unit thinks about ABS?</td>
</tr>
<tr>
<td></td>
<td>Who introduced you to ABS? (role and position)</td>
</tr>
</tbody>
</table>

* the interviews did not strictly follow these questions, instead they acted as a source of reference and guidance to steer the discussion
Table 7: Continuation on Table 6. Interview guide used in the follow-up interview (translated from Swedish to English, see Appendix C for the Swedish version).

<table>
<thead>
<tr>
<th>Themes</th>
<th>Interview questions*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational influences</td>
<td>What is important for you to know when a change of a digital tool you use is made (such as, ABS)?</td>
</tr>
<tr>
<td></td>
<td>Do you feel that you can affect the development of ABS?</td>
</tr>
<tr>
<td></td>
<td>How do you on the unit today bring up problems and areas of improvement? (regarding ABS)</td>
</tr>
<tr>
<td></td>
<td>What do you think is the benefits and drawbacks with adopting that (answer on the previous questions) approach?</td>
</tr>
<tr>
<td></td>
<td>Do you know something about the limitations concerning the future development of ABS?</td>
</tr>
<tr>
<td></td>
<td>Do you have any possibility to take part of any information regarding changes to the IT-system you use? (e.g. updates) If so, where and how do you access this information?</td>
</tr>
<tr>
<td>Winding up</td>
<td>Have you realized something about the usage of ABS that you think can be useful in the development of similar systems in the future?</td>
</tr>
<tr>
<td></td>
<td>Are there anything else you would like to add?</td>
</tr>
</tbody>
</table>

* the interviews did not strictly follow these questions, instead they acted as a source of reference and guidance to steer the discussion

5.3.3 Online Questionnaire

Four days after the field visit, an online questionnaire was sent out to all of the workers that used ABS on the unit (where the study was conducted). In total 12 people participated in the online questionnaire.

A questionnaire is a research method that can be used to gathering information from respondents by asking a series of questions and other prompts. An online questionnaire is a computer-administered questionnaire that allows the respondents to participate over the Internet [15].

The online questionnaire consisted of 14 questions in total, where different kind of questions were asked (including e.g. free text answers, grading scales and matching alternatives). In Table 8 a compromised version of the online questionnaire with the questions asked, followed by the type of answer. The original version of the questionnaire was in Swedish, but it has been translated to English.

The tool used to conduct the computer-administered questionnaire was SurveyMonkey [40], which
allowed to distribute the survey online (see section 5.4.2 for information about the analysis of the questionnaire).

Table 8: Computer-administered questionnaire (translated from Swedish to English).

<table>
<thead>
<tr>
<th>Question #</th>
<th>Type of answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How long have you been working at Arbetsförmedlingen?</td>
<td>Free text box.</td>
</tr>
<tr>
<td>2. When did you start using ABS?</td>
<td>Month and year</td>
</tr>
<tr>
<td>3. How well do you experience that ABS supports you in your daily work?</td>
<td>Unipolar scale (1-5)</td>
</tr>
<tr>
<td>4. How well do you experience that ABS interoperate with other IT-systems</td>
<td>Bipolar scale (1-5)</td>
</tr>
<tr>
<td>5. How well do you experience that ABS provide you with the information</td>
<td>Unipolar scale (1-5)</td>
</tr>
<tr>
<td>6. How well do you experience that ABS inform about changes that are</td>
<td>Unipolar scale (1-5)</td>
</tr>
<tr>
<td>7. How well do you experience that ABS support interventions on incorrect</td>
<td>Unipolar scale (1-5)</td>
</tr>
<tr>
<td>8. How do you think your colleagues would rate ABS according to the</td>
<td>Bipolar scale (1-5)</td>
</tr>
<tr>
<td>9. What is your general impression about the IT-systems you have used</td>
<td>Bipolar scale (1-5)</td>
</tr>
<tr>
<td>Question #</td>
<td>Type of answer</td>
</tr>
<tr>
<td>------------</td>
<td>----------------</td>
</tr>
</tbody>
</table>
| 10. Do you have any previous experience of working with systems that are similar / reminding of ABS? | **Alternative:** No / Yes  
If yes: describe briefly some similarities with the system you have used. |
| 11. Which of the systems below are you using daily in your work? | **Alternative:**  
- ABS  
- AIS  
- Diariet  
- Raindance  
- ELIN  
- Specify other systems: (free text box) |
| 12. Your gender | **Alternative:**  
- Woman  
- Man  
- Other |
| 13. Your age | **Alternative:**  
- Under 29 years  
- 30 – 39 years  
- 40 – 49 years  
- 50 – 59 years  
- 60 years and above |
| 14. Your highest education | **Alternative:**  
- Vocational training  
- Bachelor’s degree  
- Master’s degree  
- Doctoral degree  
In which field of study is your degree in: (free text) |
5.4 Data Analysis Phase

This section covers how raw data collected from the observational study, semi-structured interviews, and the online questionnaire were analyzed. Moreover, this section will explain how the three different data sources were used to perform a triangulation.

5.4.1 Analysis of the Observational Notes and the Semi-structured Interviews

The analysis of the observational notes, and the semi-structured interviews loosely followed the thematic analysis process outlined by Braun and Clarke [7]. The thematic analysis process outlined by Braun and Clarke was not strictly followed since the method had to be adapted to the situation at hand. In Table 9 can the process of the thematic analysis adopted be seen.

Thematic analysis is a method that can be used for identifying, analyzing and reporting patterns within a data set [7]. In other words, thematic analysis is a way to organize and describe raw data in a systematic manner.

As previously mentioned the semi-structured interviews were recorded, and the observational notes written during the observational sessions. The first step in the process of analyzing the semi-structured interviews and observational notes was to transcribe the recordings, and review the observational notes. By transcribing the recordings and reviewing the observational notes it helped to familiarize with the data set. Moreover, it helped generate initial potential codes for the upcoming themes.

The second step in the thematic analysis process was to review the transcribed interviews and the observational notes to start generating initial codes. Features and other interesting patterns of the data were coded in a systematic manner. The third step consisted of identifying potential themes, which involved collating the previously generated codes into potential themes.

The next step was to review the themes that had been generated, which meant that the themes were checked if they worked in relation to the initial codes. Lastly, after an iterative ongoing analysis (of the previous steps) the final themes were defined. The thematic analysis process can be seen in Table 9.
Table 9: Description of the thematic analysis process.

<table>
<thead>
<tr>
<th>Phase #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Familiarization</td>
<td>The first step in the thematic analysis process was to transcribe the recordings from the interviews, and review the observational notes. Transcribing the recordings and reviewing the observational notes helped to familiarize with the data, and enabled the subsequent step of starting to generate initial codes.</td>
</tr>
<tr>
<td>2. Initial codes</td>
<td>The second step was to review the transcribed recordings and the observational notes to start generating initial codes.</td>
</tr>
<tr>
<td>3. Identify potential themes</td>
<td>In the third step of the analysis process potential themes were identified, which was based on the initial codes (generated in step 2).</td>
</tr>
<tr>
<td>4. Reviewing themes</td>
<td>The fourth step of the process involved reviewing the identified themes. More specifically, this means that the themes were checked if they worked in relation to the initial codes (generated in step 2).</td>
</tr>
<tr>
<td>5. Defining themes</td>
<td>Lastly, after a few iterations (steps 2 – 4) the final themes were defined.</td>
</tr>
</tbody>
</table>

* A brief description of each stage of the thematic analysis process. However, important to emphasize is that the thematic analysis process is not linear, steps 2 – 4 required a few iterations to be able to define the final themes.

5.4.2 Analysis of the Online Questionnaire

The results obtained from the online questionnaire were processed in Microsoft Excel to generate descriptive statistics, which provided summaries about the sample and measures. The data that was used to create the descriptive statistics were generated by the computer-administrative tool SurveyMonkey. After generating the descriptive statistics were the results visualized in form of bar graphs (see section 6.3).

5.4.3 Triangulation of the Data Sources

Qualitative methods have an interpretative approach to the data gathered, which means that the researcher shape her own understanding of the situation, and thus give meaning to the experiences. In order to increase the validity of the study, and mitigate the researcher bias on the data set, a method called triangulation was adopted. Triangulation is a way of comparing different data sources in order to get a comprehensive understanding of the studied situation, and to see if the outcomes
of different methods used supported each other or not [22](e.g. if comments expressed in the interview are in line with the results obtained from the online questionnaire). In Figure 9 is the three different data sources shown (i.e. observation, semi-structured-interviews, and questionnaire), and the illustration shows how each data source were compared with each other to search for possible patterns or discrepancies in the data set. The triangulation of the three data sources, and how it was used in order to answer the research questions is elaborated more upon in chapter 7.

Figure 9: An illustration that shows the three different data sources, and how they were compared with each other to search for possible patterns or discrepancies.

5.5 Social Organization and Cooperation Analysis

The social organization and cooperation analysis is based on the analysis of two data sources in this thesis, namely the work domain analysis and thematic analysis. Figure 10 illustrates how the two different analysis methods informed the social organization and cooperation analysis.

Figure 10: An illustration that shows the two analysis methods that informed the social organization and cooperation analysis.

The purpose of performing the social organization and cooperation analysis is to show how analysis methods can be used together in order to better understand the social and organizational aspects of work with ABS. As can been seen in section 6.4 the social organization and cooperation analysis make use of the models created in the work domain analysis, and the findings from the thematic analysis.
As outlined in the literature section (see chapter 4) about the cognitive work analysis framework, the social organizational part of the framework focus on many social aspects of work. Therefore, in this thesis the purpose is not to be exhaustive in the social organization and cooperation analysis, instead the purpose is to show how it could be applied in this particular research, and thus demonstrate the potential benefits and drawbacks with adopting the approach. The social organization and cooperation analysis process is shown in Table 10.

Table 10: Description of the social organization and cooperation analysis process.

<table>
<thead>
<tr>
<th>Phase #</th>
<th>Description*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Familiarization</td>
<td>The first step in the social organization and cooperation analysis process was to review the abstraction hierarchy, abstraction decomposition space, results from the thematic analysis, and the observational notes.</td>
</tr>
<tr>
<td>2. Identify initial stories</td>
<td>The second step was to identify potential stories in the data set that could be used to describe the social organization and cooperation of work with ABS.</td>
</tr>
<tr>
<td>3. Review the identified stories</td>
<td>In the third step of the analysis process, the initial stories were reviewed in order to make sure that they were realistic, and reflected how work is conducted with ABS.</td>
</tr>
<tr>
<td>4. Decide upon stories</td>
<td>Lastly, after a few iterations (steps 2-3) the final stories were defined, which were used in a version of the abstraction decomposition space.</td>
</tr>
</tbody>
</table>

* A description of each stage in the social organization and cooperation analysis process. However, important to emphasize is that the organizational and cooperation analysis process was not linear, steps 2 – 3 required a few iterations.

5.6 Geographical Location and Ecological Validity

The observational study was conducted in Umeå, Sweden. The organizational change of centralizing decisions made the auxiliary means errands only available in Umeå, and in order to strive toward ecological validity (i.e. a term that refers to the realism in which a study setup matches the user’s real work context [18]) was the study conducted there. Important was to make sure that the study reflected the real-world usage conditions of the system ABS, and not interrupt with any intrusive behavior that might change the natural behavior of the participants in the study. It might not be possible to completely remove this aspect, but in order to mitigate this risk was much time spent in the preparation and pre-study phase of the project, with the purpose of both informing participants about the study, and develop a suitable approach and material that felt non-intrusive to participants.
5.7 Ethical Considerations

The material created in the preparation and pre-study phase (i.e. the information letter and consent form) of the work process were made to make sure that the participants were informed about the study. As previously mentioned, but important to emphasize once again, the information letter provided the participants with information about the general objective of the study and how the results should be used and publicized, and the consent forms was used in order to get acceptance to observe and audio record the participants. The ethical considerations followed the regulations formulated and suggested by Vetenskapsrådet [41]. The information letter used can be seen in Appendix B, and the consent form is shown in Appendix E.

All of the information gathered (i.e. observational notes and audio recordings) in the study was confidential. Moreover, it is important to emphasize that the participation in the study was voluntary, and that the participants could at any time withdraw their consent.

5.8 Summary

This chapter has outlined the methodological approach of this thesis. The purpose of this chapter has been to both give an overview of the process, but also insights into the methodological decisions. To summarize, the project consist of three phases, namely the preparation and pre-study, data gathering, and the data analysis phase. Each of these phases build on each other in the way that material and work conducted in one phase is used later on. Moreover, the chapter touches on ethical aspects, and how the study strived toward ecological validity.
6 Results
In this chapter the results from the research will be presented. More specifically, this means that the work domain analysis, thematic analysis and the results from the online questionnaire will be presented. Lastly, the results from the work domain analysis and thematic analysis will be synthesized, and presented in form of a social organization and cooperation analysis of ABS.

6.1 Work Domain Analysis
In this section the abstraction hierarchy (i.e. the work domain) where ABS is used will be presented. The research questions that will be answered in this section are the following two:

- How is the work domain where ABS is used structured?
- What are the contextual influences that affect the usage of ABS?

The abstraction hierarchy has been successively constructed during the thesis work, as can be seen in Figure 8. The purpose of constructing the abstraction hierarchy is twofold: (1) it provided the researcher with a way to systematically build an understanding of ABS over time, (2) it helped the process of interpreting the qualitative data obtained from interviews and observations (see section 6.2). Why the abstraction hierarchy is a helpful model when interpreting the qualitative data is because it provides an overview of the various constraints a worker using ABS operates under, and thus provides a way to interpret the qualitative findings in relation to the work domain of ABS. The final version of the abstraction hierarchy (i.e the outcome of the work domain analysis) can be seen in Figure 11.

Moreover, this section will show an example of how the components identified in the abstraction hierarchy can be used in order to construct an abstraction decomposition space (see section 6.1.5), which serves the purpose of categorizing the identified components in distinct groups.

Each component in the abstraction hierarchy will be described in more detail after Figure 11. The explanation of the components in the abstraction hierarchy will be top-down, which means that it starts explaining the components in the functional purpose layer, and successively move down in the abstraction hierarchy to ultimately explain the components in the physical form layer. The purpose is to provide more details about each component and how it fits into the work domain where ABS is used.
6.1.1 Functional Purpose

The functional purpose layer describes why the system exists. ABS is a decision support system that provides workers that use it with a uniformed and legally secure system. More specifically, this means that the purpose of the system is to ensure that all workers that handle auxiliary means errands go through a similar process, which decreases the chance of errands being handled differently.

6.1.2 Abstract Function

In the abstract function layer of the abstraction hierarchy, functions that can be used to assess the domain purpose are shown. As can be seen in Figure 11, there are five components that have been identified. Important to emphasize is that some information displayed in the components in Figure 11 partly interleave, but have been divided up to clarify the meaning of each component, and how it affects the work domain.

The component regarding minimizing the risk that errands are handled differently, means more specifically that users of ABS is following the same basic procedure when handling auxiliary means errands. Moreover, this component is tightly connected to the one about ensuring that errands are handled according to laws and regulations, which ensures that all auxiliary means errands are handled on the same conditions. The main difference between these two components is that one is focused more on the work process in ABS of handling an errand, and the other is more concerned with how well the organizational laws and regulations are in line with ABS.

As mentioned in chapter 2, the introduction of ABS has led to an organizational change (from a decentralized structure to a centralized one). One purpose of introducing ABS was to partly minimize...
the lead time in errands, but not at the cost of quality. The component regarding minimizing the lead time in an auxiliary mean errand is standing on its own, but should be seen in context with the other components in the same layer.

The component regarding supportive material that provide assistance to workers in the process of handling auxiliary means errands are also connected to the previously outlined components. More specifically, this component concern everything from material regarding laws and regulations, but also internal and external supportive material. An example of an external supportive material is the documented information regarding the auxiliary mean itself, and how it should be delivered. Internal supportive material can for example be the recommendations written by specialists in Arbetsförmedlingen, which is an essential part of the process of handling auxiliary means errands.

Lastly, since ABS and the unit Hjälpmedel where the system is used is relatively new (introduced in March 2015), the way of working is under constant development. This means more specifically that ABS is also concerned with the possible ways of how work can be conducted at the unit Hjälpmedel, which means that ABS affects the possibility to introduce new routines for how auxiliary means errands can be handled.

6.1.3 Generalized Function
Functions that ABS enables or perform are shown in the generalized function layer. As can be seen in Figure [1], there are in total seven components in this layer of the abstraction hierarchy.

As previously mentioned, one of the main purpose that ABS exists is to minimize the risks that auxiliary means errands are handled differently. ABS can with help of notifications identify if changes happened in an auxiliary mean errand, which leads to that lead time in an errand is decreased. Moreover, the usage of notifications also minimizes the risk of ignoring errands that have been active over a long period of time (but not completed), and thus the probability of handling all the errands on the same conditions is increased.

The component regarding registration and payment of an auxiliary mean are connected to the abstract function of ensuring that an errand is handled according to laws and regulations. More specifically, this means that each errand must register an auxiliary mean and follow an established procedure for the payment. Following the previously outlined steps minimizes the risk of errands being handled differently, but also minimize the overall lead time of an errand since it reduces the risk of rework.

A component that covers a lot of ground is the one concerning the process of handling the auxiliary means errands in five stages. This component interleaves with all the other components in the generalized function layer. However, it has been isolated since it is important to emphasize the process of how the auxiliary means errands are handled. The process of handling errands in ABS is separated in five stages, and have been divided up on two different type of workers, namely one that are more responsible for preparatory work (stage 1–4, which is handled by care organizers), and the other is handling the payment (stage 5, which is handled by program administrators).

In the five stages of the process of handling auxiliary means errands, several steps are necessary to follow in order to ensure that the errands are handled according to laws and regulations. Besides the registration and payment process previously described, the errands must be documented in a
way that clarifies the decisions that have been made, by doing this one can ensure that reference material exists, which makes it possible to go back and quality check errands.

Lastly, the component regarding routines and ways of working with auxiliary means errands is connected to how one could work with the system ABS. Moreover, it informs how the work should be conducted at the unit Hjälpmedel. These routines and ways of working with the auxiliary means errands provides a foundation which ensures that enough supportive material exists for the workers, but also it provides a way to document the current way of working, which make it possible to potentially identify new ways of working at unit.

6.1.4 Physical Form and Physical Function

The physical form layer of the abstraction hierarchy describes the available resources that affects ABS, and the physical function layer describes what these resources enables or can perform. As can be seen in Figure 11, six components have been identified in each of these layers. Because of the description of the components in the physical form and physical function layer are tightly connected will this section cover both at the same time. Important to emphasize is that the components in these two layers include both resources and functions that ABS provides, but also resources and functionality that the system are dependent on or affected by.

As mentioned in chapter 2, ABS is part of a larger information infrastructure, and are thus connected to other information technology systems. The identified systems that ABS is used together with included the following type of systems: systems that handle documentation and archiving of errands; an administrative system that focused on the financial part of errands; a system that acted as the main information resource for handling errands in ABS. As can be seen is the component named, other systems, connected to three components in the physical function layer, and it enables the information infrastructure necessary to conduct the work with ABS, but also it affects the working conditions of the workers.

The component regarding databases is tightly connected to the one about other systems, but have been separated since it is not clear if the information infrastructure is solely based on the other systems previously described. Basically, the component regarding databases is there to provide additional information that is necessary to handle the auxiliary means errands (e.g. information about the provider of an auxiliary mean).

The component regarding communication tools is one that the workers using ABS is dependent on and affected by. As previously mentioned in chapter 2, workers of ABS are in contact with other specialists when handling errands in ABS, which is partly because they are dependent on for example recommendations written by them. The way workers of ABS contact other specialists vary, but the most commonly used mediums are e-mail, chat (internal software) or telephone. As can be seen in Figure 11, the component communication tools are connected to the working conditions since it affects how work with the systems is carried out, but also connected to the component regarding communication with various people, which affect how a worker handle errands in ABS.

The working environment component in the physical form layer covers a lot of ground, but the main purpose of introducing this component is that the environment where ABS is used affects the system. As previously mentioned, the unit where ABS is used has been under development when the system has been built. The working environment in this case includes both the social and physical reality
where the workers operates and use ABS. As can be seen in Figure 11, the working environment component has been linked to the factors that concern the social (e.g., the communication) and physical aspects of work in ABS. This component partly interleaves with the results presented in section 6.2, and have therefore been addressed here at a higher-level to leave room for a deeper analysis in the upcoming section.

Another component in the physical form layer of the abstraction hierarchy is the one concerning notifications, which is a functionality that the workers that use ABS are dependent on in order to conduct their work. More specifically, the notifications in ABS informs about changes that happen in errands (e.g., that a new document has been uploaded to an act).

Lastly, the component labeled documents of work covers all the documents that inform how the work should be conducted. More specifically, this means that there exist regulatory and other supportive documents that should be followed when handling errands related to auxiliary means. Therefore is this component connected to the working conditions, and the component regarding guidelines for how a worker should handle errands in ABS.

### 6.1.5 Abstraction Decomposition Space

In Figure 12, the components in the abstraction hierarchy (see Figure 11) have been synthesized in form of an abstraction decomposition space. With the abstraction decomposition space it is possible to categorize the identified components in distinct groups, which provides a systematic way of showing distinct constraint groups that exists in the work domain of ABS.
Figure 12: A compromised version of the abstraction decomposition space, see Appendix I for an up-scaled version. The abstraction decomposition space consists of the components presented in the abstraction hierarchy in Figure 11.
6.2 Thematic Analysis

In this section will the result from the thematic analysis be presented. The research question that will be answered through the thematic analysis is the following:

- What perceptions do users of ABS have that can affect the motivations and attitudes toward the system?

The findings from the thematic analysis are arranged in eight separate themes. Important to emphasize is that the order of how the themes are presented is not important.

6.2.1 Experience of how ABS Interoperate with Other Systems

As previously mentioned in the work domain analysis (see section 6.1), ABS is used together with other information technology systems. The workers on the unit had varied experience of how well ABS interoperate with the other systems. The following quotes illustrates how the workers use other information technology systems in their daily work with ABS:

"In our role we must work quite widely, we need to have our heads in many different systems at the same time, it is not enough to enter information in ABS and think that it is enough, many different types of systems are used."

"Mostly we work in ABS, but sometimes we need to go in AIS (another system) if we do not have enough information."

"I think the interplay with other systems works fairly good (laughter), mostly it is enough to be in ABS, most of the things is possible to perform there, expect some controls."

Moreover, it could be derived that some workers that were involved in the development of ABS expressed a positive outlook on how it interoperate with other systems. The following quote illustrates the point of the workers involvement in the development of ABS, and how it might affect the attitude and motivation toward it:

"Since it is we (on the unit) that have been responsible for what type of information from other systems that will be moved over (to ABS), for example certain notes from AIS (another system), we have requested certain features, I think we have been involved and had a chance to say what we want to have, so I think the interplay with other systems is good, and the system (ABS) is also very easy."
6.2.2 Experience of Using ABS

As can be seen in the section about the work domain analysis, the work conducted in ABS is dependent on other systems and many other external and internal resources. For example, it is not possible to work in ABS without having access to information that is available in a system called AIS. Workers expressed several negative experiences of using ABS, and the following quotes captures some of the key insights:

"There exists no barrier (for typing information in ABS), I am used to work in AIS (another systems), where it exists barriers, like if amounts are overridden, or something else is wrong, and ABS is not doing this for us."

"Some things that are formed to help us in our work either bugs or does not simply work, for example, small things like documents not being stored correctly, which most of us does not check, these small things makes you wonder, how does this really work."

"ABS is sometimes difficult to control, I mean, if I write for example a note in ABS, then I am not always sure what have been transfered over to AIS (another system)."

"I can not work in ABS without having access to AIS (another system), and that is because we retrieve information from there"

Moreover, workers expressed that they expected that ABS could help them more in their work. The following quotes illustrates some of the concerns expressed by the workers:

"Sometimes ABS feels more like an Excel-spreadsheet, which is based on me always entering values, it is very few things I get for free."

"It is much manual labor for transferring information (to ABS)."

"It feels like I get very few things from ABS, it is based on me always producing."
6.2.3 Introduction to ABS

The workers at the unit where ABS is used have varied experience, some have been there from the start up of the unit, and others have only worked for a few months. The introduction to ABS have thus varied between workers, but there are some commonalities between how they have been introduced to the system. The following two quotes illustrates how the workers were introduced to ABS:

"We learned the system by standing beside a colleague (different colleagues, not just one), and start up new errands (the first step in the errand process)."

"It existed a routine description for how we should handle the system (ABS), I have learned the system by being in it and start up new errands (the first step of the process)."

The previously outlined quotes were from workers that had only worked for a few months on the unit. Some workers had experience of being on the unit (from the start) when the auxiliary means errands where handled by papers. The following quote illustrates the contrast between different workers and how they have been introduced to ABS:

"When I started at the unit we had paper acts in a file cabinet (for handling the auxiliary means errands), I have been here from the start of the development of ABS, until it has been launched."

6.2.4 Collaboration on the Unit

On the unit where ABS is used there are workers with various background and competencies. However, the auxiliary means errands are not distributed based on the competencies of the workers, instead everyone should be able to handle all the errands by following a similar process. Although, the workers on the unit still need to consult with each other to be able to perform their daily work. The following quote illustrates how one worker perceives the collaboration on the unit:

"The errands are not distributed based on competence, instead it is as when you are a child, you know if you should go to your mother or father to ask different things, you learn who is good at certain things."

From the interviews it could be derived that workers were positive about how the collaboration worked at the unit, despite the lack of routines for everything. The following quotes illustrates how some workers perceive the collaboration aspect of work at the unit where ABS is used:
"I think that it works good, I think that it works good in the team I am in. We are two teams now that should perform the same work, and there it has been a bit shaky, we have not really found the forms for how we should collaborate between the teams yet, and that is when it comes to division of workload, how we help each other, there exists no real routines for it yet."

"The thing is, when you become a team, you get a sort of base, but I ask all people, and that is when I need more information, there is no problem asking, we all come from different backgrounds and have varied expertise."

Moreover, some workers expressed benefits of having a unit where all the auxiliary means errands are handled. However, some workers also expressed potential drawbacks with handling all the auxiliary means errands in one place, this since it could introduce challenges in how to build trust between the different actors involved in the process of handing auxiliary means errands. The following quotes illustrates both benefits of having the unit, but also potential drawbacks and problems it could lead to:

"Here (on the unit) we are allowed to concentrate, we get the chance to be good at something if you put it that way, but sometimes it can be a bit tricky (partly since they are dependent on old routines and external contacts)."

"Seldom are errand black or white, they often require some sort of consultation with specialists or other care organizers at the unit."

"One challenge is to create a good relationship with so many colleagues that are spread out and far away from each other (e.g. the specialists), it it colleagues that work together but never get the chance to meet each other."

6.2.5 Organizational Structure

As previously mentioned, the unit has developed together with ABS. This theme encapsulates aspects related to the organizational structure, and how it might have affected the motivations and attitudes toward ABS.

Since the unit has been under constant development, new structures have been tested in the unit where ABS is used. Workers mentioned that the simultaneous development of the unit and ABS have led to some problems with false expectations. The following quote illustrates a problem with false expectations:

"We have build up structures sometimes, which have not worked because the system (ABS) has not been stable, things have gone wrong, and then you get an
increased need for control because you can not trust the system (ABS), which can be good (i.e. the increased need for control), but it also creates stress.”

Another quote expressed from a worker is shown below, it illustrates the situation with false expectations:

“The system (ABS) has grown simultaneously as the unit, which have meant that one has had visions, ideas and thoughts about how it should be, but later in practice it has shown to be different”.

Moreover, workers mentioned that they collaborate a lot with auxiliary means errands on the unit, and that it is necessary since there is not routines in place for everything yet. The following quote illustrates the point of how workers collaborate with auxiliary means errands, and that they are in need of this collaboration because not all routines are in place:

“We have close contact (on the unit), we talk with each other, and with the person who has done something wrong. The unit is also so new that there is not routines in place for everything yet, we have certain groups on the unit that works to improve this.”

6.2.6 Expectations Obtained from Using Other Systems

The workers using ABS come from many different backgrounds, some come from the private sector or other agencies. Moreover, some workers have worked in Arbetsförmedlingen for many years. This theme covers expectations that workers have obtained from using other information technology systems, which means that the workers previous experience of other systems could have an effect on how ABS is perceived.

Some workers that have experience of working in Arbetsförmedlingen before they started working at the unit (where ABS is used) mentioned that it was easier for them to learn it, this since there are many things in the system that are similar to what they have already been exposed to. The following quote illustrates the point of how previous experience in Arbetsförmedlingen helped some workers familiarize with ABS faster:

“We that have been working at the agency and start working here (at the unit) have a big advantage, we are used to work in AIS (one of the system that is used with ABS), but one also recognize pretty much.”

In contrast, a worker without any experience in Arbetsförmedlingen mentioned that she experienced frustration when learning the system. However, she emphasized that this probably was a natural thing since it was more than just the system to learn (e.g. she needed to learn the organizational
The following quote illustrates the point of experiencing frustration in the beginning of the learning process:

"I think that when I came from 'agency X' that have had their system for a very long time, and that worked well, (when shifting to a new system) I could experience some frustration in the beginning."

### 6.2.7 Awareness of the Limitations on the Development of ABS

This theme covers identified aspects that concern the awareness of the limitations on the development of ABS. From the interviews it was evident that workers knew about some of the limitations regarding developing ABS. For example, some workers expressed that they knew that ABS needs to work together with other units in the agency (see Table 1), and that it is not easy to get changes made when ABS has gone into a phase of software maintenance. The following two quotes illustrates the previously described points:

"I understood that it is not as easy to get changes made when ABS has gone into a phase of software maintenance."

"The system should also work with other units."

### 6.2.8 Social Influences

This theme encapsulates social influences that affect worker’s perception of ABS. More specifically, this theme covers how workers get influenced by each other on the unit, and in that way, affect the motivations and attitudes they have toward ABS.

As previously mentioned, the unit where ABS is used is relatively new and are still under development. Some workers are new and have only worked for a few months, and some other workers have been there from, or even before the introduction of ABS. ABS has therefore changed the way auxiliary means errands are handled, and from the interviews it could be derived that workers with less experience have heard about how errands have been handled before the introduction of ABS. The following quote illustrates the point of how workers perceive the difference with how errands are handled now versus before the introduction of ABS:

"As I have understood, before (the introduction of ABS) they used papers (when handling the auxiliary means errands), and that the introduction of ABS has been very helpful."

From the interviews, it could also be derived that the way workers organize how errands should be treated have changed over time, which is partly because the unit where ABS is used has developed
with the system. The following quote illustrates how one worker perceives how they have worked at the unit with auxiliary means errands, and how it could lead to a stressful situation for some of the workers:

“We have worked a bit impulsively, like ‘oh, now there is a new errand, let’s take a decision’, we are not used to let the errand just be, there is no one telling us to take the decision today if we have received all the resources necessary, the decision could be made tomorrow or next week, but some of us get a bit stressed because of this.”

Lastly, it could be derived that workers hear from others that unexpected things happen in ABS. For example, that unnecessary notes or details get attached to an errand, which causes confusion between the workers and mistrust towards ABS. The following quote illustrates the point of faulty attachments in the process of handling an auxiliary mean errand:

“I hear from colleagues that sometimes things get attached (to an errand) that is not expected to be included, ‘ops were that note included, that was not meant to happen’, when the note was meant toward internal use.”
6.3 Online Questionnaire

In the following section, the results from the online questionnaire sent out to the workers that use ABS will be presented. Important to emphasize is that the questionnaire is used as a complementary method to answer the following research question:

- What perceptions do users of ABS have that can affect the motivations and attitudes toward the system?

The results from the online questionnaire are outlined in form of graphs, with additional information displayed in the text of the figure (see Figures 13-20). The additional information displayed in each figure include the amount of respondents for the particular question, and if the question has a grading scale it will also present the average rating. Important to emphasize is that the questionnaire did not force the respondents to answer all the questions, which is why the amount of respondents may vary between the questions.

Moreover, the questions regarding demographic information can been seen in Appendix H (i.e. the questions 1-2, and 11-14). The purpose of filtering out the questions regarding demographic information is to keep this section focused on the research question.

![Graph showing the perception of ABS support](image)

**Figure 13:** In total 12 respondents. The average rating was 3.41 out of a possible 5.
How well do you experience that ABS interoperate with other IT-systems in Arbetsförmedlingen?

![Bar chart showing the distribution of responses](image)

Figure 14: In total 12 respondents. The average rating was 2.58 out of a possible 5.

How well do you experience that ABS provide you with the information you need to perform your daily work?

![Bar chart showing the distribution of responses](image)

Figure 15: In total 12 respondents. The average rating was 3 out of a possible 5.
How well do you experience that ABS inform about changes that are relevant to your daily work?

Figure 16: In total 12 respondents. The average rating was 2.58 out of a possible 5.

How well do you experience that ABS support interventions on incorrect entries?

Figure 17: In total 12 respondents. The average rating was 2.16 out of a possible 5.
**How do you think your colleagues would rate ABS according to the scale below?**

![Bar chart showing ratings](chart1.png)

*Figure 18*: In total 12 respondents. The average rating was 2.66 out of a possible 5.

**What is your general impression about the IT-systems you have used in Arbetsförmedlingen?**

![Bar chart showing ratings](chart2.png)

*Figure 19*: In total 12 respondents. The average rating was 2.83 out of a possible 5.
Do you have any previous experience of working with systems that are similar/reminds of ABS?

<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>92%</td>
<td>8%</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 20:** In total 12 respondents.

### 6.3.1 Summary of the Online Questionnaire

From the questionnaire, it could be derived that most of the workers that use ABS thinks that the system supports them well in their work (see Figure 13). Moreover, most of the workers of ABS had no strong opinion about how the system interoperates with other systems in Arbetsförmedlingen (see Figure 14). However, a few respondents answered that they thought the integration of ABS with other systems was not good, which could be based in the need for the workers to jump between systems while working with auxiliary means errands (section 6.2.1 presents qualitative findings from how workers perceive the interplay between ABS and other systems).

Regarding the information ABS provide for the workers, most of them are satisfied with the information displayed, expect for a few respondents which expressed that they were not satisfied (see Figure 15). It was expressed in the interviews that there is a lot manual labor when working in ABS, and that the system provides little information for the workers, and that the system is based on the workers to produce things (see section 6.2.2).

How well ABS informs about changes that are relevant to the workers had a wide spread of answers from the respondents see Figure 16 which could have a lot to do with the notifications that are used in ABS to inform about changes in auxiliary means errands. During the field visit the workers mentioned that they had problems with the notifications, which can be the reasons for the rather low score on this question.

The question on how well ABS support interventions on incorrect entries received a low score, namely an average rating of 2.16 out of a possible 5 (see Figure 17). The reason for this, could be as
expressed in the interviews (see section 6.2.2) that there exist no barriers in ABS. Moreover, it was expressed in the interviews that some perceived that ABS was sometimes difficult to control, and that unexpected things happened when working with the auxiliary means errands (see 6.2.2).

Regarding how workers rated how their colleagues would rate ABS has no evident explanation from the qualitative findings (see Figure 18). However, workers expressed that one hear comments from colleagues on the unit, for example, the difference with how errands are handled now and before the introduction of ABS, which is one example of how workers can affect each other on the unit (see section 6.2.8 for more information about social influences).

The question regarding the workers general impression about the IT-systems they have used in Arbetsförmedlingen received an average rating of 2.83 out of a possible 5 (see Figure 19). As previously mentioned, the unit where ABS is used is relatively new and under constant development. The workers at the unit come from different backgrounds and have thus experienced different type of systems in their career. One variable that can affect the general impression is the expectations the workers have obtained from using other systems, which is an identified theme in the thematic analysis, see section 6.2.6.

Lastly, it could be concluded from the questionnaire that most of the workers had no previous experience of systems that are similar or reminds of ABS (see Figure 20).
6.4 Social Organization and Cooperation Analysis

In this section, the results from the social organization and cooperation analysis will be presented. Important to emphasize is that the purpose of performing the social organization and cooperation analysis is not to be exhaustive in the analysis of the social aspects of work with ABS, instead the purpose is to demonstrate how the different methods used in this thesis can be combined to better understand the social aspects of work with ABS. The research question that will be answered in this section is the following:

- What implications can be drawn from the thematic analysis, and the work domain analysis that can help widen the application of the social organization and cooperation layer of the cognitive work analysis framework?

The work domain analysis, and the thematic analysis have been used to identify scenarios that demonstrates social aspects of work with ABS (e.g. where workers need to communicate, or where division of labor between workers is necessary). The scenarios make use of the abstraction decomposition space model, which is one of the outputs from the work domain analysis.

In Figure 21 the abstraction decomposition space is shown. However, the model presented in Figure 21 focuses on the social and organizational aspects of work with ABS. As can be seen in Figure 21 certain components in the abstraction decomposition space have been colored. The colored components illustrates where in the work domain of ABS workers need to communicate or cooperate. Moreover, each colored component have been assigned with a number, which serves the purpose of facilitating the process of explaining the scenarios, and make it clear what relation the scenarios has to the work domain of ABS.
Three scenarios have been identified in the social organization and cooperation analysis, and they are presented below. The components used in the scenarios may partly interleave, and involve both the colored and neutral components in Figure 21. Important to emphasize is that the numbers in Figure 21 does not represent any particular order, instead they are added to facilitate the process of describing the scenarios, and illustrate how they are connected the work domain of ABS.

### 6.4.1 Scenario 1 – Division of Labor Between Workers at the Unit

The focus of this thesis was to study ABS, and the workers that handle auxiliary means errands. During the field visit it showed to be two types of workers that collaborated with the auxiliary means errands, namely the care organizers and program administrators. The following scenario demonstrates where, why and how the distribution of work occurs in the work domain of ABS (the following scenario covers primarily the numbers 2, 3 and 4 in Figure 21).

The process of handling auxiliary means errands is divided up in five stages. Stage 1 – 4 in the

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**Figure 21:** A compromised version of the abstraction decomposition space, see Appendix J for an up-scaled version. The abstraction decomposition space consists of the components presented in the abstraction hierarchy in Figure 11. The colored components represents that a workers either needs to communicate or collaborate with something when working in ABS. The numbers are added to the model to help clarify the scenarios, and make it clear what relation they have to the work domain of ABS.

Three scenarios have been identified in the social organization and cooperation analysis, and they are presented below. The components used in the scenarios may partly interleave, and involve both the colored and neutral components in Figure 21. Important to emphasize is that the numbers in Figure 21 does not represent any particular order, instead they are added to facilitate the process of describing the scenarios, and illustrate how they are connected the work domain of ABS.

### 6.4.1 Scenario 1 – Division of Labor Between Workers at the Unit

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The process of handling auxiliary means errands is divided up in five stages. Stage 1 – 4 in the
process is handled by the care organizers (i.e. the type of worker studied in this thesis), and stage 5 is handled by program administrators. The care organizers are responsible for preparatory work in the handling of auxiliary means errands, and the program administrators are responsible for handling the payment and reviewing the work done by the care organizers.

More specifically, the preparatory work performed by the care organizers involve many different steps: for example, making sure that all documents are handed in, verify the recommendations written by the specialists, and the registration of the auxiliary mean. Moreover, the care organizers are responsible for taking the decision if an applicant are entitled an auxiliary mean or not, which includes that a motivation need to be written based on the laws and regulations.

When the care organizers are done with their preparatory work, previously outlined, they hand over the auxiliary means errands to the program administrators, which are responsible for the final step concerning the payment, and the review of the errand. The program administrators are thus dependent on the care organizers preparatory work in order to perform their job, and the care organizers are dependent on the program administrators for the errand to be completed. Because of this link in the process, collaboration is necessary between the different type of workers. For example, if the program administrator see any problems when reviewing the auxiliary means errand, it needs to be sent back and reviewed by the care organizers once again.

The care organizers and program administrators split the responsibility for the auxiliary means errands, which means that they need to communicate and cooperate with the errands. The way workers on the unit communicate with each other vary, but the most commonly used mediums except verbal communication are telephone, e-mail or an internal chat software.

6.4.2 Scenario 2 – Actors Involved in the Process of Handling Auxiliary Means Errands

As previously mentioned, the care organizers are working both with colleagues internally at the unit, but also externally. The following scenario focus on demonstrating how the care organizers collaborate with external actors (the following scenario cover primarily numbers 4, 5 and 6 in Figure [21]).

When working with auxiliary means errands many different actors can be involved, for example, the applicant applying for the auxiliary means, the specialists responsible for writing the recommendations, the supplier of the auxiliary means, and maybe an involved employer. In other words, the care organizers are responsible for synthesizing all the information from all these different actors in the preparatory phase of handling an auxiliary mean errand. The communication with the external actors is similar to the internal communication previously described where care organizers primarily use e-mail or converse over telephone.

The way of handling auxiliary means errand thus require the care organizers to reach out to the previously described actors, and this way of working requires an interplay and communication with a variety of people. Since many different people can be involved in the process of handling auxiliary means errands, it is important for the care organizers to document their process, which is because an errand can be active over a long period of time. Moreover, since the auxiliary means errands can be active over a long period of time, the responsibility of the errand can change between the care organizers internally, which demands that ABS must provide a way to collaborate internally to
handle the external matter. All these interdependencies between actors and their involvement in the auxiliary means errands process affects the working conditions for the care organizers, and this demands routines to ensure that errands are handled according to the laws and regulations.

6.4.3 Scenario 3 – ABS and the Routines for Handling Auxiliary Means Errands at the Unit

ABS and the unit where the system is used have developed together over time, however, after ABS went into a phase of software maintenance changes to the system is not happening as frequently. Since ABS and the unit are tightly connected, the system affects how the auxiliary means errands can be handled. The following scenario focus on demonstrating how care organizers are affected by the constraints imposed by ABS, but also on what opportunities that can be explored to change the way auxiliary means errands are handled (the scenario cover primarily numbers 1, 2, 5 and 6 in Figure [21]).

One of the main purpose for introducing ABS, and starting up the unit was to make sure that auxiliary means errands are handled based on the same conditions. As previously outlined, ABS provides the workers with a five stages process (divided upon two type of workers) in order to ensure that the errands are treated equally. Because of the rather strict process it provides the workers with directions for how to handle the auxiliary means errands, which has both positive and potential negative consequences. The positive aspect with the five stages process is that the auxiliary means errands are treated in a similar fashion. However, one negative consequence is that ABS constraints the way workers can handle auxiliary means errands at the unit, this since they are forced to follow the outlined procedure imposed by the system, which can make it hard to deviate (if necessary) from the process in for example edge cases.

The workers at the unit must thus adapt to the constraints of ABS, and it can therefore be hard to do radical changes in the process of handling auxiliary means errands. Moreover, since ABS is in a phase of software maintenance, only incremental improvements on the system can be done. However, what can be done by the workers is to change the routines regarding the external aspects of ABS, that is the way for example how the workers at the unit work (e.g. in teams or individually), and it is possible to facilitate other administrative routines such as documentation, distribution and how auxiliary means errands are divided between the workers at the unit.
7 Discussion

The present thesis has adopted methods that generated both qualitative and quantitative data, which were used to better understand various aspects of ABS. More specifically, the qualitative methods adopted were the unstructured interviews, semi-structured interviews, and the observational study. The quantitative data was obtained through an online questionnaire.

As can be seen in Figure 8, the methods adopted influenced each other and helped to shape and refine the material necessary in this thesis. For example, the preparation and pre-study phase of the project facilitated the data gathering phase, this since it helped to steer the focus of the investigation, and also prepared and gave the researcher sufficient knowledge about the domain, which helped to construct for example suitable questions for the semi-structured interviews.

Adopting the methodological approach (as can be seen in Figure 8) has proven to be beneficial in several ways. However, there are also some potential drawbacks with the approach, but for this thesis it has shown to be a predominantly positive approach. Since this thesis were a sort of exploratory investigation, it was hard in the beginning of the project to foresee how it should unfold. Many variables were unknown in the beginning of the project, such as the time and resources available for conducting the observational study. By adopting the methodological approach (presented in Figure 8), it helped to successively build an understanding of the researched domain, and based on the various constraints adopt the various methods and material as necessary.

A potential drawback with adopting the exploratory approach in this thesis is that it could lead to that methodological decisions were based on key informants or resources (e.g. opinions expressed in the unstructured interviews or information obtained in certain organizational documents). Moreover, listening to key informants or resources could lead to aspects being ignored or not prioritized in the research. However, this was thought of in the beginning of the study, and is one of the motivation for adopting several methods to get diverse perspectives, and not base methodological decisions on solely one key informant or resource.

Another important aspect to elaborate on is the emphasis on qualitative methods to generate data in this thesis. The qualitative methods adopted (i.e. the interviews and observations) have an interpretative approach to the data gathered, which means that the researcher create and shape her own understanding of the studied situation, and thus give meaning to the experiences.

One problem that can occur in the qualitative way of conducting research is that the researcher expectancies on the study can bias the research outcome. However, in order to mitigate the risk for the researcher bias to occur, certain methods were combined and result compared with each other. The method adopted in this thesis to increase validity and reduce the chance for researcher bias to occur is called triangulation, which means that the data sources were compared to get a comprehensive picture of the studied situation, and see if the outcome of different methods supported each other or not.

More specifically, three data sources were compared in this thesis, namely the data obtained from the semi-structured interviews, the observational notes, and the results obtained from the online questionnaire. By comparing the different data sources, it was possible to detect both discrepancies and patterns that supported each other. For example, in section 6.3.1 the results from the online questionnaire is compared against the result obtained from the thematic analysis (which is based on the semi-structured interviews and the observational notes).
The analysis phase of this project has spanned from the beginning of the project (starting with the work domain analysis) to the end of it. As can be seen in Figure 8, four analysis methods have been used, namely the work domain analysis, social organization and cooperation analysis, thematic analysis, and the analysis of the online questionnaire. The purpose of having the analysis interleave with other phases, and other analysis methods is that they inform each other, and have helped to successively build an understanding over time, which have ultimately made it possible to answer the research questions.

In the following subsections, insights obtained from answering the research questions will be presented and reflected upon.

7.1 ABS – Work Domain and Contextual Influences

In this section, insights from the following research questions are presented:

- How is the work domain where ABS is used structured?
- What are the contextual influences that affect the usage of ABS?

For a more detailed walkthrough of the results connected to the previously outlined questions, see section 6.1.

The work domain analysis provided a description of the functional structure of the work domain where ABS is used, and this in form of two models, namely the abstraction hierarchy and the abstraction decomposition space (see Figure 11 and 12). With help of the abstraction hierarchy and the abstraction decomposition space it was possible to structure the identified contextual influences which affected ABS (the contextual influences are the components identified in the models). Important to emphasize is that the context definition used in this thesis is defined as an analytical term, where the individual (in this case the care organizer) constructs the context on their own, and therefore is the contextual influences incorporating all the components in the work domain of ABS.

The abstraction hierarchy and abstraction decomposition space (with the identified contextual influences) worked as way for the researcher to systematically build an understanding of ABS. Moreover, the models helped the researcher to interpret the qualitative findings from the thematic analysis by allowing the insights to be mapped against the work domain of ABS.

A work domain analysis is not an end in itself, rather it should be seen as something that can be helpful to drive implications for design as done in this thesis. The results from the work domain analysis are used as a basis for the upcoming subsections.
7.2 Motivations and Attitudes Toward ABS

In this section, insights from the following research question is presented:

- What perceptions do users of ABS have that can affect the motivations and attitudes toward the system?

For a more detailed walkthrough of the results connected to the previously outlined question, see section 6.2 and 6.3.

Qualitative research was necessary to answer the questions related motivations and attitudes toward ABS. More specifically, observations and interviews were performed in order to gather qualitative data. The data were then used in a thematic analysis which identified several themes that could potentially influence the motivations and attitudes of the workers that use ABS.

As previously mentioned, the results from the work domain analysis were used in the interpretation of the findings from the thematic analysis, which allowed the insights to be mapped against the work domain of ABS. This technique proved to be useful in the way it allowed the researcher to switch between a macro and micro perspective in the analysis phase, and be able to see connections between otherwise hidden (or hard to notice) patterns.

The results from the online questionnaire were also helpful to identify patterns within the data set. For example, by following discrepancies in the questionnaire, it was possible to identify potential causes for them in the thematic analysis. In other words, the combination of methods allowed for a better understanding of the data set as a whole, and in that way, it provides the possibility to suggest more insightful and realistic recommendations for design.

7.3 Implications for Widen the Application of the Social Organization and Co-operation Analysis Layer of the Cognitive Work Analysis Framework

In this section, insights from the following research question is presented:

- What implications can be drawn from the thematic analysis, and the work domain analysis that can help widen the application of the social organization and cooperation layer of the cognitive work analysis framework?

For a more detailed walkthrough of the results connected to the previously outlined question, see section 6.4.

The results from the work domain analysis (i.e. abstraction hierarchy and abstraction decomposition space) and the thematic analysis were used together to perform a social organization and cooperation analysis of ABS.
The abstraction hierarchy provided a description of the functional constraints of the work domain where ABS is used, which gave an overview of the various dependencies that exists between the components (i.e. through the means-ends links). The abstraction decomposition space was used to categorize the identified components (from the abstraction hierarchy), and it provided a way to systematically map out the social aspects (e.g. where communication or cooperation is needed) of work in the domain where ABS is used. The thematic analysis is based on the qualitative insights from the observational study and semi-structured interviews, and together with the results from the work domain analysis it provided a way to generate realistic scenarios that demonstrates various social aspects of work in ABS.

The main implication that can be drawn from adopting the various methods outlined, to perform the social organization and cooperation analysis, is that it is a valuable approach in the way it can provide actionable implications for design. For example, it provides a way to anchor the qualitative findings from the thematic analysis, in the formative models (i.e. abstraction hierarchy and abstraction decomposition space) of the cognitive work analysis, which focus on the constraints imposed by the physical and social reality. Therefore, by adopting the particular approach outlined in this thesis it is possible to strengthen recommendations one make based on qualitative findings, which is because they are tightly connected to an analysis of the work domain.
8 Conclusion

This thesis adopted the cognitive work analysis framework as basis to investigate contextual influences, and social aspects of work with a decision support system. Through adopting the cognitive work analysis framework as basis, and combining methods to gather both qualitative and quantitative data, this thesis has shown the value of understanding the functional constraints of the work domain when analyzing social aspects (such as the attitudes and motivations of the workers) of work with a system. In other words, by combining different types of methods (e.g. interviews and observations) with the cognitive analysis framework, this thesis has shown that it is possible to identify more subtle aspects of work that can influence the usage of a system, and with the methodological approach adopted it provided results that were nuanced and connected to the users’ perceived reality.

More specifically, the methodological approach adopted in this thesis provided a way to explore the domain where ABS is used, and provide insights of the various constraints that affect it. Moreover, the social aspects of work could with help of the models provided by the cognitive work analysis framework (e.g. abstraction hierarchy and abstraction decomposition space) anchor the findings in the work domain where ABS is used, and thus provide more realistic descriptions of how for example work is conducted with help of the system.

The purpose of this thesis has been to look beyond the usage of ABS, and focus on studying the various constraints that affect it, and through this better understand how contextual influences and social aspects of work can affect the usage of a system. By looking beyond the usage of ABS, it has provided insights that can help explain various attitudes and motivations that exists toward the system. Moreover, by better understanding the various constraints (may it be social or physical) that affect the usage of ABS, the insights could be used to provide more actionable recommendations to the future development of the system, and thus increase the chance of creating a system that better support the users in their daily activities.

By adopting a more holistic approach when designing systems, and look beyond the system itself, it is possible to identify more subtle factors that can easily be overlooked, but have vast implications for how a system can be used. This thesis has by its exploratory approach provided a way to widen the application of the cognitive work analysis framework, and that is by using the framework as a foundation, and adopt several methods to reveal the contextual influences and social aspects of work that affects ABS.
9 Future Work

An important outcome of the research is not just the answers to the research questions, but also the experiences gained by answering them. Therefore, this chapter will look beyond the initial research questions, and based on the experiences of conducting the research suggest areas that could be interesting to study in the future.

The cognitive work analysis framework was adopted in this thesis to study contextual influences and social aspects of work with ABS. The cognitive work analysis framework has shown to work as a solid foundation when conducting the research. More specifically, the framework provided a way to systematically build an understanding of ABS over time. Moreover, the framework was flexible in the way it allowed to be tailored to the studied situation. For example, methods that generated qualitative and quantitative data were combined, and by adopting a mix of methods with the theoretical framework (i.e. cognitive work analysis) as a basis, it allowed for a unique approach to studying the contextual influences and social aspects of work with ABS.

Based on the experience of conducting the research with the previously outlined approach, a suggestion would be to not be dogmatic when adopting the cognitive work analysis framework, but instead make use of the flexibility the framework provides, and adapt it to the specific research objectives.

Moreover, the methodological approach outlined in this thesis could be used as a basis for researching other domains, and since this thesis focus particularly on contextual influences and social aspects of work, it would be interesting to see future studies that study other social aspects, such as the work culture, conventions, and for example privileges that exists between different type of workers. However, future studies should not limit to the social aspects of work. The cognitive work analysis framework and the methodological approach could be used to expand the study of the contextual influences, and study for example various environmental aspects and their impact on the usage of a system.

Lastly, a suggestion based on the experiences of conducting the research presented in this thesis, would be to conduct studies that focus on the temporal aspect of using a system. For example, this could mean that one investigate how attitudes and motivations toward a system changes over a period of time.
References

This glossary includes the abbreviations and terms that have been marked with italic throughout the thesis. However, each word has only been marked with italic once, and that is at the first occasion that it gets a central significant meaning. The following index include a brief description of each abbreviation and term, and could be used as a reference when reading this thesis.

**ABS** – is the name of the system being scrutinized in this thesis.

**Abstraction hierarchy** – consist of five levels of abstraction (functional purpose, abstract function, generalized function, physical function, physical form), and provides a context-independent description of the work domain.

**Arbetsförmedlingen** – is Sweden’s public employment agency, and they are responsible of providing employment services to both employers and jobseekers.

**Care organizers** – is the name of the job role that users of ABS have, and they are responsible for handling auxiliary means errands.

**Cognitive Work Analysis** – is a framework that was developed to model constraints within a larger work systems (see cognitive and environmental constraints).

**Cognitive constraints** – are constraints that are associated with worker cognitive characteristics.

**Environmental constraints** – are constraints associated with factors that are external to the worker (e.g. the physical reality).

**Hjälpmedel** – is the name of the work unit where the system ABS (auxiliary means errands) is used.

**Participant observation** – is a method that can be used for observing behavior. In a participant observation, the observer is part of the group being studied, which means that the observer participates in the activities performed by the members of the group.

**Social and organizational analysis** – a form of analysis that is concerned with investigating how the technical and social factors in a system can work together in order to enhance the performance.

**Vetenskapsrådet (The Swedish Research Council)** – is a public agency in Sweden that operate under the authority of the ministry of education and research.

**Work domain** – is the whole system being controlled, independent of any variables that might affect that only parts of the system are being used (e.g. the type of worker).

**Work domain analysis** – a form of work analysis that identifies the functional structure of the studied work domain.
Intervjuguide – förstudie

Introduktion
• Gå igenom syftet med studien verbalt (använd informationsbrevet)
• Informera om hur lång tid intervjun beräknas att ta (30–45 minuter)
• Påminn om att det inte finns några fel svar – informationen kommer att hjälpa mig att bättre förstå ABS och den kringliggande arbetssituationen
• Informera om att jag inte kommer att spela in, utan anteckningar kommer att tas löpande under intervjun (på grund av det utforskande syftet)

1. Idag vill jag prata med dig om hur du upplever användandet av ABS och din arbetssituation, men innan vi fördjupar oss vill jag veta lite mer om dig.
   • Vad har du för roll?
   • Hur länge har du arbetat på enheten hjälpmedel?
   • Vad har du för tidigare erfarenhet/bakgrund?

Vanlig arbetsdag med ABS (hjälpmedel)
2. Hur ser en vanlig arbetsdag ut för dig?
3. Hur mycket tid i timmar uppskattar du att du sitter i ABS per dag?
4. Genomför du några andra arbetsuppgifter som inte är kopplat till ABS (hjälpmedelsärenden)?

Kollegor och fysisk arbetsmiljö
5. Hur arbetar ni på enheten hjälpmedel? (t.ex. i team eller individuellt)
6. Hur skulle du beskriva den fysiska arbetsmiljön på enheten du arbetar på?
7. Samarbetar ni något med hjälpmedelsärenden?
8. Vad finns för kompetens på enheten? (t.ex. typer av specialister)
9. Hur är kompetensen fördelad på enheten?

ABS (hjälpmedel)
10. Hur länge har du varit en användare av ABS?
11. Vilka är de vanligaste ärenden som hanteras i ABS?
12. Hur fördelas ärenden i ABS mellan er på enheten idag?
13. Är du beroende av andra för att fatta beslut i ABS? (t.ex. specialister)
14. Vilka verktyg används för att kontakta specialisterna? (telefon, mail, brev)
Case
16. Vilka kriterier går ni efter vid beslutsfattningen?
17. Vilken information baserar ni beslutsmotiveringen på?
18. Hur sammanställs den slutgiltiga beslutsmotiveringen? Görs det löpande under processen?

Edge cases
19. Förekommer det ärenden som ABS inte stödjer fullt ut? Hur jobbar ni i så fall runt det? (använder ni t.ex. andra system)
20. Har ni möjlighet att rådfråga någon enhet? Hur gör ni så fall det?
21. Behöver ni nå ut till någon extern support-enhet vid frågor? Hur gör ni i så fall det?

Centralisering av beslut
22. Hur upplever du att centraliseringen av besluten har påverkat beslutsfattningsprocessen?
23. Ser du några fördelar respektive nackdelar med centraliseringen?
24. Finns det några framtida utmaningar du kan se utifrån din erfarenhet med ABS?

Avslutning
25. Är det något som du skulle vilja tillägga som du tror skulle vara värdefullt i min studie utifrån ditt perspektiv?
26. Vid kompletterande frågor, är det möjligt att kontakta dig via mail?
Informationsbrev – studie om ABS

Bakgrund
Under perioden januari - juni genomförs en studie som är ett samarbete mellan Arbetsförmedlingen och Uppsala universitet. Syftet med studien är att kartlägga användningen av ABS genom att göra en så kallad kognitiv arbetsanalys, där information samlas in med hjälp av observationer och intervjuer. Resultatet i studien kommer att bidra med djupa insikter om ABS och dess användare, vilket kommer att hjälpa till i vidareutvecklingen av systemet.

Studien består av följande tre delar:

• Förstudien – intervjuer kommer att genomföras på distans med syftet att bättre förstå vilka användarna är och hur systemet används idag
• Observationsstudien – deltagarna i studien kommer att observeras under sitt arbete med ABS
• Uppföljningsintervjuer – efter varje observation kommer en intervju att genomföras, vilket syftar till att följa upp det som observerats och bättre förstå motivationer och attityder för användandet

Studiedeltagande och hantering av information
Deltagandet i studien är frivilligt och du kan när som helst avbryta genom att återkalla ditt samtycke. Informationen som samlas in är konfidentiell och kommer enbart att vara tillgänglig till personer som arbetar med studien. Vidare kommer resultatet inte på något sätt att kunna kopplas till dig personligen.

Resultatet av studien kommer att sammanställas i två rapporter. En extern akademisk rapport, samt en intern rapport riktat mot vidareutvecklingen av ABS för Arbetsförmedlingen.

Vid frågor om studien kontakta Zayera Khan via e-post eller telefon.

Vänliga hälsningar,
Zayera Khan och Marcus Henricsson

Kontaktinformation:
Telefon:
E-post:
Intervjuguide – uppföljningsintervju

Introduktion

- Gå igenom syftet med intervjun verbalt
- Informera om hur lång tid intervjun beräknas att ta (30 minuter)
- Påminn om att det inte finns några fel svar – informationen kommer att hjälpa mig att bättre förstå ABS och den kringliggande arbetssituationen
- Informera om att jag kommer att spela in, men även ta anteckningar under intervjun för att underlätta mitt analysarbete

1. Idag vill jag prata med dig om hur du upplever användandet av ABS och dina förväntningar på systemet. Vidare är jag intresserad av att få din syn på hur du upplever att den kringliggande arbetssituationen påverkar användandet av systemet, men innan vi fördjupar oss vill jag veta lite mer om dig.
   - Hur länge har du arbetat på enheten hjälpmedel?
   - Vad har du för tidigare erfarenhet/bakgrund?

Erfarenhet

2. Hur länge har du varit en användare av ABS?
3. Hur har du lärt dig att arbeta i ABS? (t.ex. utbildning, kollegor eller självlärd)

Allmänt om ABS

5. Hur upplever du att ABS sammepelar med andra informationssystem inom myndigheten?
6. Hur upplever du att ABS stödjer dig i ditt dagliga arbete?
7. Ser du några begränsningar utifrån din erfarenhet med systemet idag?
8. Förser ABS dig med den information du förväntar dig? Om inte, vad saknar du och varför?
10. Hur ser du på säkerhet- och tillförlitlighetsaspekterna i ABS?
11. Vad gör du om något problem uppstår i systemet som du inte själv kan lösa?
12. Har du någon gång förlorat information i ditt arbete?
13. Vad innebär ett enhetligt och rättssäkert beslutsstödsystem för dig?
Sociala influenser
1. Hur tycker du samarbetet fungerar med kollegorna på enheten?
2. Vad har ni för organisatorisk struktur på enheten? Vem fattar beslut inom arbetsgruppen?
3. Vad har du för uppfattning om vad dina kollegor tycker om ABS?
4. Vem introducerade dig till ABS? (vilken roll och befattning)

Organisatoriska influenser
5. Vad är viktigt för dig att veta under ett förändringsarbete av ett digitalt verktyg som ABS?
6. Känner du att möjlighet finns att påverka utvecklandet av ABS?
7. Hur tar ni på enheten upp problem och utvecklingsområden med ABS?
8. Vad tror du det finns för fördelar respektive nackdelar med det tillvägagångssättet?
9. Hur väl känner du till begränsningarna vad gäller utvecklandet av ABS?
10. Har du möjlighet att ta del av någon information vad gäller förändringar av de IT-systemen du använder idag? (t.ex. uppdateringar) I så fall hur och var gör du det?

Avslutning
11. Vilka är några insikter du har fått kring användandet av ABS som du tycker kan vara viktigt att tänka på vid utvecklandet av liknande system i framtiden?
12. Är det något som du skulle vilja tillägga som du tror skulle vara värdefullt i min studie utifrån ditt perspektiv?
13. Vid kompletterande frågor, är det möjligt att kontakta dig via mail?

Tack för ditt deltagande i studien!
# Observationsstudie – studieschema

## Onsdag – 22/3

<table>
<thead>
<tr>
<th>Tid</th>
<th>Aktiviteter</th>
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<tbody>
<tr>
<td>10:00 – 10:15</td>
<td>Förberedelser inför observationsstudien</td>
</tr>
<tr>
<td>10:15 – 11:45</td>
<td>Observation 1</td>
</tr>
<tr>
<td>11:45 – 12:30</td>
<td>Lunch</td>
</tr>
<tr>
<td>12:30 – 14:00</td>
<td>Observation 2</td>
</tr>
<tr>
<td>14:00 – 14:15</td>
<td>Sammanställning och förberedelse inför nästa observation</td>
</tr>
<tr>
<td>14:15 – 15:45</td>
<td>Observation 3</td>
</tr>
<tr>
<td>15:45 – 16:00</td>
<td>Sammanställning</td>
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## Torsdag – 23/3

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<tr>
<td>08:00 – 08:15</td>
<td>Förberedelser inför observationsstudien</td>
</tr>
<tr>
<td>08:15 – 09:45</td>
<td>Observation 1</td>
</tr>
<tr>
<td>09:45 – 10:00</td>
<td>Sammanställning och förberedelse inför nästa observation</td>
</tr>
<tr>
<td>10:00 – 11:30</td>
<td>Observation 2</td>
</tr>
<tr>
<td>11:30 – 12:30</td>
<td>Lunch</td>
</tr>
<tr>
<td>12:30 – 14:00</td>
<td>Observation 3</td>
</tr>
<tr>
<td>14:00 – 14:15</td>
<td>Sammanställning och förberedelse inför nästa observation</td>
</tr>
<tr>
<td>14:15 – 15:45</td>
<td>Observation 4</td>
</tr>
<tr>
<td>15:45 – 16:00</td>
<td>Sammanställning</td>
</tr>
</tbody>
</table>
Samtyckesblankett – observationsstudie

Bakgrund
Under perioden januari - juni genomförs en studie som är ett samarbete mellan Arbetsförmedlingen och Uppsala universitet. Syftet med studien är att kartlägga användningen av ABS genom att göra en så kallad kognitiv arbetsanalys, där information samlas in med hjälp av observationer och intervjuer. Resultatet i studien kommer att bidra med djupa insikter om ABS och dess användare, vilket kommer att hjälpa till i vidareutvecklingen av systemet.


Studiedeltagande och hantering av information
Deltagandet i studien är frivilligt och du kan när som helst avbryta genom att återkalla ditt samtycke. Informationen som samlas in är konfidentiell och kommer enbart att vara tillgänglig till personer som arbetar med studien. Vidare kommer resultatet inte på något sätt att kunna kopplas till dig personligen.

Resultatet av projekterbaket kommer att sammanställas i två rapporter. En extern akademisk rapport, samt en intern rapport riktad mot vidareutvecklingen av systemet för Arbetsförmedlingen.

Vänligen signera nedan att du har tagit del av informationen som presenteras i dokumentet, samt att du har fått möjlighet att ställa kompletterande frågor om studien.

__________________________  __________________________
Datum  Ort

__________________________  __________________________
Underskrift  Namnförtydligande
Genomgång av ABS

Generell information
Varje session kommer att börja med att vi tillsammans går igenom och diskuterar användandet av ABS, där jag främst är intresserad av att veta vilka resurser som finns tillgängliga och hur dessa är kopplade till funktionerna som finns i systemet idag.

Efter att vi har pratat om ABS vill jag vara med och observera användandet av systemet, där användaren genomför några utvalda uppgifter i systemet.

Frågor och aspekter att gå igenom
1. Vilka resurser finns tillgängliga i ABS och vad bidrar dom med? (resurser täcker allt från virtuella till fysiska ting, samt personer som användaren är beroende av i beslutsprocessen)

2. Vilka funktioner finns i ABS?
   - Vilka är dom huvudsakliga uppgifterna som systemet måste klara av?
   - Vilka funktioner i systemet används mest frekvent?
   - Vilka funktioner används vid sällsynta tillfällen?
   - Vilka uppgifter i ABS kräver hjälp av fysiska resurser? (t.ex. telefon, arkivering och dokumentation)

3. Vad anser du är det huvudsakliga syftet med ABS?

4. På vilket sätt kan man mäta om ABS uppfyller sitt huvudsakliga syfte vi pratade om? (t.ex. tid, kvalité eller genomströmning av ärenden)
   - Vet du vad man tittar på när man utvärderar ärenden? Vem är det som genomför kvalitékontroller?
   - Används några kriterier idag vid utvärderingen? (t.ex. policies och regler)
Appendix G – Abstraction hierarchy

Provide the workers with a decision support system that is uniformed and legally secure.

Minimize the risk that errands are handled differently.

Ensure that errands are handled according to laws and regulations.

Minimize the lead time in an errand.

Identify new possible ways of working with errands.

Ensure that there exists supportive material in the process of handling errands.

Identify new errands.

Registration and payment of an auxiliary mean.

Process of handling errands (five stages):
- Documenting decisions in the errand process.
- History of errands.
- Identify changes that occur in active errands.

Routines and ways of working with errands.

Inform about changes in an errand.

Personal information about the applicant.

Information about the auxiliary mean and the beneficiary.

Communicate with the applicants, colleagues, employers and specialists.

Working conditions.

Documents of work.

Functional Purpose
Reason the system exists.

Abstract Function
Assesses overall purpose.

Generalized Function
Functions performed by the system.

Physical Function
What the physical objects and available resources are allowed to perform.

Physical Form
Physical objects and available resources within the system.

Notifications
Other systems
Databases
Communication tools
Working environment
Working conditions
Information about the auxiliary mean and the beneficiary
Registration and payment of an auxiliary mean
Identify new errands
Routines and ways of working with errands
Identify changes that occur in active errands
Inform about changes in an errand
Personal information about the applicant
Information about the auxiliary mean and the beneficiary
Communicating with the applicants, colleagues, employers and specialists
Working conditions
Documents of work
Functional Purpose
Reason the system exists.

Abstract Function
Assesses overall purpose.

Generalized Function
Functions performed by the system.

Physical Function
What the physical objects and available resources are allowed to perform.

Physical Form
Physical objects and available resources within the system.
Appendix H – Questionnaire

Question 1

How long have you been working at Arbetsförmedlingen?

- 0 – 4 years: 45%
- 5 – 9 years: 18%
- 10 – 14 years: 9%
- 15 – 20 years: 9%
- 21 – 25 years: 18%

In total 11 respondents.

Question 2

Usage of ABS (in months)

- 0 – 5 months: 33%
- 5 – 9 months: 17%
- 10 – 15 months: 50%

In total 10 respondents.
Appendix H – Questionnaire

Question 11

Which of the systems are you using in your daily work?

- ABS: 12
- AIS: 12
- Diariet: 12
- Raindance: 5
- ELIN: 6
- Other systems: 1

In total 12 respondents.

Question 12

Gender

- Male: 27%
- Female: 73%
- Other: 0%

In total 11 respondents.
Appendix H – Questionnaire

Question 13

![Age distribution chart]

In total 10 respondents.

Question 14

![Highest education distribution chart]

In total 11 respondents.
<table>
<thead>
<tr>
<th>Decomposition</th>
<th>System</th>
<th>Sub-system</th>
<th>Functional object</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstraction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Functional Purpose</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional Purpose</td>
<td>Provide the workers with a decision support system that is uniformed and legally secure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abstract Function</td>
<td>Minimize the risk that errands are handled differently</td>
<td>Ensure that errands are handled according to laws and regulations</td>
<td>Minimize the lead time in an errand</td>
<td></td>
</tr>
<tr>
<td>Generalized Function</td>
<td>Identify new possible ways of working with errands</td>
<td>Ensure that there exists supportive material in the process of handling errands</td>
<td>Identify new possible ways of working with errands</td>
<td></td>
</tr>
<tr>
<td>Physical Function</td>
<td>Identify new errands</td>
<td>Registration and payment of an auxiliary mean</td>
<td>Process of handling errands (five stages)</td>
<td></td>
</tr>
<tr>
<td>Physical Form</td>
<td>Documenting decisions in the errand process</td>
<td>History of errands</td>
<td>Identify changes that occur in active errands</td>
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</tr>
<tr>
<td></td>
<td>Routines and ways of working with errands</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Physical Function**

- Inform about changes in an errand
- Communicate with the applicants, colleagues, employers and specialists
- Working conditions
- Provide the worker with guidelines for how errands should be handled

**Physical Form**

- Personal information about the applicant
- Information about the auxiliary mean and the beneficiary

- Notifications
- Communication tools
- Working environment
- Documents of work

- Databases
- Other systems
## Appendix J – Abstraction decomposition space

<table>
<thead>
<tr>
<th>Abstraction</th>
<th>System</th>
<th>Sub-system</th>
<th>Functional object</th>
<th>Other</th>
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</thead>
<tbody>
<tr>
<td><strong>Functional Purpose</strong></td>
<td>Provide the workers with a decision support system that is uniformed and legally secure</td>
<td>Minimize the risk that errands are handled differently</td>
<td>Ensure that errands are handled according to laws and regulations</td>
<td>Minimize the lead time in an errand</td>
</tr>
<tr>
<td><strong>Abstract Function</strong></td>
<td>Ensure that there exists supportive material in the process of handling errands</td>
<td>Identify new possible ways of working with errands</td>
<td>Identify changes that occur in active errands</td>
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<tr>
<td><strong>Generalized Function</strong></td>
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<tr>
<td></td>
<td>Documenting decisions in the errand process</td>
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<td>Identify changes that occur in active errands</td>
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<td></td>
<td>Routines and ways of working with errands</td>
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<tr>
<td><strong>Physical Function</strong></td>
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<td>Working conditions</td>
<td>Provide the worker with guidelines for how errands should be handled</td>
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<td>Personal information about the applicant</td>
<td>Information about the auxiliary mean and the beneficiary</td>
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<td>Notifications</td>
<td>Communication tools</td>
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<td>Databases</td>
<td>Other systems</td>
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<tr>
<td><strong>Physical Form</strong></td>
<td></td>
<td></td>
<td>Working environment</td>
<td>Documents of work</td>
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