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Scoping design situations in Business Intelligence

How design situations are influenced by self-service

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ABSTRACT

Business Intelligence (BI) users have started to demand more flexible products, which has forced the BI field to move towards self-service. Flexible products do however imply new challenges for designers, in order to facilitate such design. Thus, BI designers must be capable of understanding organizations better and what decision makers need, and thereafter frame appropriate solutions for them. The purpose of our research is thus to empirically show how BI requirements have evolved towards the usage of new capabilities that self-service BI systems provide. Further, our thesis aims to provide a better understanding of organizations' and users' need for designers. To achieve the goal, we have adapted the existing PACT (People, Activity, Context, Technology) framework for Business Intelligence. In addition, contingency variables have been used to investigate the PACT elements. By using our adapted PACT framework, we conducted interviews which provided experience about perceived requirements by suppliers and a vendor, and thus the design situations of BI systems. We have found that self-service BI should be seen as a complement rather than a substitute to traditional BI. This implies that designers have to consider a more complex design situation. The research complements existing research on what designers need to know, in order to fulfill requirements which have evolved for BI systems over time. This is of significance as designers have struggled to understand BI requirements for a long time.

Key-words: *Business Intelligence, self-service, PACT, Persona, decision making, design situations, Human-centered design*

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1. Introduction

In this introductory chapter we provide a background of how the BI field has evolved. We then present a problem in the BI field and thus formulate our research question. Also, this chapter includes our purpose and delimitation of the study.

1.1 Background

Historically seen, the idea of data analysis is to make sense of what has happened in the business. According to Davenport (2014) who is one of the major researchers within the BI field, the notion of data analysis started to be used in the 1950s. But as technology and the focus of decision making has changed over time, different terminologies (e.g. Decision support, Executive support) have been used, with slightly different meanings. One of the more recent terms has been Business Intelligence (BI) which evolved in the 1990s (Davenport, 2014), and the term is still with us today. BI has in recent years been regarded as the top-priority for Chief Information Officers (CIOs), and most top managers today agree that BI is vital to companies' competitiveness (Jenster & Søilen, 2009; Porter & Millar, 1985). The meaning of BI can be described as "*Tools to support data-driven decisions, with emphasis on reporting*" (Davenport, 2014, p. 10). Whilst we further discuss BI we refer to this meaning. Davenport (2006, 2014) has however articulated that today's data analysis require more skills in order to support decision making.

Meanwhile, users have started to demand more flexible products (Imhoff, 2005), which has resulted in a new approach of delivering BI, namely the term self-service BI (Imhoff & White, 2011). In self-service BI, users are supposed to be empowered and to serve themselves better with less reliance on IT departments (Imhoff & White, 2011). Hosack et al. (2012) have thus stated that there is an increased need to understand how the human-technical interaction changes, in order to support decisions with rapidly changing interfaces that self-service results in. In line with this, researchers within the BI field (e.g. Eckerson, 2011; Imhoff & White, 2011) have highlighted the goals and benefits of using self-service BI. However, Jenster and Søilen (2009) have argued that too much research has focused on *why* companies should engage in BI, which also seems to be true for self-service BI. Despite the valuable contribution made by some researchers (e.g. Imhoff & White, 2011) in highlighting the

benefits and objectives of self-service BI, we motivate our research differently, as we agree with Jenster and Søilen (2009), who have argued that research should focus more on *how* organizations can engage in BI.

1.2 Problem and motivation for research

Imhoff (2005) has previously highlighted that the need for flexibility in BI involves increased challenges for designers, who must understand specific user requirements. However, according to Cooper et al. (2007) the term 'user' is ambiguous, as the designer might have their own interpretation of who the user is, and what the user needs. This goes in line with Imhoff (2005), who states that BI designers have always struggled to understand what customers want and need. Jenster and Søilen (2009) have also presented examples of this challenge within the BI field with their experience from firms in Nordic countries. The firms did not know which user needed what information; the firms did not know which information had been produced for users; and the firms did not know whether or not there was a demand or need for the delivered information. Similarly, Keen (1980, p. 15) has also stated that *"Users do not know what they want and the designers do not understand what they need"*. Nicholas (2000) has found the same problem, and has pointed out that users cannot even anticipate what the needs will be. Meanwhile, as the volume of information in organizations becomes larger, with more variants and increased velocity, the challenge of distinguishing between 'want' and 'need' has become an even greater challenge (O'Leary, 2013). In line with this, BI designers must be capable of understanding organizations better and needs among their users, and thereafter frame appropriate solutions for the users (Chen et al., 2012). This is the focus of our research problem.

However, as mentioned by Marakas (2003) both users and organizations are very different, and the requirements of decision support is thus subject to change. In line with this, the information needed to support decision making can been collected either among individuals or organizations as a whole (Kirschkamp, 2008). Kirschkamp (2008) has consequently identified a problem that most of the studies focused on individual behavior. Vuori (2006) suggests that rather than using methods for understanding individual BI requirements, it would also be useful to collect BI requirements based on an organizational context.

Based on the problem and motivation for research, our research question is:

RQ: How does self-service influence design situations in BI systems?

1.3 Purpose

Due to the fact that self-service BI has become a viable concept, given that it is requested by more and more BI users, this change implies that designers need to understand organizations and users better, in order to facilitate self-service BI. By adapting the PACT framework for BI, we aim to provide an explanation which can be used in practice by designers, to design appropriate solutions for BI users. The purpose of our research is thus to empirically show how BI requirements have evolved towards the usage of new capabilities that self-service BI systems provide. Our research also shows how designers' and IT departments' work might be influenced by self-service, as it is commonly known that changes in technology might affect organizations.

Also, our study will explain the concerns that organizations face as the approach to designing BI systems shift, and we will try to illustrate that facilitating self-service in different organizations is viable.

1.4 Delimitations

The thesis will focus on requirements and organizational necessities rather than technical challenges. Our aim is not to provide a comparison among various products in the market, but to instead focus on self-service in general terms.

2. PACT framework for Business Intelligence

In the first part (chapter 2.1) of our literature review, we present a brief introduction to our adapted PACT framework. In the next part (chapter 2.2), we explain how People influence the requirements of BI systems. We then (chapter 2.3) explain Activities that decision makers are intended to focus on and which requirements it implies. In chapter 2.4, we explain in which social and organizational context that decisions can be taken. Finally (in chapter 2.5), we explain design requirements that self-service as a Technology enforces. We then (chapter 2.6) summarize the theoretical requirements based on our PACT framework for BI systems, which is later used for coding empirical findings (chapter 3.8).

2.1 Briefing our adapted PACT framework

In this part, we have written a literature review, where we aim to provide theoretical knowledge for our research. The outline of our literature review is based on the PACT framework by Benyon (2013). We provide a review of the four PACT elements (i.e. People, Activities, Context and Technology) and adapt it based on domain knowledge within the BI field. The original idea of using PACT framework is to collect requirements from an organization before designing interactive products (Benyon, 2013). By design, Benyon (2013) explains that it is a creative process for creating new interactive products, where designers ought to produce various layouts, color schemes, graphics, and a design for the overall structure. However, in order to guide the design process, designers should create Personas and scenarios by undertaking a PACT analysis. PACT framework can be used to understand the current situation within organizations, to scope potential problems, improvements and to provide the right thinking for designers on design situations for interactive systems. PACT framework is thus useful for both analysis and design phases of interactive systems (Benyon, 2013). As we focus on the analysis and design phase, we found that PACT framework is appropriate as it is primarily useful for these two phases. The use of PACT framework elements can later be used by designers to distinguish *Personas,* and to create both *scenarios* and *user stories* (Benyon, 2013). Scenarios and user stories do however require certain business cases to materialize. However, as we focus on Business Intelligence, we have

selected theories for the elements in the PACT framework based on corresponding BI literature.

As we have aimed to explore how self-service operates and influences the analysis and design of BI systems, a contingency approach appeared suitable. Donaldson (2001) has pointed out that contingency theory has provided a coherent paradigm for the analysis throughout the years. Weill and Olson (1989) have also pointed out that contingency is useful in order to understand how Information Systems (IS) operate under varying conditions. The contingency approach confirms that there is "*no single best way*". We therefore believe that a consideration on contingency will provide our study with an objective focus on the analysis and design phase of BI systems. By investigating the PACT elements with a contingency approach, we will try to explain the design situation for self-service BI. Our selected contingency variables (i.e. *strategy*, *individual*, *environment*, *task*, *size*, *structure*, and *technology*) will be explained in correspondence to PACT elements throughout the literature review.

2.2 People

By people, we mean decision makers who are users of a BI system. Benyon (2013) suggests that the people who will use a system should be presented as Personas, an idea first introduced by Cooper et al. (2007). Persona has become a widely used method for designers to create user profiles. Persona should have a name, a background, behavior, attitudes, aptitudes and motivation (Cooper et al., 2007). Similarly, Benyon (2013) has more simply listed that people might have different *goals* (1), and *needs* (2) when it comes to the usage of technologies. Further, social differences may well exist among people which affect their *motivation* (3) to use technologies. These three aspects (i.e. goals, needs and motivation) are used to structure the first part of People from a BI perspective. Benyon (2013) also notes that People have different *abilities* and *skills* to use technologies, which can further be described as *mental models*, that make it possible to categorize users into different *users types*. The term 'people' refers to users of a product. We have chosen to combine these various characteristics of People, and present them as three subchapters below.

2.2.1 Goals, needs and motivations

When building a BI system, designers have to understand the BI requirements, i.e. the information that decision makers want, demand, need, and use in their jobs (Herring, 1988; Nicholas, 2000; Vuori, 2006). Nicholas (2000) is a leading figure in researchs on information needs, and believes that it is impossible to understand information needs if you ask the users themselves, as users do not know what their needs are, and users cannot anticipate what their needs will be.

In other words, Nicholas (2000) criticizes the so called User Centered Design approach. Nicholas (2000) has further suggested that information needs are better collected by identifying people in terms of their *Job, Country, Personality, Awareness, Gender, Age, Time, Access, Resources* and *Overload*. We will not describe all these factors at length, but it is however possible to recognize that people should be regarded as humans rather than users. This design philosophy goes under the notion of a Human Centered Design, and is emphasized by many researchers, e.g. Benyon (2013), Cooper et al. (2007) and Nicholas (2000). In order to define the motivations among people, Cooper et al. (2007) have found that motivations can be explained according to experience goals, end goals and life goals. These categories were introduced by Norman (2004). Further, Cooper et al. (2007) have developed the definition: *experience goals* refer to the feeling users want to experience during the interaction with a product; *end goals* refer to the user's motivations to accomplish a task; and *life goals* refer to people's long-term desires and motivations. Moreover, Cooper et al. (2007) have pointed out that end goals is the most important factor when designing a product for people. We have thus interpreted that end goals and motivation are strongly related to each other.

Cooper et al. (2007) suggest that designers can identify different Personas by observations and interviews with users and managers. But designers might also be required to collect data from stakeholders, market research data, market segmentation models and literature reviews. A similar method to collect information needs is also described by Nicholas (2000).

Researchers, e.g. Marakas (2003), further suggest that decision makers should be classified as either individuals, multiples, groups, teams or organizations. We do, however, find this categorization somewhat exhausting and emphasize that people should primarily be regarded as humans and as individuals. However, more importantly, Marakas (2003) has pointed out that the focus of decision making differs depending on which level where decisions are taken

in an organization. The need of BI should thus be defined based on the roles that people have within organizations, and must be taken into consideration when designing a system for decision support. This is also emphasized by Jenster and Søilen (2009), and also goes in line with the factor *Job* factor as identified by Nicholas (2000). We do however mean that decision making is mainly the end goal, and thus that the end goal differs depending on People's role. Further, in decision making, the roles within an organization can be classified at either a Strategic, Tactical or Operational level, as presented in Figure 2-1 below.

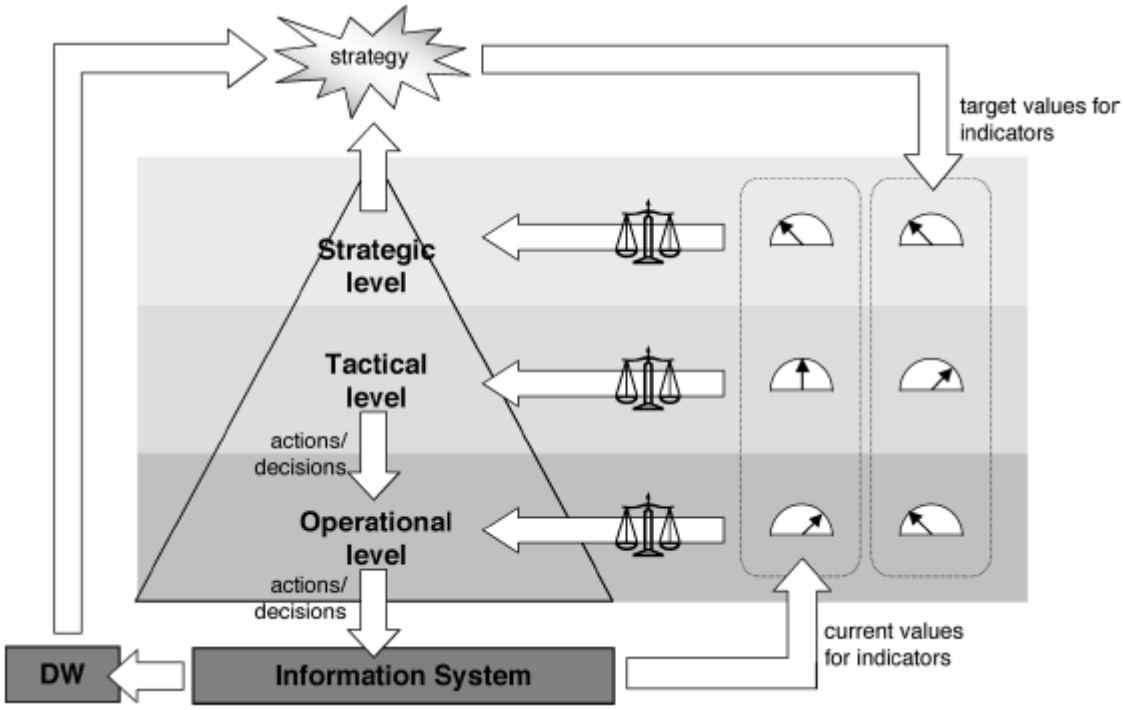

Figure 2-1 Different goals depending on people's level (Golfarelli et al., 2004, p. 2)

As can be recognized in Figure 2-1 above, the end goals and thus the decision making differs depending on people's roles and at which organizational level they act. Golfarelli et al. (2004) further articulate that goals at different levels affect which data has to be gathered. People at Tactical and Operational levels need *current values* as indicators in a BI system, while people at a Strategic level need *target values* as indicators based on business strategy (Golfarelli et al., 2004). We also found that Mintzberg et al. (1976), Marakas (2003) and Jenster and Søilen (2009) have provided similar explanations. As pointed out by Marakas (2003), there may exist a problem for which designers have to consider, namely that the diversity of skills differ and must be found at every organizational level. A further implication is that people's roles will vary, implying that users have styles in decision making (Marakas, 2003). This brings us to the next chapter regarding people's abilities and skills.

2.2.2 Abilities and skills

Using technology might require specific skills and knowledge, and Benyon (2013) notes that specific skills might be necessary in order to use some products. Abilities can be related to people's likeliness to get answers related to their questions by using a product, which require technical skills. Further, Benyon (2013) explains that some people can figure out how to use a product very rapidly, while it might take longer for others to use the same product. Needless to say, people often have different educations, backgrounds and capabilities which influence learning, which Cooper et al. (2007) define as personal aptitudes. Even if it might appear somewhat absurd, in relation to various aptitudes, Marakas (2003) has stated that designers sometimes promote people's features in a product depending on the level of skill and ability the people have. In other words, if people are regarded as incompetent, a designer might adapt the design accordingly, and vice versa. This view is supported by Benyon (2013) who explains that mental models and social differences amongst users affect people's ability to use technology. For example, figures and tables are sometimes easier for users to remember or relate to, rather than previous analytical results (Benyon, 2013).

The required analytical skills are thus forever changing, because of the increased volumes of data, of higher velocity and variety. Davenport (2014) has also pointed out that activities in today's decision making require more advanced analytical skills than in the past. Unsurprisingly, as identified by Davenport (2006), organizations should not expect people to have all the necessary skills for every task, even if some people possess a very diverse skills set. Davenport (2014) suggests that people's skills can be categorized based on people's roles, as people can be either business experts, trusted advisors, quantitative analysts, scientists or even hackers for example. Among these roles, skills such data analysis, business knowledge and the ability to frame decisions can be found.

In line with the motivations as we described earlier, Marakas (1995) has found that users must be allowed to conceptualize a hypothesis and then use a system to verify its truth, in order to stay motivated. Marakas (1995) further points out that such motivation requires two essential skills to be promoted among people: to formulate hypothesis, and to verify hypothesis by using a system. A similar description of skills has also been put forward by Davenport (2014). For the designer then, it is thus necessary to design a system which supports people to use their skills for decision making activities. A further description of activities can be read in chapter 2.3.

The principle of allowing and empowering business people to conduct more by themselves by using self-service BI products seems as a good idea; Jenster and Søilen (2009) claim that users in distinct business functions have greater knowledge of the business.

2.2.3 Mental models and user types

As mentioned above, people have different styles, abilities, dreams and motivations (Benyon, 2013; Cooper et al., 2007). These differences among users creates a significant problem when it comes to designing a common product. The relation between design model and user differences has been widely investigated by Cooper et al. (2007) and the theory of personas has been used as a solution. Cooper et al. (2007) suggest that users should be classified as *elastic* or *real users*. Cooper et al. (2007) mean that users can be classified in the way based on how often they use a product. *Elastic users* are those who are first-time users or power users, rarely using the product. Meanwhile *real users* are those who use a product more regularly. Moreover, Cooper et al. (2007) point out that these user types should be differentiated further, and that designers primarily should meet the needs of *real users*.

In addition, Nicholas (2000) has stated that user roles and job titles are thus important factors to distinguish user types. Davenport (2014) has emphasized that People can be distinguished based on their roles and expertise, e.g. if they are a *hacker, scientist, trusted adviser, quantitative analyst* or *business expert*. Similarly, Imhoff and White (2011) state that user types can be defined as *information producers* (i.e. power business users), *information consumers, information collaborators,* and *BI/Data warehouse builders*. For the above job roles and user types, it is however impossible to distinguish whether they are *elastic* or *real users*. We thereby emphasize that designers should consider better descriptions of their users by using a Human Centered Design approach (e.g. Persona), when designing BI systems, but emphasis that designers should collect requirements from r*eal users*.

Jenster and Søilen (2009) have pointed out that the distinction of user types is crucial and must be defined correctly when it comes to delivering BI products. Moreover, Cooper et al. (2007) and Young (2008) argue that user mental models can be used to describe the different mentalities and motivations held by people. The research regarding mental models has primarily been conducted by Norman (2002) for many years, as it is important in order to fully understand what people want to get done. For instance, mental models can be useful to understand that some people may need to know all details about the information inside a

system in order to use it, while other people may only require general information on the system.

Similar to user mental models, the significance of personas in Business Intelligence might also be considered, as designing for users is always a complex and exhausting task since people have different demands and requests. Cooper et al. (2007, p. 77) stress that the best way to provide software for each user is to "*design for specific types of individuals with specific needs"*, adding that the most important user group must be prioritized as the main target in order to provide an acceptable product.

As Cooper et al. (2007) identify user mental models and personas, Benyon (2013) likewise states that distinguishing personas is an important part of the design process for interactive systems. According to Benyon (2013), it is thus challenging to design products for a homogeneous group of people, since each person has a different style, conversation, dream and motivation. We should thus not be biased about Persona, as there will always be exceptions where people have needs which are not included among the generalized user types. Finding the personas is however an important part of the design process for interactive systems (Benyon, 2013). The significance of personas in Business Intelligence could thus be considered as a powerful tool, as BI designers have always struggled to understand users' demands and needs.

2.2.4 Contingency among decision makers

Weill and Olson (1989) suggest that information can be incorporated as assets and opportunities into a firm's strategic planning by computerizing information in business functions. They refer to Porter and Millar (1985) who further suggest that information and thus information technology transforms how organizations operate, and that information is of strategic significance for organizations to remain competitive. More recently, Davenport (2006, 2014) has argued that firms compete by having the right people to make data analysis and decision making. This complies Benyon (2013) who notes that people should be distinguished in terms of goals, needs, motivation, abilities, skills, mental models and thus user types. The People element seems to depend on these characteristics, and it appears that there is no single user type identifiable to use self-service BI systems. Our literature review evidently shows that there exists a range of potential users for self-service BI and we assume that this implies a challenge for designers. In line with the description of the variable *strategy*,

we will use this contingency variable in our research framework to validate users' goals and needs. Also, we use the individual variable to investigate the motivation (or rather intention) among various user types. Our proposition is that a contingency allowance should exist, i.e. that there is no single most appropriate user, and thus that the design situation for should include several user types, based on several characteristics (see Table 2-1).

Table 2-1 Contingency in People

Items within PACT Framework	**Contingency variables**
People: Goals, needs and motivations Abilities and skills Mental models and user types	**Strategy:** Information assets and opportunities that can be incorporated by firm's people **Individual** Decision making responsibility, control

2.3 Activities

Benyon (2013) explains that activities can be described in three aspects; (1) the *complexity* of an activity, which we relate to the complexity of decision making (2) *temporal aspects* which is related to the regularity that activities have to be solved, i.e. decision speed, and (3) *cooperation* among people which is related to a user's the need for support.

2.3.1 Decision complexity

The complexity of a task or activity can be determined by its requirement of knowledge and skill (Wood, 1986). In short, decision making can be described as an activity which consists of several phases (Boland, 2008; Marakas, 2003; Mintzberg et al., 1976), where humans have to evaluate alternative choices among actions and then make a choice. The decision making becomes more complex if there is an increased variety of information available, as it increases the difficulty in terms of information gathering and information use (Byström & Järvelin, 1995; Sprague, 1980).

In the decision making process, the most important determinant leading to complexity lies with the amount of decision alternatives available (Payne, 1976): an increase in the amount of

alternatives causes a higher degree of complexity. However, Simon (1993) has described that decisions as either *rational*, *irrational* or *nonrational*. By rational, Simon (1993) describes decisions as an action which leads to expected goals; irrational whereby decisions are made poorly which suite the goals; and finally nonrational whereby decisions have no goals. In line with the description of rational decision making by Simon (1996), the development of alternatives from which to choose and the analysis and selection among these alternatives is a rational process of the human brain. Based on Simon's model of problem–solving, most scholars therefore agree that the decision making process consists of three phases, (1) identification of the decision to be made, (2) development of alternatives from which to choose, and (3) the analysis and selection among alternatives (Griffith et al., 2008; Marakas, 2003).

The first phase is according to Marakas (2003) the phase of *Intelligence*, where decision makers are "on the lookout" for information or knowledge, which can be gathered and used for a decision. Due to the fact that the meaning of BI is to support decision making, our interpretation is that BI primarily aims to support decisions in this first phase of the decision process, i.e. to provide *Intelligence gathering* by enabling decision makers to gather information for later use to support their decisions. Moreover, as BI systems nowadays involve increased information gathering on competitors in the market, technical competences, possible partners, and organizational or individual influencers that define and limit the business activities in order to keep the organization business competitive, the amount of alternatives for decision makers increases (Jenster & Søilen, 2009), and with the complexity of supporting decisions (Byström & Järvelin, 1995; Sprague, 1980).

Furthermore, Marakas (2003) has stated that the Intelligence phase can be either periodic or continuous. What Marakas (1995) means, is that the information can be either prepared in beforehand for *expository*, or for *discovery*. Similarly, Meyer et al. (2010) have also stressed that exploratory usage can lead to discoveries. However, interestingly they have also found that people can use exploration without any purpose or goal, and still find valuable discoveries. Both Meyer et al. (2010) and Marakas (1995) have however stated that discovery requires that decision makers are able to validate the hypotheses they create, but problem solving through discovery can be a better way of making decisions. Interestingly, Marakas (2003) further describes discovery by the following:

"*The idea is that the user is in control of the process and can let curiosity and personal interest drive the search of the problem space rather than be inhibited by rules governing the "rightness" or*

"wrongness" of answers and intermediate outcomes. Rather than being limited to developing an understanding of the problem from the output of- a set of normative analytical models, the discovery learner develops a much richer, more generalizable set of problem-solving skills and understanding of the problem domain." (Marakas, 1995, p. 72)

Marakas (1995) argues, that one of the main differences between expository and discovery, is that decision makers can perceive discovery as a kind of freedom, rather than the limited or restricted expository approach. More recently, Davenport (2014) advocates a usage towards a more continuous approach, where discovery and experimentation with data is becoming more important. It is however not only about discovery, but also recognizing the great value still derived from the traditional use of reports from production processes and internal systems for decision making (Davenport, 2014).

2.3.2 Temporal aspects

Benyon (2013) argues that the design of products is based on infrequent activities, for instance, the design work might be conducted once a week or once a year. It is therefore worthwhile to know how often decision makers use BI tools during the decision making process and how often they need to make decisions. These infrequent activities affect decision makers' abilities to learn the BI dashboards. However, time pressure is also a significant factor when it comes to designing a product as users may not have sufficient amount of time to explore the functions (Endsley, 2001; Mintzberg et al., 1976). Benyon (2013) also suggests designers should be aware of this dynamic factor.

In the context of temporal aspects, response time is also another critical factor for decision making (Benyon, 2013). Responses from the systems are important for the users, since time for decision making is significant and the users should take a decision. In line with the objectives and goals that People might have depending on their job, Davenport (2014) has pointed out that the objective is either to make better decisions or to make faster decisions. Davenport (2014) has thus assumed that it is not possible to achieve both at the same time. Our interpretation is however that faster decisions can result in better decisions.

2.3.3 Cooperation

Another significant factor influencing BI tools is cooperation: can the activity be conducted by the user alone or does the activity require help from other people (Benyon, 2013).

Davenport (2014) has articulated that it is challenging to assemble a team of people with different skills in order to prepare data for decision support. For example, people working in IT may have been working in the department for years, but they may now be required to assemble a team with different skills with other people who do not have all the skills required for using Business Intelligence. This factor is also important since decision making is often an individual task (Davenport, 2014). Users need to carry out all decisions alone without IT support or help from the other users.

2.3.4 Contingency in activities

In line with Weill and Olson (1989), the contingent variable *environment* should be used to describe in relationships between the business volatility, the complexity and the tasks within an organization. The *Task* variable itself, is described by Weill and Olson (1989, p. 64) accordingly; "*Task as a contingency variable refers to the types of activities to be supported by Information Systems*". Weill and Olson (1989) further suggest that *Task* can be analyzed as either simple or complex, which is also pointed out by Benyon (2013) in PACT framework. In other words, the environment and task variables appear to be strongly related to activity as described by Benyon (2013). We have thereby chosen to combine the contingency variable *Environment* with *Task* in order to discuss *Activity a*s it is described in the PACT framework. Moreover, in line with both Benyon (2013) and Weill and Olson (1989) we emphasize those activities which are supported by BI systems, i.e. the Intelligence gathering in the decision making process (as explained in chapter 2.3.1). Benyon (2013) further stresses that the designer should first and foremost focus on the purpose of the activities. In line with this, we aim to explore contingency of activities in terms of complexity, by considering the different skills and abilities when using self-service BI to support decision making (see Table 2-2).

Table 2-2 Contingency in activity

Item within PACT framework	**Contingency variable**
Activity: Complexity, Temporal aspect, Cooperation	**Environment and task:** Volatility, complexity and task supported by Information Systems

2.4 Context

Benyon (2013) argues that context is the general environment which surrounds the user during their activities. These environments can vary from physical to social, and organizational contexts. In terms of BI, the context is thus the environment surrounding the decision makers while they conduct their decision making. According to Alter (1991), the activities depend on the practical trade-offs in an organization, whereby an organization can be generalized as either centralized or decentralized. With too much centralization, users often feel that they do not receive enough support and that the IT department does not listen to their needs (Alter, 1991). Alter (1991) continues, with too much decentralization, users have better support but have less ability to use an information system in a consistent way. Further, Alter (1991) also states that IT professionals usually value a system's technical elegance, while users would rather prefer a system which supports their needs.

2.4.1 Organizational and social context

Meanwhile, Jenster and Søilen (2009) have pointed out that there have been many opinions on where the Business Intelligence function should be placed within an organization, and how it should operate. Furthermore, Jenster and Søilen (2009) have stated that there is no single best way to build an organizational model to support an effective BI system. In other words the organization models are subject to change. Jenster and Søilen (2009) have however identified nine (9) different models which organizations can choose from, or at least act as a guide on how they should structure their organizations: *special department model, advisory model, professional model, top-down model, integrated intelligence model, bottom-up model, single department model, multiple department model* and *ad-hoc model*. We will not describe all these models at length, however it is very likely that organizations apply a combination of the different model types, depending on which industry they are in. Davenport (2014) suggests exactly the same idea, as he states that organizations will end up with a hybrid mix of models. As further pointed out by Davenport (2014), organizations do however not establish new structures, but rather evolve and integrate new models into existing ones. Both Davenport (2014) and Jenster and Søilen (2009) believe that the contingency in which organizational structures apply depend on the business, organization size, leadership and level of competence among employees within the organizations.

Jenster and Søilen (2009) describe the special department model where intelligence function works in a special department, often alone in isolation, without using competence which exist in other departments, and without sharing competence with others. Further, Jenster and Søilen (2009) point out the Top-Down Model where intelligence is communicated by people from the top level management; authors claim that this model works best for companies where the employees have low skills e.g. in mass production based companies. In contrast to the Top-Down Model, Jenster and Søilen (2009) describe the Bottom-Up Model as a system whereby employees from the bottom level of the organization are allowed to access valuable information, to provide intelligence. Jenster and Søilen (2009) claim that the Bottom-Up Model is common in sales- and marketing-driven organizations, where the intelligence function is distributed to the bottom level employees.

2.4.2 Contingency in organizational and social context

Weill and Olson (1989) have found that *size* and *structure* are two variables which many researchers include as contingency variables. We have chosen to combine them, as the organizational size can moderate the relationship between Information Systems and organizational structure (Carter, 1984; referenced by Weill & Olson, 1989). Further, it has been found that the *size* is a variable which has an important moderating influence on other variables. The contingency variable *structure* itself, can be used to analyze the fit between organizational structure and the structure of a service function using an Information System, i.e. in our study we regard people working with Business Intelligence as a service function. Similarly, Benyon (2013) notes that there are many books on the impact of new technologies in organizations. In correspondence to these two contingency variables (size and structure), Benyon (2013) further argues that designers can not affect the organizational and social context, but instead have to think about the organizational change in terms of security, and which users are permitted to access what. The organizational context is important in order to alter the power structure of an organization. Also, the social context where the activities take place is also important, especially when considering whether people interact with a product alone or in teams. As pointed out by Benyon (2013), cooperation refers to whether users function as support for others, and by centralization we mean that the support is a centralized function in an organization.

Based on this literature review on Context, we will use the variables *size* and *structure* to explore the social and organizational context (see Table 2-3).

Table 2-3 Contingency in context

Item in PACT framework	**Contingency variable**
Context: Organization and social context	**Size and structure** Structure of service functions, power structure

2.5 Technologies

Benyon (2013) describes the *Technology* element as hardware and software components in interactive systems. It is intended that the components should work together well to support the user's activities, which in our case is decision making. Moreover, Benyon (2013) claims that designers must understand how these components work and how to design something in the best way for users. More specifically, interactive systems should be designed according to various possibilities of input, output, communication and content (Benyon, 2013). According to Cooper et al. (2007), the most important users must thus be prioritized in order to provide an acceptable product for all users.

2.5.1 Content

Benyon (2013, p. 42) has stated that "*Content concerns the data in the system and the form it takes*". With regards BI, the content has to be accurate and well presented. In order to accomplish such a challenge, Cooper et al. (2007) suggest a framework to design the interactive systems with the so called Visual Design Framework. The framework consists of developing language studies and applying a visual style. However, Cooper et al. (2007) claim that the principles of visual interface design should be followed. These include creating a hierarchy, a visual structure, an appropriate imagery, an integrate style and avoiding visual noise i.e. an overwhelming amount of data. Visual language studies also define colors, types, widgets and dimensions as important aspects of presented data. Furthermore, Cooper et al. (2007) explain that the framework could be useful in order as visualization of information can be different depending on different technologies. Visual language can thus help designers understand the boundaries of presentation data on different devices (Cooper et al., 2007).

Within BI, visualization is defined as a process of displaying data for the people (Wingyan et al., 2003) and dashboards are often used to present reports as an interactive system. Stephen

Few is one of the most popular researchers within dashboard design, and has defined dashboards by the following:

"*A dashboard is a visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so the information can be monitored at a glance" (Few, 2006, p. 34)*

Few (2012) points out that dashboards are significant for users to be aware of what is going on now and in the future. Understanding the information on the dashboard is therefore important for the user. In line with BI, Few (2012) claims that all this important information should be gathered on a single screen. However, in order to succeed with a successful dashboard design, designers should avoid too much complexity, overwhelming visualization, distracting visualization and not enough context (Few, 2012).

2.5.2 Input and output

Benyon (2013) states that input devices help the people to enter the data securely and safely. The placement of buttons and textboxes is the main source for the individuals when they need to enter data into the system. In the context of the displays' size, Benyon (2013) also states that designers should be aware of the screen size, as some information should not be on the dashboard if the screen size is small. In other words, it is possible to conclude that some functions cannot be available on the smaller screens. Tona and Carlsson (2013) identify that display sizes on a desktop computer, tablet and Smartphone do differ and therefore users have the ability to use certain functionalities. Consequently, designers should prioritize the most used functions, buttons or texts in the design of the display. New technologies such as touch screens facilitate the individual's interaction with the display, such as multi-touch features which allow user to zoom in or out on a specific image or text (Benyon, 2013). It could be argued that the most important difference between a desktop computer and a mobile device is that one can be used with a mouse (separate device), whilst the other can be used with a finger, which can be considered as "ease-of-use".

Meyer et al. (2010) have explored the interactive visualization which refers to analyzing large amounts of data and visualization information. Their study concludes that a good visualization results in better decision making. In terms of interactive visualization, Meyer et al. (2010) claim that there are three categories within visual reasoning: exploratory, supervisory, and routine in terms of visual analytics. However, exploratory is the most

interesting among these tasks with the user having no purpose or idea of what will be investigated. Once the discovery has been found, the user can continue to explore the new perspectives. In other words, Meyer et al. (2010) point out that new discoveries can be achieved when engaging with visualizations.

2.5.3 Contingency in technology

According to Weill and Olson (1989), that the contingency variable *technology* can be used to analyze the type of decision support technology that is used and how users are desired to participate in the development. Such contingency has specifically been studied by Mann and Watson (1984) and McKeen (1994). This falls in line with the self-service approach in BI systems where users are expected to participate in the development process, and the variety of desired user involvement in the development differs between different user types (Mann & Watson, 1984; McKeen, 1994). Similar to the description by Benyon (2013), we will thus explore to what extent input and output is appropriate for different user types. Also, due to the fact that interactive systems typically contain a lot of data or information content (Benyon, 2013), designers need to be aware of this kind of material (i.e. the input, output and content in an interface). Thus, we aim to explore how the input and output differs between different technologies' screen size (i.e. desktop, tablet and Smartphone) in terms of self-service sophistication as a tool and how this enables users to be part of the development process. Based on this literature review on Technology, we will use the variable *technology* to explore the input, output and content in an interface (see Table 2-4).

Table 2-4 Contingency in technology

Item in PACT framework	**Contingency variable**
Technology: Presentation of content Input/output	**Technology:** Usage of technology and level of user-development participation

2.6 Summary of literature review

In order to guide a design process, designers need to think about the PACT elements, i.e. *People*, *Activities*, *Contexts* and *Technology* (Benyon, 2013). In other words, it is necessary to

explore these elements in the analysis phase in order to understand the design situation (Benyon, 2013). The usage of the PACT framework elements in requirement analysis usually provides information for the further design phase, i.e. to distinguish *Personas*, and to create both *scenarios* and *user stories*. Scenarios and user stories do, however, rely on certain business cases to create them. As it is widely known that "no size fits all" in the design of interactive systems (Benyon, 2013), we aim to provide an objective view of the design situation. We have thereby described PACT elements from a contingency perspective in our literature review. As can be recognized in tables 2.1-2.4, based on the PACT framework we have matched used contingency variables to investigate whether any contingency exist in BI literature. By combining all the tables (2.1-2.4) we have created the following research framework for our study in Table 2-5:

Table 2-5 Research framework

Theme	**Research Items**	**Contingency variables**	**Supporting BI literature**
People	Goals, needs and motivation (GM)	Strategy Individual	Nicholas (2010) Marakas (2003)
	Abilities and skills (AS)		
	Mental models and user types (UT)		
Activity	Decision complexity (DC)	Environment Task	Davenport (2014) Simon (1993, 1996), Marakas (1995, 2003), Mintzberg et al. (1976)
	Cooperation (CO)		
	Temporal aspects (TA)		
Context	Organization context (OC)	Size Structure	Mintzberg (1979) Jenster and Søilen (2009)
	Social context (SC)		
Technology	Content (TC)	Technology	Benyon (2013), Few (2006, 2012), Keen (1980), Cooper et al. (2007), Meyer et al. (2010)
	Input and output (IO)		

3. Research method

In this chapter we explain the motivation of our research strategy and approach accordingly. We have extended our research framework by conducting a literature review and used the contingency variables in order to establish theoretical themes. These variables are used to gather empirical findings and for the interview process. After all, we have detailed the transcription and analysis of interviews as well as the quality of our research.

3.1 Research strategy

When choosing an appropriate research strategy, initially we discussed the object of analysis and purpose of our study. For our purpose, we found that a qualitative research method would be appropriate, as the prime example of qualitative studies is to explore social and organizational contexts, as well as understanding the way people live, operate, behave, and why a phenomena has occurred (Recker, 2013). As our purpose for the design situation is both explorative and descriptive, the study must be conducted by means of qualitative interviews. As we considered conducting qualitative interviews, we found that Kvale and Brinkmann (2009) have suggested a qualitative interview process which we have followed.

We decided to conduct interviews with both vendors and suppliers of self-service BI systems, as we claim that both of these perspectives help us to be more objective, and thus to understand the requirements from two slightly different points of view. However, as designers might have their own (individual) conception about the need and thus the design situation, they are not appropriate to interview in our study. Instead, we claim that managers at consultancy firms and vendors of the self-service products themselves have more knowledge about the design situations - as they deal with both needs and thus the challenges which both developers and designers face in their ongoing work towards enabling of self-service in organizations. This goes in line with our purpose to empirically show how BI requirements have evolved towards the usage of new capabilities that self-service BI systems can provide.

The expected contribution will be a clarification of how the design situation has changed. To explain this, we use the PACT elements, adapted it for BI, and conduct interviews in order to

reason about the design situation. We claim that these findings will be valuable for firms in designing BI tools for decision-makers, even if they do not adopt self-service BI features.

3.2 Research approach

In order to describe the research method most properly, we will next describe the approach. Our previously presented research framework is based on a thematisation in our literature review, which mainly included the four PACT elements (Benyon, 2013), later used to create Personas and scenarios (Cooper et al., 2007). We have found that Contingency theory is appropriate for our research and thereby we have designed the interviews accordingly. The PACT elements have been matched with seven contingency variables found by Weill and Olson (1989). In other words, we have conducted our research with a contingency approach.

As the first phase in research approach (see Figure 3-1), we have conducted a broad internet search in order to acquire knowledge of the field. This knowledge has helped to bridge the connection between the reality and scholars. Parallel to our internet search, one of the authors has participated in software conferences as well as data courses in The Swedish Computer Society. Discussions at these sessions have given a broad perspective on the term of self-service from both vendor's and end-user's perspectives. Furthermore, we have conducted a literature review in the field as well as looked at vendor's white papers, such as Qlik and Tableau. Following the literature review, we have read about a selection of theories within IS research[1].

Following the method approach, we have chosen to use the interview stages suggested by Kvale and Brinkmann (2009) which are shown in Figure 3-1. We have decided to structure our research method in the same order continuously through this chapter (3.3 - 3.10).

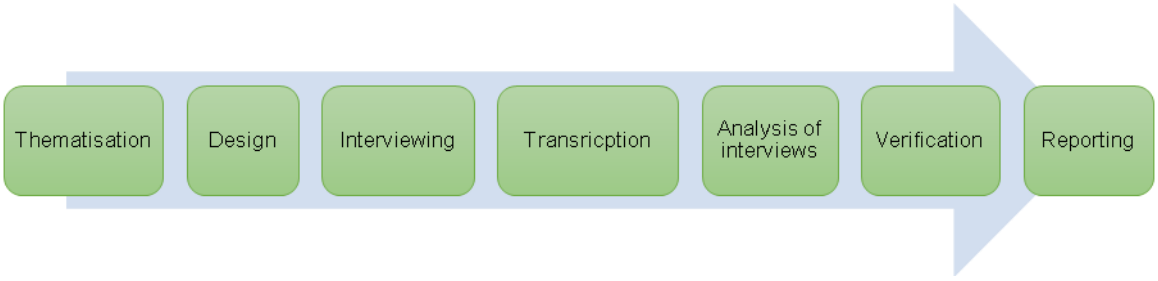

Figure 3-1 Seven stages in qualitative research (Kvale & Brinkmann, 2009)

[1] http://istheory.byu.edu/wiki

3.3 Thematisation of the literature review

Our study is conducted as qualitative interviews. As Kvale (1996) has suggested, authors should provide an explanation to the questions on *what* and *why* during the thematisation. We thereby describe how we gained preknowledge of our subject below.

We have followed the structure offered by Benyon (2013) in the PACT framework, but have written it from a BI perspective. Our thematisation is based on PACT framework, which has been matched with the contingency variables. This match and thus the questions for our study have been described in our interview guide. The questions have been formalized based on background knowledge we have developed from conducting a broad internet search in order to gain better domain knowledge of the BI field. Parallel to the internet search, one of the group members has participated in the Software conferences at FooCafé[2] and The Swedish Computer Society[3]. Further, we have conducted a literature review, searched for IS theories and structured our PACT framework based on our domain knowledge. A further presentation of what we did to gain preknowledge, can be recognized in the Figure 3-2 on the next page.

As part of our research approach (see Figure 3-2), our background knowledge has helped to bridge the connection between the reality and scholars, an idea advocated by Kieser and Leiner (2009) who also argue that this helps researchers collect both relevant and rigorous research for themselves and practitioners. Discussions at these sessions have given a broad perspective on the term of self-service from the sides of both vendors and end-users. Furthermore, we have conducted literature review in the field in addition to referring to vendor's white papers, such as Qlik and Tableau. Following our literature review, we have read up on a selection of theories within IS research[4], where we found several theories to choose between (e.g. Cognitive Fit Theory, Agency Theory, Behavioral Decision Theory). However, we considered that the Contingency theory was appropriate for our research - as contingency variables can be used to describe different situations that organizations face, i.e. in our case the design situation. We have thereby designed the interviews based on contingency variables, as presented in chapter 3.4.

[2] www.foocafe.org
[3] www.dfs.se
[4] http://istheory.byu.edu/wiki

Internet Searching	Data Analysis News
	TDWI- The Data Warehouse Institute
	Interaction HCI magazine
	IDG Computer News
	Network World
	Computer World
	CIO
Conferences	FooCafé (www.foocafe.org)
	The Swedish Computer Society
Literature Review	LubSearch
	Google Scholar
Theory Searching	IS Research Theory
Structuring the Framework	Life Cycle of BI
	Contingency Theory
	PACT
	Persona

Figure 3-2 Sources for collecting background knowledge

Based on our background knowledge, the thematisation of our research has been constructed using BI theories to adapt the PACT framework. During the thematisation we have thus matched the PACT framework with the contingency variables. The reason for this match has been described earlier in chapter 2. Our selection of contingency variables are those found by Weill and Olson (1989), i.e. *Strategy*, *Structure*, *Size*, *Environment*, *Technology*, *Task* and *Individual.* Weill and Olson (1989) have found these variables by conducting a comprehensive summary from various researchers' work on the contingency theory. The summary conducted by Weill and Olson (1989) is based on 16 issues found in JMIS and 26 issues from MIS Quarterly, which represents 177 articles from which 105 were reviewed in detail. It is thus the most comprehensive summary of the contingency theory variables that we could find.

3.4 Design of interview guide

The design of the interview guide has been conducted by considering to the question of *how* (Kvale, 1996), as we reflected on how to acquire knowledge of different research methods in order to decide on an appropriate method for our research. We have chosen to use semi-structured interviews (Kvale & Brinkmann, 2009) which enabled us to explore our research questions in greater depth by asking follow-up questions, and to make sure that all our research items (within PACT) were answered.

In designing the interview questions we have used the research framework, which has facilitated the structure of the interview. As Kvale and Brinkmann (2009) recommend that the design of the interview should consist of three parts: briefing, interviewing and debriefing, we have designed our interview guide accordingly. The motivation of our interview guide structure is presented below, with corresponding numbers of the questions as presented in Appendix 1. Due to the semi-structured interview approach, the order of our questions has changed during the interviews. We beneficially created follow-up questions to develop a discussion and to allow our informants to elaborate their answers even further. In other words, we did not strictly follow the design of our interview guide. It enabled us to obtain answers in more depth, and to even get answers on multiple questions sometimes as they often were related to each other.

3.4.1 Briefing

Part 1- Introduction and General Questions

As we introduced ourselves at the beginning of the interview, we described why we are conducting the research and the aim of the interviews. We gave a short introduction of the problem area and our research question. The aim of the introduction was to inform the interviewee about our expectations, in order to reduce irrelevant answers.

We then requested to start the interview and the recording (Question 1 & 2). To briefly start the interview, we asked our informants to tell us more about their background and current role in their organization (Question 3).

3.4.2 Interview

Part 2- Strategy

This part corresponds to understanding people's goals and their motivation for requesting self-service in firms, and furthermore, how firms respond differently to such requests by incorporating it in their strategies (Question 5). In line with the description of the variable *strategy* in chapter 2.2.4 (i.e. to incorporate information assets and opportunities), we question people's goals and motivations (Question 4). Moreover, as suppliers and vendors are strongly influenced by a wide range of user requests among their customers, we expected that they will provide a multiple perspectives on the goals and motivations.

Part 3- Size and structure

This part will question both the variable *Size* and *Structure* as described in chapter 2.4.2. Our questions aim to explore how the BI function can be structured in different firms (Question 6 & 8), the role that IT support has (Question 7), how users are supposed to acquire support in decision making (Question 7), and thus how it differs depending on a firm's size (Question 6). It is worthwhile questioning how users are supposed to operate, in an organizational and social context in terms of the Context element.

Part 4- Environment and task

This part corresponds to *Activity* in the PACT framework, as both the environment and task has to be considered in decision making as described in chapter 2.3.4. Thereby, we requested what a scenario (environment) can look like (Question 9), and thus what this implies in terms of decision complexity (Question 10 & 11), the speed of decision making (temporal aspects) and thus how the decisions are taken e.g. in cooperation.

Part 5- Technology

The *Technology* part, as described in chapter 2.5.3, aims to explore how devices in different sizes can enable self-service BI to present information content more adaptively (Question 12). Also, what does self-service functionality imply, and given that it enables users to make more input, what risks may consequently occur in the output (Question 13).

Part 6- Individual

This part aims to find out whether vendors and suppliers have categorized *People* based on their skills or mental models, as described in chapter 2.2.4, and thus if they have been distinguished as different Personas (Question 14). In any case, we questioned whether there exists different levels of self-service BI and if these levels match different people - based on skills and user motivations (Question 15).

3.4.3 Debriefing

Part 7- Ending questions and closing

In the last part of our interview guide, we looked at the summary of the interview and if we had missed any parts of the questions. Finally, we asked the interviewee if they wanted to share any additional information on how self-service BI influences analysis and design (Question 16 & 17).

3.5 Selection of informants

In line with the background, problem area and purpose of our research, we found that neither users nor designers are capable of defining the needs and requirements of BI systems. As a result, selecting suitable informants was challenging but crucial. We selected informants with a background in developing/designing who were currently working as managers. Another criteria was that they should currently have continuous contact with customers, and that they should understand the needs and requirements of various firms at both the organizational and individual level.

Since the purpose of our research relies on an organizational perspective rather than an individual perspective, we have chosen specific criteria which the companies had to meet. The companies in our study had to be either vendors or suppliers and had to have worked with self-service BI for a few years. We have conducted the study with the companies shown in Table 3-1 on the next page.

Table 3-1 Overview of the companies

Company Name	Perspective	Location	Size
Qlik	Vendor	Lund, Sweden	1800 Employees, 32000 Customers
Advectas	Supplier	Stockholm, Sweden	70 Employees 150 Customer
Affecto	Supplier	Malmö, Sweden	1100 Employees

Informants should have knowledge on self-service Business Intelligence. As self-service BI is the main area of our study, we have explored the forefront actors in the industry within Sweden. To get in contact with our interviewees we used our contacts from the Business Intelligence industry who have worked in the field for a couple of years. We have emailed potential informants and attached our pre-prepared Informant Guide (see Appendix 2). We selected experienced BI developers and managers to provide an overall connection between designers and customers. However, we believed that choosing designers would result in too many technical findings for our thesis, which was not our purpose. Our informants hold a broad experience of BI development and could provide an understanding of the designers' work. An overview of the informants in our study is shown in Table 3-2.

Table 3-2 Overview of informants

Name	Role	Company	Location	Method
Thomas Svahn	CEO	Advectas	Gothenburg, Sweden	Phone
Murray Grigo-McMahon	Director of User Experience	Qlik	Lund, Sweden	Skype
Vinay Kapoor	Product Manager	Qlik	Lund, Sweden	Skype
Ingemar Carlo	Product Manager	Qlik	Lund, Sweden	Skype
Sandra Sakratidis	Consultant Manager	Affecto	Malmö, Sweden	Phone

Thomas Svahn has been working in the Business Intelligence profession for approximately 15 years. He is the first enforcement and deputy CEO of Advectas, as well as holding

responsibility for Microsoft delivery. Furthermore, Thomas helps the customers with the Business Intelligence Strategy and thus has contact with the customers in order to figure out how they use self-service BI. His knowledge of BI has made him a valuable source between the end-users and designers .

Murray Grigo-McMahon works at Qlik as Director of User Experience. He looks after the User Experience for the new generation of product, QlikView.Next. His background includes almost 20 years in Digital Media, and he has worked for a long time in the web industry in marketing, services and also software development. During his last six years Murray Grigo-McMahon has been working with analytics and visualization software. He sets up the user experience practice at Qlik with the UX team, which consists of interaction designers, visual designers and user researchers. He also contributed with his experience and knowledge on users for our study.

Vinay Kapoor is Product Manager for mobile and social at Qlik and responsible for creating a strategy for the mobile products and social products. He works on both the R&D side and the customers' side. He has continuous contact with customers and partners. His knowledge in technology and product management made him a valuable participant in our research as he provided great knowledge of the current demand among customers in the market.

Ingemar Carlo is Product Manager for Client Development Controls & Libraries at Qlik. He has six years experience in software development and eight years experience as a consultant implementing BI solutions for customers. In his previous role at Qlik he had a Cross-platform role as a Program Manager, where he held responsibility for requirements, design and commissioning projects. Ingemar was selected as an informant because of his experience in working with designers and developers.

Sandra Sakratidis is Consultant Manager and Practice Manager at Affecto and has worked with Business Intelligence for 15 years in a variety of roles including Project Management, Development and educating customers. She was selected because of her broad experience within BI. She has also written a white paper on self-service BI.

3.6 Interviewing

In spite of living in the same city as some informants, we conducted our interviews via Skype and phone in order to collect the data as soon as possible. Conducting face-to-face interviews

would have been far more time consuming. However, we requested two informants at Qlik to make a visit at their office in Lund (19th of May 2014). This helped us to clarify questions we had on self-service and to verify that our empirical findings were valid.

For the interviews, we divided our interview process into three parts: *preparation - conduction - evaluation*. We spent approximately 30 minutes on technical preparations before each interview. Since we chose to use Skype video call, we tested Skype and the recording software on one of our laptops, and made sure that the internet connection worked well. In the email communications with each informant, we received their Skype account name and added them before each interview. In preparation we familiarized ourselves with the background of the interviewee and checked the interview questions to consider if any part of the interview should be given greater focus, based on the informants' experiences.

After the preparations, we conducted the interviews which lasted between 35 and 60 minutes. As mentioned in chapter 3.4, Kvale and Brinkmann (2009) have divided the interviewing into three parts: briefing, interviewing and debriefing. In the briefing part, we started by introducing ourselves and explained our research purpose, in order to get an appropriate perspective on the responses we hoped fro from our questions. We believe that we saved some time in doing this, as it eliminated some irrelevant topics. Also, this prevented ethical issues (i.e. informed consent) in case our informants had not read the informant guide.

As we have chosen to conduct semi-structured interviews, we have changed questions or added extra questions depending on the respondent's answers during the interview stage. Also, during the interviews we acted in two different roles, i.e. one person was asking the questions while the other made notes to make sure that we extracted enough information from the interviews. This enabled us to ensure that we covered the important parts of our themes, from which we could better ask follow-up questions in case we had missed anything of significance.

Finally, after the interviews had been conducted, we re-read our notes and discussed how we could use the empirical data for our study. This process has also confirmed that the design of our interview guide is appropriate for conducting the interviews.

3.7 Transcription of interviews

For the interviews, we have followed the steps of our interview guide. However, as we have used a semi-structured technique, some of the questions have been adapted for each interview. The transcriptions of our interviews are presented as appendices, and the text is presented as tables. The tables have several columns to improve the readability and to present line number, person speaking, text of transcription and finally the coding.

In the briefing part of our interviews, we requested to record the interviews and then started the recording. Our recording method enabled us to transcribe the interviews, as it otherwise would have been impossible to present valid quotes in our empirical findings. Furthermore, we transcribed our recordings within two or three days after the interviews had taken place. This method has helped us to remember what we have talked about, and thereby to add comments and include the verbal affectations, such as laughs, emotions and the context of our discussions during the interviews. It also enabled us to create a better interpretation of the findings, and thereby provide a better analysis. The transcriptions were conducted by listening slowly to the recordings, and simultaneously writing every word from the interviews (word-by-word). It was an exhausting process to directly transcribe each interview in detail, but we deemed it necessary as it would have been poor analysis if any words from the interviews were missed.

We also assured the quality of each transcription, by listening to the recordings several times together. Finally, we sent the transcriptions to our informants, to get their approvals in order to use it for our analysis. We requested that our informants should read through the transcriptions, and offered the opportunity for them to correct or even complement their answers. All our informants accepted our interview transcriptions without removing any text. Some informants did however provide valuable feedback on some parts of the interview that were incorrectly transcribed, due to poor sound quality in some recordings.

3.8 Data Analysis

In our study, the interviews were our primary source for collecting empirical data, and we have considered the best way to analyze this information. Recker (2013) explains several data analysis techniques, and we have chosen selective coding for our data analysis. We have

decided to create a coding schema which has been used in the transcriptions in order to show the valuable findings from our interviews. Our coding schema is shown in Table 3-3.

Table 3-3 Research framework variables

People	**GM:** Goals, needs and motivation	**AS:** Abilities and skills	**UT:** User Type
Activity	**DC:** Decision Complexity	**TA:** Temporal aspects	**CO**: Cooperation
Context	**OC:** Organization context		**SC:** Social context
Technology	**TC:** Content		**IO:** Input/output

Initially, we used open coding in order to achieve a conceptual understanding of our empirical findings. However, we then analyzed our empirical findings based on the PACT items as used in our literature review. By using our coding schema (Table 3-3), we could easily find quotations from the transcriptions and thus presented them as examples in of our empirical findings (chapter 4). This process has strengthened our discussions since we have used a valuable coding schema which matches our literature review. We believe that this process also improves the readability of the thesis, especially if readers would like to find the context in which the quotation was taken.

We have referenced the quotations with corresponding appendix numbers and line numbers. An example of the quotations in our data analysis for the coding is e.g. "*they have to have access to the data they need to make the right decisions. And that's the model for most of the companies - give people the information that they need anywhere and anytime* " (6:55). This quotation refers to a statement in appendix 6 which is an interview with Ingemar Carlo, taken from line 55.

The main idea of the data analysis has been to compare the empirical findings from our informants, and to create the basis for our later discussion. Since the coding corresponds to our research items in the PACT, there is a strong linkage between our literature and empirical findings. For each research item, we have presented the important quotations from each informant in a table format, and explained our interpretation in respect to the contingency variables and the differences between the quotes. Finally, we have outlined what we have found from the empirical findings as a summary of collected data.

3.9 Ethics, verifying and research quality

Kvale (1996) recommends that researchers verify the interviews with respondents, in order to confirm the generalizability, reliability and validity. This is supported by Morse et al. (2002) who emphasize verification as a process in order to check, confirm and certify results. Thereby, we have carried out this stage in the following phases.

3.9.1 Reliability

We have tried to achieve reliability in our study by giving a rich description of our research method and empirical findings, as Kvale (1996) explains that reliability is the consistency of the empirical findings. We believe that by describing our research method and detailing the experience and knowledge of our informants, we would provide a good explanation on how and why we have chosen the right and eligible informants for our study. In conducting qualitative methods, it can be difficult to achieve reliability, but we have chosen semi-structured interviews in order to achieve quality data from our interviewees. Furthermore, by offering the possibility to our informants to explain their knowledge, our study has benefitted from a rich description of the BI field and thus self-service BI. Transcribing the interviews from the recordings has also provided internal reliability. All transcriptions have been verified by informants, and to our informants we gave the opportunity to add or change their opinions.

3.9.2 Validity

In order to provide validity throughout our research, we have used two-step confirmation logic during the interview transcriptions. After the interviews, we have carried out the transcriptions within two or three days so as to remember what was said. After this, we have checked each other's transcriptions and corrected some mistakes or misunderstandings from the recordings. Finally, we have sent the transcriptions to our informants and requested them to verify whether the transcriptions are valid or not, and whether they contain any confidential information. This two-step confirmation has also provided a more trustworthy analysis since our research's primary data source depends on the interviews.

Kvale (1996) explains that validity is controlling whether the research explores what it is intended to be explored. Aiming to achieve the validity in our research, we have compared the transcriptions with the design of our interview guide (see chapter 3.4). Further, for each

research item, we have presented the linkage between our interview questions and quotations in chapter 4.

Also, we have adjusted our research question to match our purpose and conclusions, in order to further achieve validity. This goes in line with Morse et al. (2002), who claim that researchers should move back and forwards between the research purpose and their conclusions in order to improve validity. In addition, we have chosen to present our research purpose and research question before presenting our conclusions in chapter 6 as it improves the readability.

3.9.3 Ethics

In addition to the seven research stages presented by Kvale and Brinkmann (2009), we have considered that some ethical issues can arise and we have therefore followed Kvale (1996) ethical guidelines, which outlines informed consent, confidentiality and consequences.

According to Kvale and Brinkmann (2009), informed consent refers to briefing and debriefing with regards the research's purpose and background. When we have searched for possible interviewees, we sent them an email with an informant guide (Appendix 2 Informant guide). In our informant guide we explained the research's purpose and background, and pointed out that participation in our research is voluntary. Moreover, we have also catered for informed consent during the interviews by explaining the purpose of our study, and confirmed approval with each interviewee to carry out the interview before we began to ask the questions.

Confidentiality has been a concern as self-service BI is a sensitive topic with the vendor Qlik, as they have a new product which will be released in 2014. Kvale (1996) emphasizes that research should not consist of any private data and researchers should be aware of this. We have ensured that our transcriptions did not consist of any confidential information, regarding the companies, their products or their customers. We have also asked the informants if they would like to be anonymous in our study. Therefore, we have suggested to our informants that they provide general answers to our questions, which has also provided us with a more objective perspective. Thus, we purposely chose to avoid asking detailed questions on the companies' product/services, and existing Non-Disclosure Agreements (NDAs). Furthermore, we also sent each interviewee the transcriptions of their interview to allow them to verify that the transcriptions did not include any confidential information.

Kvale (1996) stresses that consequences following an interview should not harm informants or the company they represent. In reflection of this, we have designed our interview questions with a general perspective instead of demanding specific product details. As Kvale (1996) points out, informants might also retrospectively regret that they have provided some intimate information during their interviews. We have therefore sent our transcriptions to them, in case they have regretted the answers they have given, and allowed them the opportunity to delete them.

3.10 Reporting

Reporting as the last phase of the interview process, all interviews should be reported without missing any text. As recommended by Kvale and Brinkmann (2009), after transcribing the interviews we have presented the empirical material in a readable format by inserting the text into tables. However, Kvale (1996) claims that the main purpose of a report, is to inform the reader of the trustworthiness of the empirical findings. In order to make our research more readable and to provide a clear and concise communication with the results from our interviews, we have created several tables in chapter 4, which show the most relevant findings and quotations in correspondence to each research item. After each table, we have analyzed our empirical findings in relation to our research variables and thus the PACT elements. This provides an overview of our empirical findings and enables our readers to interpret the quality of our empirical research.

4. Empirical results and analysis

In this chapter, the empirical findings will be summarized. The main empirical findings in the thesis are presented as quotations for each variable. Referencing for the quotations has been outlined with the number of the corresponding appendix, and with a line number where the quotes were found in the transcriptions. Such cross-referencing enabled us to conduct our coding and analysis. Also, we hope that this also help our readers to find the references in an easy way. The major quotations have been presented in tables. However, other cross references are also used during the analysis.

4.1 People

In this section, we will present empirical findings regarding people and as explained in our chapter 3.4, we regard people's goals, need, motivation, abilities, skills, mental models and thus categorization of user types. This section is structured in the same way as our literature review chapter 2.1.

4.1.1 Goals, needs and motivations

In this first part, we asked question 4 in order to explore the underlying cause of self-service i.e. People's goals and motivation. In line with variable strategy, in other words incorporate information assets and opportunities, we asked Question 5 to explore how firms respond to requests by incorporating self-service in their strategies (see Table 4-1).

Table 4-1 Goals and motivation of using self-service

Interviewee	Quotation
Thomas Svahn **Advectas**	“[…] everybody have personal needs for BI information. With the traditional tools, techniques and methods we could not deliver that to every person." (3:30). "The ability to have control and the ability to do analysis that they want to do, that's the driving force." (3:48)
Murray Grigo-McMahon **Qlik**	"[...] they [decision makers] need to ask questions and needs the information. If you code this kind of traditional reporting approach to it, whereas someone goes off and define what this thing contain up from. They spend a long time in doing it," (4:14)
Vinay Kapoor **Qlik**	"What self-service does is giving people the information they need, when they need it, in the form they need, in order to be able to make better decisions." (5:15) "Their (users) needs are very simple and people like to be free. Freedom is a very basic need of people." (5:17)
Ingemar Carlo **Qlik**	"The more freedom they have to choose the data that they need to make better decision. I think the most people can think that way. " (6:53) "[...] self-service is something that I have seen since the day one, so since 1990's" (6:15)
Sandra Sakratidis **Affecto**	"The motivation was that it took a long time for the IT department to developed the questions from the users. It takes too long time to give users’ a report or an application to use. It is a long lead time it took for the user to get right tool and information." (7:17)

Our interpretation of users' need based on what our informants answered, it appears that it was the users who requested to be allowed to do more themselves, which caused a change for organizations who had to develop new strategies of delivering BI. The goal was to make better use of BI as a tool to support decisions. The need among users was in other words to make better decisions. As pointed out by Thomas Svahn, there is a big point of using self-service BI as the users know their business, in contrast IT people did not know the business and could thereby not deliver what users needed (3:46).

All informant stated that the idea of self-service grew as the IT departments acted too slow in delivering the requested information. The so called traditional approach of BI does however

still appear to be viable, as there still is a need among users for the static reports. The so called traditional BI, was an approach where IT departments delivered BI dashboards to its users based on presumptions of what the users' need. The IT departments did simply pushed out a BI software without fulfilling different needs among users. As pointed out by Vinay Kapoor, this approach has been used due to the fact that the software strategies in organizations historically seen has been decided by IT departments (5:13). Due to this, all informants did argue that the traditional approach for BI does not fulfill all the requirements among people. However, Thomas Svahn (3:50) still claimed that the traditional BI approach still was viable as it fulfilled a need. Thomas have explicitly stated that self-service is like a complement to traditional BI, in order to fulfill all needs in decision support (3:16). Even further (3:29), Thomas Svahn stated his perceived reality as BI systems can fulfill about 25-30 % in the total need of decision support, while the other 70 % needs to be fulfilled in another some way (without BI system). Maybe 10-20 % could be thus be complemented by using some kind of self-service solution, if 100% of the information would exist within the BI system (3:29). As it appears apparent from Table 4-1, our informants means that static reports have caused many unhappy users, with emphasis that self-service BI can fulfill people's need better, and that users are motivated by the fact that they can find support for their decisions faster, by not contacting the IT department. As pointed out by Ingemar Carlo, the need does however depend on the business of the organization (6:55).

4.1.2 Abilities and skills

In this part, we asked Question 14 to explore whether vendors and suppliers have categorized *People* based on their abilities and skills (see Table 4-2). In any case, we questioned whether there existed different levels of self-service BI that would more appropriate based on People's different skills. We use this finding to later discuss on contingency, i.e. if there is no single best self-service BI for all users.

Table 4-2 Required abilities and skills to use self-service

Interviewee	Quotation
Thomas Svahn **Advectas**	"They [users] need to be more into and understand what are the dimensions, what are measures and how information is related to each other." (3:46)
Murray Grigo-McMahon **Qlik**	"[...] if you are picking the data yourself, and you design the dashboard. You need to know what you are doing; you need to know what the data is; and to search the right one; you need to be aware that you may not be able to get all the data; there might be another data source out there." (4:25)
Vinay Kapoor **Qlik**	"[...] we have a persona for somebody who does not know using analytical product and they just know that they are looking at the data. They cannot understand that it is a product. So we have the personas for different analytical skills." (5:39)
Ingemar Carlo **Qlik**	"[...] if you are user who understands where the data sources come from and also trustworthiness for of the data - then you might have a little easier way be able to even define the indicators on your own." (6:26)
Sandra Sakratidis **Affecto**	"[...] you need to have specific knowledge about the tool; you need to have specific knowledge about the information and about the data; and how they can be loaded." (7:19)

Self-service approach demands more technical skills (3:34), and users should be aware of these necessary technical abilities before using the self-service BI (3:46). However, in terms of motivating the users and distinguishing them according to abilities and skills, the bulk of respondents have mentioned that there are differences among the users having different skills. Furthermore, most of respondents have stressed also the real motivation of using self-service BI is to not depending on IT department when they need a new report or application (4:21; 5:37). In order to fulfill that need, users have started the term of the self-service BI with their initiative (3:7). On the other side, in order to use the self-service tools, most of the respondents have claimed that users need to know information about data and need to have technical abilities. Thomas Svahn has explained that BI users do need to know the data dimensions and how they are related each other.

If these technical abilities can be achieved by the users, then can be called power user or expert. Ingemar Carlo has also continued that BI products should be evaluated for users' skills and understanding (6:26). In order to understand how applications will be used, all respondents from Qlik have also explained that they have several examples and scenarios.

4.1.3 Mental models and user types

In this part, the purpose of asking question 14 was to further explore if People might have been categorized according to different user types (see Table 4-3).

Table 4-3 User types within self-service

Interviewee	Quotation
Thomas Svahn **Advectas**	"The basic thing is that user of self-service BI [can be] compared to normal BI user" (3:46) "So they are becoming like BI developer for other users and managers in the organization." (3:48)
Murray Grigo-McMahon **Qlik**	"And we have in the business user part; peripheral users, casual users, ambitious users and sense makers. And that can be seen in the literacy continual technical skills as well, and needs based on their business roles." (4:31)
Vinay Kapoor **Qlik**	"The persona is a user experience term which allows to define who the user is and very specific profile that kind of user. [...] And we have some focus personas: primary persona that build the product for, and the others that are enabling. For example, IT guy, we have persona for that." (5:37)
Ingemar Carlo **Qlik**	"I cannot have a single persona that is strictly of how it should work. My users can basically they can do anything imaginable, or they can do things that I have not imagined, or even if I imagined that they want to do yet. So it is very different approach." (6.32)
Sandra Sakratidis **Affecto**	"[...] the less experienced users or information consumer in organizations. They just consume the data, they just get report, run it and just look at the figures." (7:19) "[...] power users [...] are more familiar of the tool and are more familiar with the data. It [self-service] is not for a simple user like an information consumer, it is more like for power users with the company." (7:37)

Due to that the self-service BI approach is different, Ingemar Carlo mean that one user type is not enough but the identification of several personas might be necessary. Ingemar Carlo even mean that the users are unpredictable as they do things that no one ever could imagine. In addition, except just identifying the users as pointed out by Murray Grigo-McMahon (4:21), it now is necessary to distinguish personas in the developers world. Further, the developer personas they have identified are e.g. designers, problem solvers, data scientists and architects (4:31).

So, broadly speaking, personas can be either users or developers but it is necessary to be more specific. Both Murray Grigo-McMahon and Vinay Kapoor pointed out that they at Qlik use several personas to understand their users better, and that they do that by identifying their skills and needs based on their business roles (4:31; 5:37). Understanding the user's as personas provides a better picture of how to design a BI tool for different user types (5:39).

4.2 Activity

This section we will present empirical findings regarding *Activity* in the PACT framework, which in our thesis regard decision making. This section is structured in the same way as our literature review chapter 2.3.

4.2.1 Decision complexity

In this part we asked Questions 10 and 11 to explore how decision complexity has influence on design of self-service (see Table 4-4).

Table 4-4 Complexity of decisions

Interviewee	Quotation
Thomas Svahn **Advectas**	"The risk that IT departments normally speak of is that they are not 100 % sure that the data they are looking at is correct. Because it has not been tested 55 times and it has not been quality assured in so many ways that will be made in a standard BI solution" (3:29)
Murray Grigo-McMahon **Qlik**	“I need this piece of information now, so that I can make the decision in time”. And that’s the kind of need they have for these things, so they make the right decision" (4:16)
Vinay Kapoor **Qlik**	"You have better data, you have possibility cross-query information." (5:25)
Ingemar Carlo **Qlik**	"What is the consequence of not making the decisions? It is potentially more catastrophic. Of course there has to be right balance. The people has to have access to the data that is trustworthy; that is accurate." (6:57)
Sandra Sakratidis **Affecto**	"That would be risk because the data is not always qualified within the self-service BI. If the data is not qualified then it is a big risk, of course if they are taking decision based on that." (7:35)

The bulk of respondents have stressed out that data quality is the most important factor on decision quality. Due to that, that might be a risk for decision quality during using self-service BI since data has not been tested as it should be (3:29; 7:35). However, finding the necessary data is an good opportunity with self-service (5:27), it is still a question of how to evaluate the data during making a decision. Ingemar Carlo states that making a decision is often better than not making a decision, and decisions should therefore depend on right and accurate data (6:57). Murray Grigo-McMahon pointed out that the users can make the right decision among several alternatives (4:16). This is especially true if the decision makers (BI users) need to make decision and taking the responsibility of the consequences, but users do need data quality in somehow in order to make good decisions. Finally sharing of a common thought among respondents is that self-service approach will definitively improve the data quality as well as decision (3:27; 4:41; 5:27; 6:30).

4.2.2 Temporal aspects

In this part, we requested a scenario by asking Question 9, and thus we wanted to be given an environment, and how infrequent decisions are taken (see Table 4-5). This provide an example of how the decision making process might be changed and what BI requirements that thus must be supported.

Table 4-5 Decision frequent

Interviewee	Quotation
Thomas Svahn **Advectas**	"Five years ago BI, there was a big queue of people that are standing in the line into the IT department's room, to get all the reports constructed for them. Now they can do that themselves and they do not need to stand in that queue any more. They can build it themselves" (3:48)
Murray Grigo-McMahon **Qlik**	"Looking at their system initially, and they will have four or five weeks between getting their information back. We could turn that around into four to five hours. And that's what happened with the decision is that we can take them more quickly, they need that information right now, as the information can change over time." (4:14)
Vinay Kapoor **Qlik**	"So we have personas for developer and for the dashboard. But it has spent a lot more time analyzing and asking question and answering which is what you want the people do. [...] (5:45)
Ingemar Carlo **Qlik**	" [...] they have to have access to the data they need to make the right decisions. And that's the model for most of the companies - give people the information that they need anywhere and anytime." (6:55)
Sandra Sakratidis **Affecto**	"If they [users] have tools that easily to present the data and if they have asked the data then it becomes get faster and easier. I think that is the good motivation for the user. " (7:45)

In terms of empowering the users with the ability to explore data and to further solve the get answers of new questions that has arisen, bulk of respondents states that self-service BI will decrease the analysis of data (4:37). Murray Grigo-McMahon explained that the users who wanted to add or create new reports had to contact the IT department which took long time to get the data and thereby led to long decision making (4:14). Due to the fact that the users did not get the sufficient support from IT departments (3:48), they had more motivated to use self-service approach in order to increase the decision making process. Considering the having new abilities and easier tools within BI, the users will be satisfied to be able to explore

more data. Vinay Kapoor has also stressed that the visualization is not the issue within BI and the main point is how to get access or have the information they need in time. Finally bulk of respondents have the same idea that self-service approach empowers the users with better ability to explore data and to further find answers of newly arisen questions. Due to that, the users will not be dependent on IT departments and they will not have wait long time to get required data such as four-five weeks (4:14).

4.2.3 Cooperation

In this part, as we asked Questions 10 and 11, we also wanted to explore how decision makers are supported by IT department and other business people. It describes the variety of environments in which decisions are taken, if self-service imply changes on communication and coordination between users, and IT departments (see Table 4-6).

Table 4-6 Supporting decisions in organizations

Interviewee	Quotation
Thomas Svahn **Advectas**	"The companies that really embrace self-service BI, closed the gap between the IT and Business. Either if it is IT people who get more into the Business side of thing, or Business people who get more into the IT." (3:9)
Murray Grigo-McMahon **Qlik**	"We are more likely to go over and ask someone we know "Can you do something?", than go on to IT support. Because we know that we are not going to get much back from the IT support in a large corporation." (4:23)
Vinay Kapoor **Qlik**	" [...] in a small organizations it is typically the IT person, the user, the developer and everybody has such a role of developer, so it is not so much there in small organizations. But in large organizations, [...] people go to IT only if they have requirements to be enabling." (5:21)
Ingemar Carlo **Qlik**	"For many of these sources it could be very difficult for the business users to get access to these sources, and sometimes it is harder for them to get the information they need from IT, than if they would just go for it on their own. This conflict demonstrates between business and IT which I have seen over and over again." (6:24)
Sandra Sakratidis **Affecto**	" they [users] can develop their own application and do the small proof-of-concept when they combine that kind of data, look at the information and ask; “Is this something we can use broader within the organization, or is it not?" (7:21)

In terms of the gap between the business people and IT people during the decision making process, such as getting the required analysis or data to improve the decisions, the bulk of respondents have claimed that there has been significant gap between the business and IT people several years (5:21; 6:24). Thereby business people efforts to be able to get the required abilities to cover this gap (3:9). Self-service approach has become a solution to bridge between business and IT people, and Sandra Sakratidis has also pointed that the communication is the mandatory element to bridge that (7:35).

However, Vinay Kapoor have shown that size of the company is another factor to determine this gap, and he continued to claim that the gap is not so significant in small companies meanwhile it is getting bigger in larger organizations (5:21). These are also seen by Ingemar Carlo (6:24) and Murray Grigo-McMahon (4:12) as the main and trustworthy sources to get information in decision making which is significant to determine the gap between the business and IT people.

4.3 Context

In this section, we present empirical findings regarding *Context* element of PACT framework, and this section is structured in the same way as our literature review chapter 2.4.

4.3.1 Organization context

In this section, we have asked Question 6 to explore which type of firms are suitable to adopt self-service BI and thus how self-service alter the roles within firms (Questions 7 & 8). We showed most important quotations from informants in Table 4-7.

Table 4-7 Size of companies within IT department

Interviewee	Quotation
Thomas Svahn **Advectas**	"I think in some way that self-service is viable for both types of company in different way. [...] In big companies self-service is more complement to find all related need that will able to fulfilled with the traditional BI support. But in the small companies, which does not have any big resources, they do not have BICC and then BI tools and techniques might well be the full BI solution." (3:16)
Murray Grigo-McMahon **Qlik**	"[IT departments] thought themselves as gatekeepers, [...] [However their role change] If they have to support every single app and every single dashboard that people produce that is not going to apply, right. " (4:21)
Vinay Kapoor **Qlik**	"[...] in the past when you had IT-driven reporting, IT department's job was everything from purchasing the software, preparing reports, designing reports and making sure that they get delivered. In self-service BI, the good thing is that IT's role is limited to managing and enabling [...]" (5:19)
Ingemar Carlo **Qlik**	"I think it is not so much the size of the company [the viability for self-service in organizations], that's is much more the nature of the business of the company, and the profile of the users of Business Intelligence tools." (6:19)
Sandra Sakratidis **Affecto**	"I don't see any particular favor if they are big or small companies." (7:23) " If they have a IT department that is like the bottleneck. Then they are more likely to demand self-service BI. IT departments with this kind of missing resources can be in both for smaller or larger organizations."(7:25)

The structure of how organizations work with Business Intelligence is not directly related to the size of organizations (6:19;7:23), but the size affect the role that IT departments have in order to support decision making. And how organizations work also differ dependent on the business and of who the users are (5:17; 6:19). Vinay Kapoor further point out that small organizations typically allow more flexibility for the users, while bigger organizations are less flexible (6:19). In other words, it appears that the size of companies affect the structure of how organizations work with Business Intelligence.

Even further, Sandra Sakratidis means that self-service change how organizations work with data used for decision making, as users can discover new usage areas where data can be used to support decisions (7:21). Vinay Kapoor thus mean that the role of IT departments change

when applying self-service, and Vinay Kapoor have pointed out that the primary task in IT departments will be to provide the infrastructure, i.e. to manage and enabling Business Intelligence (5:19). Sandra Sakratidis have stated that the IT department primarily will prevail in order to get data qualified (7:21), while Thomas Svahn points out that the support of decision making can be supported by a special department (3:20).

4.3.2 Social context

As we have questioned about how BI function operate within firms, we asked about their structure and responsibility. In Questions 7 and 8 we explore who provide decision makers with information that decision makers need, i.e. where the responsibility lies when providing self-service (see Table 4-8).

Table 4-8 Responsibility and roles for support in organizations

Interviewee	Quotation
Thomas Svahn **Advectas**	"From IT's perspective, a lot of people talk about responsibility; who is responsible, from of IT department side. They want to know how much they take responsibility for." (3:18)
Murray Grigo-McMahon **Qlik**	"[...] data governance becomes the headache as all of those things [in the self-service world]" (4:8) "[...] So with that kind of governance around the data is incredibly important in the bigger and more structured companies." (4:16)
Vinay Kapoor **Qlik**	"They will not go to IT department for self-service BI to ask for a new report or new visualization because they can do it themselves. So it makes IT's job a little bit easier, [...] instead of having to support the every user's need. They can support the basically infrastructure." (5:21)
Ingemar Carlo **Qlik**	"[...] it is absolutely crucial that everyone is looking exactly the same metrics where IT has being total control of what people are measuring because, if there is any discrepancy, they could make the wrong decision and they could have legal consequences." (6:28)
Sandra Sakratidis **Affecto**	"[…] Another cornerstone is how you steer the organization's roles and responsibilities. It is part of the data. [...] They need to have a clear roles and responsibilities there. And also another thing is the competence as I mentioned." (7:31)

In terms of social context, the major quotes have been represented according to our respondent's explanation regarding how appropriate self-service approach within different size and structure of companies. Somewhat surprisingly, all respondents have stressed that self-service might be appropriate in both big and small companies, but the need and thus the usage among users does not directly differ in terms of company size. However, Sandra argued in a confident manner that the structure of the company is a much stronger factor which affect how organizations incorporate self-service in the BI systems (7:31). Further, Sandra Sakratidis argued that the structure of companies depend of their size and culture. In other words, the size does indirectly influence how viable self-service is in companies. Similarly, both the usage and need rather depends on what industry the companies are in, and the role that the business people (users) have. Murray has mentioned that there is a difference between big and small companies, since bigger companies have a greater concern regarding data governance and permissions among users. Even further, Thomas Svahn and Sandra Sakratidis pointed out that big companies are likely to use static reports to a greater extent, due to the governance implications which cause them to restrict who (which organizational members) that are allowed to access only specific information (data). Due to this, it might be difficult for bigger and more structured companies to change the their approach towards self-service. Thus, all informants mean that self-service imply a change for IT departments, but our informants describe the change differently. Sandra Sakratidis mean that IT department have development role (7:27), while Vinay Kapoor (5:19) and Thomas Svahn (3:9) state that the responsibility might be placed elsewhere.

4.4 Technology

In this part, we present the empirical findings regarding *Technology* element of PACT framework, and this section is structured in the same way as chapter 2.5 in our literature review.

4.4.1 Content

In this section, we have questioned how different devices are able to provide self-service BI functionality (see Table 4-9), by presenting adaptable information content (Question 12).

Table 4-9 Using self-service BI on different types of devices

Interviewee	Quotation
Thomas Svahn **Advectas**	" [...] of course there are lot of different technical capabilities. There are still to be found really good self-service BI solutions on mobile devices." (3:36)
Murray Grigo-McMahon **Qlik**	"That's a fully flexible application that can do all the matter of things. It can go from being a single set of dashboard to a couple of charts on, to an incredible rich interacting experience with lots of logics inside it, basically a piece of software." (4:10)
Vinay Kapoor **Qlik**	"So one things that I can say that the user have a lot responsive of these things in order to be able to distinguish between devices. So there are techniques, tools, which are using responsive [design] [...]." (5:31)
Ingemar Carlo **Qlik**	"When you look at mobile devices they are coming from many sizes, and depending on what kind of mobile device you use you want a software to adapt to the screen size in an effective way. " (6:34) "Few years ago any QlikView App would be develop using with very standard windows environment. Now that is not much the case. You have to have a better knowledge of the latest HTML5 and presentation techniques." (6:59)
Sandra Sakratidis **Affecto**	"For a standard reports and that kind of information it's ok. But I think there could be more features within tablet. That is for data discovery tool for laptops and computers, then I think that there are some great tools to use for the self-service BI." (7:41)

In selecting a suitable device or technical environment is a significant factor for the business people during the decision making (4:27). Due to this fact, developers should be aware of making easier for the business people to support their decision making process. Vinay Kapoor has explained that developers in today use new technologies such as responsiveness to detect which device the user has and visualization is adapted automatically on the dashboard size (5:31). Using these new technologies has been also seen by other respondents (3:38; 4:35; 6:34; 6:59) and Thomas Svahn has also pointed that there are several other functions on mobile devices to improve the business people's decisions (3:36). However, Sandra Sakratidis has also the same thought with more functions on tablets and thereby using self-service BI on tablets is user-friendly environment.

4.4.2 Input and output

As we have asked Question 13, we have explored what self-service functionality actually means for users, how they are supposed to change the output (content of a dashboard) by making more input Table 4-10.

Table 4-10 Input and output when using self-service BI

Interviewee	Quotation
Thomas Svahn **Advectas**	“From technical perspective, there is very light self-service thing and there is very deep self-service thing. Self-service is very deep and close to actually building a real BI solution” (3:31) "The different kind of self-service BI, I mean, basic self-service and more advance self-service." (3:54)
Murray Grigo-McMahon **Qlik**	“If so that a developer couldn't find on the charts, now developers can define it in a list of chart that was viewable with specific data, like: plot chart, line chart, a table. They just cycled through [with a laugh in lack of hope] to bring that back home” (4:29)
Vinay Kapoor **Qlik**	"As long as you have a data source that will support, you can more and less click and import it instead of that in other product that you have type very complex SQL queries and you have to join, and you have to go somebody who is an expert on SQL to even bring the data." (5:43)
Ingemar Carlo **Qlik**	"This is different kinds of the self-service, where you are given the choice of which visualizations you want to see, or where you are allowed to define the dimensions and measures of what you want to see." (6:26)
Sandra Sakratidis **Affecto**	"When the data gets presented with kind of tools, it needs to be obvious what the meaning of the data is, like, if it is presented in the best way; It is the presented with the best colors; with the best kinds of graph for the information. If the right kind of information is highlighted and so on. Visualization is very big part in the data discovery tool." (7:47)

The level of self-service is considered as an important point by respondents and the definitions, such as advanced self-service or light self-service BI (3:54) has been expressed in order to present the differences. This difference comes from the functionality of the dashboards (7:47). There are means of addressing the level of self-service to certain the different visualizations (6:26) and all these user's choices are significant factors to determine which application is appropriate for the user (4:10). Whilst light dashboard gives little

opportunity to the users according to the user's skills and experience within BI, advanced BI or deep BI gives the user more functions (6:26). Finally all these terms have been expressed by bulk of respondents to show the different possible self-service for different user types. Finally, it is also mentioned that developers should also be aware of how self-service BI getting used in the first time by the users (4:12).

4.5 Summary of empirical findings

In terms of the four elements in the PACT framework (i.e. *People, Activity, Context, Technology*), we have presented and analyzed the empirical findings from our interviews. In the first element *People,* we have found that the requirements is to have a complementary tool which enable users to gather the information they need at the right situation. Self-service does however require more skilled users which are able to choose the appropriate data themselves. This thus require that users can see the data dimensions, if the data source is qualified, and how the dimensions are related to each other. As pointed out by our informants; in order to understand a better picture of how to design a BI tool for different users, it is necessary to identify several user types by People's skills, and needs based and their business role. According to our additional interview, designers should find the user types by conducting interviews and observations.

In comparison with the static dashboard, our informants have meant that decisions can be supported better. Designers have to open up the creativeness for users to find the data themselves and choose the visualization which fit their personal mental models the best. In self-service users are expected to not use just a single static dashboard, but they should also make real analysis by creating assumptions about the business and verify if they are correct by elaborating with data. All our informants have indicated that verification of these assumptions was too complex to be supported by static dashboards. However, informants have stated that such tasks imply risks, and indicate that self-service should not be used by everyone. The results from interviews have indicated that self-service approach is more appropriate for infrequent decisions in order be able to answer new questions which arise over time. Our interviews have stressed that it sometimes is easier and faster to get support and cooperate with nearby colleagues, rather than contacting IT support to qualify data.

All informants have stressed that size of organization is not determining if self-service is suitable, but rather People's abilities, skills, the business and thus the structure of a firm. There is however some indications that self-service is more suitable in small organizations, as they might not have any BI function which create the static reports for decision makers. Further, one interviewee has stressed that large organizations have more use of static reports, and should focus on maintain them rather than facing the risks with self-service BI. The risks are described as a data governance issue, to know who is the responsibility of the data quality and use. A further finding is thus that the role of IT departments might change.

Interestingly, one of our findings regarding *Technology* is that Qlik will as responsive design, which imply that designers won't have to enable adapt the dashboards depending on different screen sizes. Before this was required, but will now adapt automatically based users' personal choice of devices. However, the self-service BI features on tablets gives less input and output options than being on a larger screen (i.e. at desktop computers).

5. Discussion

In this chapter we discuss the research's empirical findings in our literature review, i.e. our PACT framework for BI. Each PACT element will be discussed in regard to the contingency variables. Finally, we present a summary of our discussion.

5.1 People

As several researchers (e.g. Benyon, 2013; Cooper et al., 2007; Norman, 2002; Young, 2008) have argued that each individual has different needs, goals and motivations, it might thereby be difficult to design a product for various users. Empirical findings indicate that users' needs and motivations depends on people's business role, which is supported by several researchers (Davenport, 2014; Golfarelli et al., 2004; Jenster & Søilen, 2009; Marakas, 2003) - the decision focus changes dependent on the job they have. It is thus possible to conclude that business strategy and people's roles in firms are reflected in the goals and needs of individual decision makers. We thereby consider that goals within organizations have significant influence on decision maker's requirements on self-service BI.

As our empirical findings show, the provision of information when using the traditional BI approach often fell short in providing decision makers with the information they needed. Our interpretation is however that decision makers do not want self-service per se, but rather to have the support for infrequent decisions without having to contact someone to prepare the data (e.g.IT department). The motivation is in other words based on mainly end goals and experience goals as described by Young (2008). We have interpreted that end goals are better at decision making. During the interviews we came across the term ‘freedom’; businessmen want to work without having to contact their IT departments, and want to create the new analysis based on new data. We have thereby interpreted that freedom (less reliance on IT) can be described as an experience goal.

For us it was however difficult to find any proof that life goals have been influenced by self-service capabilities. It is thus questionable whether life experience should be considered by firms in their strategy when designing BI. We thereby consider whether it is worthwhile to

explore if self-service is required by people based on their life goals, and thus if firms should incorporate such requirements by people.

In contradiction to Imhoff and White (2011) who have stated that the objective of self-service BI is ease-of-use, we would rather argue that the objective is to make better informed decisions, or as articulated by Simon (1996) to make more rational decisions. The objectives pointed out by Imhoff and White (2011) should rather be regarded as necessities of a self-service product, as ease-of-use cannot be expected of self-service due to the fact that people have to operate something by themselves. On the other hand, Norman (2002) also argues ease-of-use and states that complex dashboards can also be easy-to-use, such as complicated car dashboards. Within this discussion, we state that self-service BI might be more complex than the traditional approach, but it might be easy-to-use for the user.

Another important finding, is that people need to understand the business and where the data source originates from. More specifically, it requires that users can see data dimensions, if the data is qualified and how dimensions are related to each other. Further, users need to have the ability to explore the data themselves and to choose a visualization which best fits their decision support need. This corresponds to Marakas (1995) and Meyer et al. (2010) who explain that users must have the ability to formulate hypothesis and verify their truth. Our interpretation is that from both our empirical and literature findings are satisfying, it is possible to conclude that people using self-service should combine both technical and business skills. It is however questionable if all these skills are required for all users. This brings us to the discussion on different user types.

As our empirical findings indicate, designers at vendor have used Persona in order to distinguish different types of users with different skills and mental models. Meanwhile, suppliers use other terms to categorize their users, i.e. information consumer or power user. As mentioned before, there are several terms used interchangeably among BI users. While the terms of elastic, first-time, power and real users are used by (Cooper et al., 2007), *information consumer* and *information producer* is yet another way of distinguishing People according to Imhoff and White (2011). Davenport (2014) on the other hand has emphasized that people can be distinguished based on their roles and expertise, e.g. if they are a *hacker*, *scientist, trusted adviser*, *quantitative analyst* or *business expert*. Exploring these terms of users types have confirmed the idea of that different user types are indeed determined by how the users have used the product.

We can conclude from our empirical findings that different types of users are significant for designers at vendors and suppliers in order to make better and more useful products, as pointed out by Young (2008). However, we found a non coherent use of terms for user types among both scholars and our empirical findings. We thereby suggest that there should be a common terminology among vendors and suppliers to avoid any ambiguities of who the users are, and thus the design situation within BI.

5.2 Activity

Our empirical findings indicate that self-service BI, in comparison with the static dashboard, allows for a better support for decisions. In self-service, users are expected to not only use just a single static dashboard, but also conduct analysis by creating assumptions about the business and verify that these are correct by elaborating with data. This corresponds to our literature review as decision makers have to evaluate alternative choices in terms of their actions and then make either a rational or irrational choice (Boland, 2008; Marakas, 2003; Mintzberg et al., 1976; Simon, 1993).

In the decision making process, complexity in decision making lies with the amount of available decision alternatives (Payne, 1976). However, as also found in our literature BI is only supposed to provide support in identifying the decisions to be made (Griffith et al., 2008; Marakas, 2003). Moreover, our empirical findings indicate that verification of assumptions is too complex to be supported by static dashboards, and we can thereby state that static dashboards enable users but with limited functionalities to support decisions. Further, we have found in our results that designers have to open up the creativeness for users and allow them to find the data themselves by choosing a personal visualization. Therefore, we can conclude that designers face new design situations in BI. When evaluating alternative choices with self-service BI, it appears to be more flexible for decision makers. In contrast to all the benefits of self-service, our empirical findings identify a concern that self-service imply users may pick unqualified data sources, which we deem a result of users requiring more business and technical skills.

An even further explanation of decision support complexity in BI systems, is the activity whereby decision makers are “on the lookout” for information and knowledge which is needed to support their decisions. In our empirical findings, we have found that traditional BI

systems are used by having so called static reports, while self-service BI enables the users to make business discoveries. This corresponds to earlier research that decision activities can be categorized as exploratory or discovery (Marakas, 1995; Meyer et al., 2010). Thus, we agree with Meyer et al. (2010) that all these decision making process is complex as the variety of data (i.e. large scale) with many variables, as it increases the amount of alternative decisions. We thus can conclude that decision complexity (variety of variables) can be handled better in self-service BI.

We acknowledge, and as articulated by Marakas (1995), that the combined usage of expository usage and discovery usage will provide a more generalizable way of problem-solving and understanding of the problem domain. It might thus enable decision makers to support their decisions better. This can be suggested as a future research. It is however important to point out that interpretation is that self-service approach will not substitute the static reports, but rather complement and increase the opportunity to support decision making. This is also supported by Marakas (1995). Also, in contradiction to the use of BI systems, our empirical findings show that decision makers might take decisions without using any BI system. This can be cause due the importance of making rapid decisions, as time is critical factor for decision making (Benyon, 2013). This also correspond to the irrational decision making as explained by Simon (1993), as our understanding of irrationality (i.e. rapid decisions without using BI systems) thus might causing that incorrect decisions can be made. We further believe; if discovery activity becomes more common by using a self-service approach, maybe the irrational decisions becomes less common due to the fact that self-service potentially can increase the rational decisions. We can however conclude that designers need to consider which information that is important, in order to understand which decision support that should be enabled by BI systems.

In our empirical findings, we found that there is a gap between business people and IT people, due to that decision makers have to go It departments to request new reports. As pointed out by Benyon (2013), significant factor in BI tools is cooperation which is regarding of completing activities alone or need to work with other people. Similarly, as pointed out by one interviewee, people are likely to go to the colleague nearby rather than contacting IT. Our interpretation is thus that self-service BI might enable the users to complete tasks (i.e. decision making) themselves, but that self-service also might imply that support for activities are provided by other decision makers. This brings us to the social and organizational context.

5.3 Context

Initially, our empirical findings indicate that viability of self-service does not depend on the organizational size, but rather on the business and the structure of firms. Hence, the business and structure also change how IT departments work. One interviewee even stated that IT department should not be the primary support for decision makers in a BI system, as the IT department would be overwhelmed if they supported every single app and dashboard.

The structure of an Intelligence functions has been thus explained by Jenster and Søilen (2009), as organizations might have structure their BI functions accordingly to one or several organizational models, i.e. there is no single best structure for all firms. In line with this, our empirical findings indicate that firms, traditionally seen, have structured their BI functions in a top-down approach, where the IT departments were in charge of the IT strategies, delivered static dashboards and also acted as gatekeepers for BI users who requested changes. As our result indicate, the self-service approach might thus imply, that the structure of a BI function in firm's change, and for IT departments' their evolved role in the BI function to manage infrastructure and enable flexible use of BI systems, rather than only delivering static reports. The role of IT department are in other words been changing and we have found that IT departments' new role in the BI function is to manage and enable, rather than delivering, in other words the IT departments can support decision making by qualifying the data that decision makers are using in the BI system.

We do however find it important to point out, that static dashboards won't disappear. And as Thomas Svahn specifically wanted to underline; large organizations still need a traditional approach as it can fulfill much need of information for decision makers with our using self-service. Further, Thomas Svahn stated that self-service BI should be seen as a complement to the traditional static reports (3:16). As we agree with Thomas, we thereby emphasize that there is still a need for static reports, especially in large organizations.

As suggested by Jenster and Søilen (2009), firms can structure the support for decision Intelligence work in nine different ways. What is important for BI designer is however, as out by Benyon (2013) that designer should consider the social context where activities (decision making) take place, as it may dictate the acceptability of a design. Benyon (2013) further describes that firms need a supportive function which can provide help for activities, i.e. decision making. In line with the bottom-up model as articulated by Jenster and Søilen (2009), users are more likely to solve problems themselves, but support and responsible for

data security, i.e. who has access which data and when they gain access (Benyon, 2013). More importantly, despite the security challenge, our interpretation is that firms who wishes to use self-service should allow the so called bottom-up structure.

As we earlier stated that IT departments have acted as gatekeeper in firms as they acted in a top-down approach, self-service and thus the bottom-up approach might affect that IT department's role will evolved. Sandra Sakratidis specifically stated that IT departments will have a new role, as IT departments did not have a development role before. We can thereby consider that who will be responsible for data and security, i.e. there will be ambiguities in firms. As one interviewee, Thomas Svahn has pointed out that in some firms, Business Intelligence Competence Center (BICC) are used (3:9). This is supported by Jenster and Søilen (2009) as firms can have specialized departments, but it might also imply problem as skills which are needed in the organization, moves and becomes isolated in the specialized department. We can thereby conclude that specialized departments can be one way of structuring a BI function, but that especially larger firm's should consider several models and that the choice depends on the firm's resources. Perhaps we believe that specialized departments (i.e. Business Intelligence Competence Centers) might be complementing the role of IT departments. Taken together, we can thus conclude that design situation has evolved for BI systems, as designers have to consider both static and dynamic dashboards.

5.4 Technology

Our empirical findings show that input and output differs depending on screen's size, which also is supported by Tona and Carlsson (2013), who have evaluated the usability on Smartphones, tablets and PC/laptops. As pointed out many times earlier, the use of self-service BI as a technology is increased flexibility, in order to make explorations and discovery. However, as our empirical findings further show, there is currently a lack of ability to use self-service on mobile devices, but the ability to use self-service at different devices might evolve and thus expand in the future, especially on tablets. However, the ability to use self-service will probably always be higher on a larger screens, which also is pointed out by Meyer et al. (2010) as the ability for exploratory use increases at larger screen sizes. In other words, it will be easier for a user to investigate new discoveries and thereafter the new perspectives with data will be explored easier in larger screens.

In terms of input and output at one screen, we believe that designers should facilitate the business discovery by giving more "freedom" to the users. This contradict that Cooper et al. (2007), who have explained that it is important to have a Visual Design Framework in order to determine which or how different types of dashboards will be used. Our interpretation is however that this might be less important for designers in the future.

Further, Tona and Carlsson (2013) have pointed out that the type of devices used by People can be categorized into user groups based on their business need. Due to the fact that user can have different type of devices, designers have to consider this, but a surprising finding in our study show that designers do not need to consider which device that users will be using in the future, as the interviewee at Qlik mean that their product use responsive design where the visualization adapt based to a device's screen size. Our interpretation is thus that this funding imply changes on the design situation, as designers might not have to configure each dashboard for each different device among users.

Our empirical findings show that designers might need to have skills in the new web development techniques, but designer do not need to consider different device as much as before. In other words, the new technologies change designers work. The new technologies used in BI tools are using responsive design. Thereby, dashboards do not need to be created for different devices, because all dashboard size adapt to different screen sizes.

Surprisingly, empirical finding show that there are different types of self-service, namely light or deep self-service. There is some indication that the level of self-service depends on users' skills and which technology they use. We can thereby conclude that designers should be aware of how business users use the application, rather than the size of their devices.

6. Conclusion

In this chapter we summarize our research findings based on previously presented empirical analysis and discussion, which correspond to our literature review, i.e. our PACT framework for BI. As a result, we present the answer to our research question in correspondence with each PACT element. Finally, we present reflections on our thesis and suggestions for further research.

6.1 Answering the research question

How does self-service influence design situations in BI systems?

The purpose of our research was to show empirically how BI requirements have changed with new capabilities of self-service BI systems. In our research, we have explored how self-service BI influences analysis and design phases, and thus how design situations are influenced by self-service approach. We have also adapted the PACT framework for BI in order to show how the design situations have evolved.

This study demonstrates that people's requirements differ depending on their role within the organization, their business goals and their needs. Designers need to know that for decision makers, their experience goal is to use self-service BI with freedom, while their end goal is to make better decisions. Depending on the decision makers' goals, designers should allow users to choose variables, dimensions and visualizations themselves. The variables and dimensions thus depend on which business role the decision maker has, which can be categorized by their level in the organization. Some decision makers have a need for making infrequent decisions, and therefore might need to support decisions by exploration of new data to make new discoveries, while others fulfill their need for decision support by using static report. In other words, discovery enables decision makers to consider more decision alternatives, but discovery is not always needed. The challenge for designers then is to know which decision makers have sufficient abilities and skills to use self-service, as decision makers are required to have both skills about their business and the ability to create and validate hypothesis. As self-service implies that BI users' skills are of increasingly varying nature, it demands that

various skills and mental models should be taken into account by designers. Designers should then consider which level of self-service BI should be used by different decision makers.

Also, in respect to organizational structures, designers need to know that the role played by IT support might have evolved, towards e.g. a bottom-up or special department structure. Designers should acknowledge this, especially as our findings show that there are concerns regarding data quality and data responsibility, particularly if users are supposed to include unverified external data sources. This demonstrates a challenge for designers, as they have to recognize which decision makers will access and use specific data.

Finally, in respect to new technologies within self-service, designers do not need to consider that technologies differ among different devices, despite changes in screen size. Interestingly, the content does not differ, but only how the data is presented by visualizations. It is more important that designers allow for appropriate variables, dimensions and visualizations which users can choose between, and to assign appropriate controls for how the content should be presented in different formats.

6.2 Significance of the findings

Throughout our study, we have found that self-service BI should be seen as a complement rather than a substitute to traditional BI. This implies that designers have to consider a more complex design situation. Further, our study has contributed to existing literature by providing an adapted PACT framework for BI, which can help BI designers improve their understanding of a firm’s business and thus the design situation. Our adapted PACT framework for BI might be used by designers to create Personas and scenarios in their own design of BI systems. Further, we claim that Personas could also be used by consultancy firms in order to design appropriate solutions for different types of users. We empirically showed how our adapted PACT framework can be used to distinguish users and their needs, which is of significance as designers struggle to understand these needs in BI systems. Thus, we consider our adapted PACT framework for BI to be useful as a guideline for empowering users. Our study has also contributed with some indications of how designers' and IT departments' work are affected by self-service BI.

6.3 Reflections and suggestions for further research

In terms of defining the user types, we have found that designers at Qlik are using Persona, whilst suppliers might use either information consumer or power user. As we have found that the goals among decision makers are based on experience goals, we emphasize that suppliers might benefit in using a Human-centered design approach (e.g. Persona) in order to fulfill the needs and goals better. We also believe that there may well be a need for a guideline for users in how to design and use self-service, as the main idea of self-service is to empower users. Thus, our findings might be relevant to the HCI field, as there has been an ongoing debate on whether User Centered or Human Centered Design approaches should be given priority. In our thesis we found that User Centered Design can also be useful, and that the Human Centered Design approach might be more appropriate if BI dashboards are designed for large scale users. It is thus possible to conclude that our findings might be useful for research in both the BI and HCI field.

A further study is thus suggested to complement eventual perspectives which designers and users can provide. A study of the like might also result in a better adapted PACT framework for Business Intelligence. It would be worthwhile to study users' perspectives as a longitudinal study, and how decision makers perceive the use of self-service, in order to understand the suitability of activities in certain scenarios. Moreover, a further study could explore whether self-service is required by decision makers based on their life goals, and whether firms should consider incorporating such requirements. From an organizational perspective, another study might be to investigate how organizations support their decision makers by evolving the structure of their Business Intelligence function. Perhaps it would even be useful to create an assessment form, whereby the results would indicate whether the designers should design the dashboards, or if the users themselves should be allowed to create the design.

Appendices

Appendix 1 Interview guide

Part 1- Introduction and General Questions

1. Is it ok to start interview?
2. Can we record interview?
3. Can you explain your education-background and your current role in the organization?

Part 2- Strategy

4. Do you remember when, and why the self-service term first was introduced? Motivation?
5. How do you think strategy of delivering self-service is aligned with users' goal and need?

Part 3- Size and structure

6. Do you expect that self-service BI is more viable for small, medium or large organizations?
7. How would you describe that IT support should support decision makers in organizations?
8. In terms of self-service BI, does it affect whether the IT support is centralized or decentralized in the organization?

Part 4 - Environment and task

9. Do you have a scenario how self-service BI should be used?
10. How do you think that self-service BI will affect on decision making process?
11. Do you think self-service change the difficulties and risks for decision makers?

Part 5- Technology

12. How have you distinguished the use of different devices, and does self-service BI have differ on the such devices? How sophisticated do you think the technology is, can dashboards be redesigned by users?
13. Which kind of risks do you expect in using self-service BI functionality today, and in future's technologies?

Part 6- Individual

14. Which analytical skills are expected by the individuals (different user groups) who use self-service?
15. How would you describe users' request/motivation of operating BI as self-service, in comparison of being served by IT?

Part 7- Ending questions and closing

16. How does self-service BI influence the lifecycle of BI, in terms of analysis and design?
17. Do you have anything else to add which you think is important?

Appendix 2 Informant guide

Dear ...

We are two master students in the MSc program in Information Systems at Lund University. As part of the program, we plan to conduct a study which will result as a master thesis in Information Systems. This document intend to inform you (as a potential informant) about our research purpose.

Self-service is expected to empower users with the ability to use BI products in a more flexible way. However, there exist some ambiguities what self-service actually imply for BI designers. For instance, there exist a risk that users misinterpret (analyze) data incorrectly and miscalculate significant variables, which might cause that decisions are based on bad data analysis. Also, it is unclear how self-service will affect the delivery of BI dashboards, and thus affect the level of IT support that users will request in the future.

In our study, we will perform qualitative interviews among managers at vendors and suppliers, working with self-service BI. The purpose of our research is thus to empirically show how BI requirements have evolved towards the usage of new capabilities that self-service BI systems provide. Thereby, the contingency theory by Fred Fiedler and the Persona by Alan Cooper are used to construct the model and to analyze the collected data.

In our research we address this by the following research question:
RQ: How does self-service influence design situations in BI systems?

Form a ethical point of view, the participation as informant is voluntary and can be cancelled at any time. The interview will be transcribed, and a copy of final interview protocol will be sent by email for your approval.

We would appreciate if you agree to participate in our study.

Yours sincerely,
Doğan Alkan
Robin Carlsson

Appendix 3 Interview transcription of Advectas

Interview with Advectas- 17.04.2014

Interview Duration: 43 min 31 sec

Thomas Svahn (TS) – CEO and Consultant Manager

Doğan Alkan (DA)

Robin Carlsson (CS)

Line	Speaker	Text	Code
1	DA	Can you explain your education-background and current role in the organization?	
2	TS	I have a Master's degree in Business Administration- Civilekonom in Swedish. I have been working in Business Intelligence profession for about 15 years. I have started a Management Consulting and then moved into more closer to IT. My role today is that I am the first enforcement and deputy CEO in our company. I am responsible for our Microsoft delivery so we have lot of Microsoft consulting including self-service consulting. And I am also consultant, to help the customers with Business Intelligence Strategy. I have a few customer assignments that I work on. Most least I talk about Self-Service BI with our customers and try to figure out how they should use that.	
3	DA	When have you used the term of self-service BI the first time, do you remember the history and motivation for that?	
4	TS	I think it might be like five years ago, and I think it was Microsoft to start talk about it [self-service BI]. They talked a lot about it when they released their Power Pivot tool. It was around 2009 or 2010, so it was five years ago.	
5	RC	That sounds correct.	
6	DA	Thanks for that and I would like to add another question. Which was the main motivation for the implementation of self-service BI?	
7	TS	In my opinion, it is coming from the fact that the traditional BI approaches to traditional BI tools did not come all the way in implementing Business Intelligence in company. Five years ago, all BI was related almost too standard reports, from for example Cognos	GM

		Business Objects, Microsoft Report Service and such tools. Those tools are very technical and take very skilled professionals to build the reports. So the personal need for everybody, I mean everybody has personal needs for BI information. With the traditional tools, techniques and methods we could not deliver that to every person. There were a lot unhappy users out there and they didn't get what they needed. So they started to look around for other approaches, they started building gigantic BI tools or using only Excel which was meant not to be used in that way. So they did it without consulting IT department in a company. There was a long line of needs that was not fulfilled, so there was a need for something to happen. One correspondent that came up on that time was self-service BI. And another thing, I don't want discuss for, but another closely related area was the emergence of data discovery.	AS GM CO GM
8	RC	Yeah it was a good answer actually and it brings to next question. How is self-service being incorporated and how does it change the firm's strategy for BI?	
9	TS	The companies or organizations that really embraced this [self-service BI] changed a lot on how they work. In my opinion, there are still lots of organizations that still think in the old way of BI thinking. So they still think that every BI need should be fixed in the standard report. The companies which really embraced this, started working differently. Swedish Business Intelligence Competence Center (BICC) consists of maybe two-three-four BI developers and then there are people in your organization that are counterpart in the organization. So there is big difference between IT people and Business people. The companies that really embrace self-service BI, closed the gap between the IT and Business. Either if it is IT people who get more into the Business side of thing, or Business people who get more into the IT side of things. They closed the gap and bridge the gap between IT and Business. They do that using self-service technique and methods. It also changes how IT works with BI instead of having the responsibility to create full completed BI solutions with reports and portals. Maybe they have responsibility instead of creating the basis, in forms of Data Warehouse and different kinds of Data Marts. Then it is up to self-service business oriented people to work from there and onwards - using tools like Power Pivot, Tableau, Cognitive Insight, and of course QlikView is also a part of this.	GM SC SC CO SC
10	RC	Very nice answer and you have actually answered another question.	

11	TS	I am sorry for that.	
12	DA	No, it is really good answer.	
13	TS	Yeah, I have problem to talk very shortly.	
14	RC	That's no problem for us, it is good [everybody laughing]. So, the next question. Do you expect that self-service is more viable is certain organizations, with specific size? Does it differ between small, medium and large organizations?	
15	DA	I think you have also more knowledge about the users and their organizations size. Which organization are more appropriate for self-service BI? Do you think that it might vary between these organizations?	
16	TS	I think in some way that self-service is viable for both types of company in different way. Because big companies have still the traditional BI approach and they should still have the traditional BI approaches. Lot of information Business Intelligence is fulfilled with traditional portals like BI tools like standard reports and so on. In big companies self-service is more complement to find all related need that will never be fulfilled with the traditional IT BI support. But in the small companies, which does not have any big resources, they do not have BICC and then BI tools and techniques might well be the full BI solution. I mean they don't have BI platform at all companies. I don't know what you mean by small companies if you talk about 10 or 15 employees, something like that. Maybe they don't have a BI tool. Maybe they have one QlikView License or something like that. But they have more self-service approach when they are constructing their BI solutions. Do you understand what I mean?	OC SC
17	RC	Yeah, we understand that exactly and it is the answer we expected. I think we can continue the next question. In terms of IT support, how self-service affect the how the IT support work? Do you think that IT support becomes more centralized in organizations or rather decentralized?	
18	TS	I think that if I really take this into consideration - they [IT Department] change how they work with IT support. From IT's perspective, a lot of people talk about responsibility; who is responsible, from of IT department side. They want to know how much they take responsibility for. If you have traditional approach and they build full solutions with standard reports on top, they cannot take the responsibility for the full	SC

		solution, they can only take responsibility for the correctness of the figure that they are presenting. If we cut the lot of that - so that we don't have standard report, we don't have any portals, maybe we don't even have any cubes that IT department can take the responsibility for - who will then be the responsible for the figures that has been presented and in which BI tools they are using. Do you understand the problem?	SC
19	RC	Yeah information responsibility problem.	
20	TS	Information responsibility problem. This is a big issue for the IT department. When we talk about self-service BI, they are very terrified about that word. Of course normally it is the IT department that have the responsibility for IT Support and they are a little bit reluctant in changing how they work, even though I think that they should change how they work. They should have maybe satellite [place of responsibility], IT support satellites or if you might say so also satellites to Business Intelligence Competence Center that are located in outside in the business. There are working like maybe business controllers and they are the Master's of self-service BI.	SC OC
21	DA	Do you have any scenario how self-service BI should be used?	
22	TS	Do you mean Business Scenario?	
23	DA	Yeah. A simple scenario for getting information about users, and which kind of problems they might have by using self-service BI?	
24	RC	An example?	
25	TS	From my perspective, there are lot of different perspectives or scenarios were this is possible. One very comment situation is that we have business user and maybe business controller that are working following up prognoses or the figures. And they have in the standard reports and have a lot of information and they build into this information, in order to find the problem that have occurred somewhere. When they reach the lowest level and the smallest detail that they can find in the standard solution, they still don't have the answer to the problem, because they like some data that they need in order to complete these analysis. That's a common self-service problem. So, if they have self-service capabilities, if they have self-service tools available, they can move on and add data to that analysis in order to understand what the real problem is. Even though data might not be available in the standard solution.	DC IO
26	RC	How do you think that self-service BI will affect the decision quality?	

27	TS	I think it will improve the decision quality drastically.	
28	RC	Is there any risk or is it only good?	
29	TS	There are lot of risk. The risk that IT departments normally speak of is that they are not 100 % sure that the data they are looking at is correct. Because it has not been tested 55 times and it has not been quality assured in so many ways that will be made in a standard BI solution. BI developers are very skilled persons and they know a lot about data, relationships in data. If you make a self-service report [for users] and if you don't understand the data that it is based on, you make very bad decisions. But I think that risk should not be overstated. We have maybe 100 % of all the information that company needs in order to make the right decision. I think, in my world, maybe standard BI solution can be maybe 25-30 % that is total need. So the other 70 % needs to be fulfilled in some way. Lot of information needs to be fulfilled by people talking to each other, calling each other, and reading unstructured data, so on, in order to find out more things. I think also that maybe 10-15-20 % could be fulfilled by using some kind of self-service solution. They can enrich the standard data that they already have or they can actually add new data to complete their analysis. Maybe 5 % of the time that they do that [adding data to the analysis] - they come to the wrong decision, because they don't know how the data works. But the other 95 % is just fine and of course made the all the picture very much better.	DC UT GM DC
30	RC	Can you categorize or distinguish who the users are of the self-service?	
31	TS	Yes, I can but for me, it is a very big difference (between the users). I think self-service concept is very wide and big concept, and there are very different kinds of self-service. From technical perspective, there is very light self-service thing and there is very deep self-service thing. Self-service is very deep and close to actually building a real BI solution. Are you technical people and do you know Power Pivot?	IO
32	RC	Yeah.	
33	DA	Yes.	
34	TS	So in my opinion, self-service BI using for example Power Query and Power Pivot in Excel - is pretty deep self-service and you need to be quite technically skilled in order to work with these kinds of things. For me, self-service light is just to learn using how to use Excel	IO AS

		PivotTables against the originate cube. So for me, that is self-service light or some kind of analysis and so on. Depending on which end of scale [user skills] you are on, you have pretty much very different users. Regarding the deep self-service BI, the more technically skilled self-service BI - it has very small amount of people that can actually do that. If you have a company that have BICC with four BI developers, maybe three-four persons more that will work with that kind of very differences of self-service BI. But on the same company, it might be 500 people that work with self-service light. So it depends on what you mean and how you define self-service Business Intelligence.	UT IO
35	RC	Very interesting perspective. It is actually why we are writing this thesis as well. If we move over technical things, can you describe any use on different devices? If the use of self-service BI differs from different devices, like laptops, tablet or cell phone?	
36	TS	Yeah, of course there are lot of different technical capabilities. There are still to be found really good self-service BI solutions on mobile devices. It is coming right now, I don't know if you have looked into QlikView.Next, for example?	TC
37	RC	Yes.	
38	TS	I mean, that solution or implementation will complete with BI solution using on iPad. But normally, before you develop these kinds of solutions on laptops or similar machine, then you present it. That makes self-service available on other devices and then computers. It is more like consuming and light analysis. The thing that you will normally do a PivotTable in Excel. I think it differs a lot. Maybe it won't in three-four years, but in this moment it differs a lot.	TC IO
39	DA	Yes, we can move on the other technical question, I think. Which kind of risks do you expect in using self-service BI? Today's technology can differ in different situations or technologies. Do you think that it might be risk for self-service BI?	
40	TS	We have talked about the risks before. The risk over information quality and so on. Do you mean technical risk?	
41	RC	No, actually you have answered a little bit before. Ok, let's take another question here. Actually you answered that as well.	
42	TS	Yes, I talk a lot.	
43	RC	Could you just distinguish which skills users need in order to use self-service?	

44	DA	You have talked about a little bit technical skills users should have.	
45	RC	Can you say something more about this?	
46	TS	Yes, I can say- no worries. It is of course again, it [skills of users] differs between which kind of self-service light or self-service advanced. The basic thing is that user of self-service BI compared to normal BI user, needs to be more aware of the information contents, how the information is structured. They need to be more into and understand what are the dimensions, what are measures and how information is related to each other. So that competence is very important. They need of course to have understanding of the actual tool that they are working with. It might be Power Pivot or so on. But I think the information actually is a big points of using self-service BI because the business information side of this, it is something like that business side normally has IT developer but normally they does not have. So it is very big point of using self-service BI because the users actually know their business. So going to IT to ask for a report is one step too much. If they can construct that, they are themselves more keen and served to understand these sort of things. So that is a big point. But of course they need know more about the information and have knowledge about databases and IT in general, to work with this [self-service BI].	UT AS GM GM OC AS
47	RC	Yes, actually we have only two more questions now. How would you describe the user motivation of using at BI tools with self-service instead of traditional way that IT delivery the dashboard and report?	
48	TS	The ability to have control and the ability to do analysis that they want to do, that's the driving force. They are not in hands of IT department in order to get the information they need to run their businesses. So this is the main thing. Five years ago BI, there was a big queue of people that are standing in the line into the IT department's room, to get all the reports constructed for them. Now they can do that themselves and they do not need to stand in that queue any more. They can build it themselves. Of course it is not everybody that will do it. It is maybe 25 % of users, but for them it is very important thing. Also these 25 % of the users can also provide the other people the information. So they are becoming like BI developer for other users and managers in the organization.	GM OC TA UT
49	RC	Are there any situations that users do not want self-service?	

50	TS	Yes, there are a lot of times that self-service is not good. There should always be a standardized BI solution that take care of the biggest information need, the information that should be provided over time. It should look the same for month after month, for example the company's profit and loss statement. In order to able to control the business that should be very consistent. It should not look different every time you present it, because the user is maybe not the most technical ones and will have difficulties of understanding the business. There are lot of standard reports that they need. When new generations enter the company, this need will become smaller and smaller and need for self-service BI will come bigger and bigger. It is very big challenge for IT professionals and BI professionals due to get on that wagon, to provide them with the tool they need, to change our state of mind, and how will look on Business Intelligence.	GM GM OC
51	RC	Now it is our last question. If you think of developers, how does self-service BI affect their work, how they collect user requirements and how their work is changed basically?	
52	TS	It has become both easier and harder because when BI developers have users on the other side, that has requirement, and those users are well-trained in terminology that using Business Intelligence. They will have to be much better to easily understand each other. The business people will be better to find setting for the right domains and asking for the right things. On the other hand, when it is more difficult - maybe they will not provide a finished solution which they can take full responsibility for, all the way. They will provide a solution that is valid to 50 % and the user themselves will make the solution ready by using BI self-service techniques and tools. It is a little harder to say that "yes" you have delivered what you were supposed to deliver as an IT person. The actual result is maybe not as easy to say that yes, you have delivered what you were supposed to. That is a difficulty of course. And that is big difficulty for us to change our state of mind, you know the Swedish expression "Make learn old dogs how to think". There are a lot of IT people out there, who have been working on the field for 20-30 years. They are used to working in the old fashion way and now a new generation is entering in the arena, they have other demands, they are expecting more mobility, they are expecting to be able to do more things themselves, they do not want to be on hand of IT person. That movement in the state of mind is big challenge for the IT developers in Business Intelligence.	AS OC SC SC SC

53	RC	Is there anything else you would like to add important?	
54	TS	I would just ask you the question. The different kind of self-service BI, I mean, basic self-service and more advance self-service. Do you agree?	IO
55	RC	Yes, actually that's why I found so interesting as well. There is no consistency actually. Some actually mean, what I heard at least, that something that self-service is that you can drill-down in the BI tools, and some says that you are supposed to create a new data model and mash-it-up.	
56	DA	And from another perspective, you can also select the data sources as well. Because the first or general idea of the self-service BI was only to change or provide new reports from the same data sources, but now we are talking about the changing the data sources. It is becoming more interesting topic.	
57	RC	And in the academia, university, that's kind of that we hope that our thesis will provide some clarification somehow what is self-service, actually is and what it means. Because it is not actually very clear, not among in the academics.	
58	TS	I understand. I am not 100 % sure that in five years self-service BI will still be an important topic because I think it will very much be incorporated in the way working with Business Intelligence. Right now it is still phenomenon and I think it is a good thing you are digging into this phenomenon. But I think it will come natural in few years. For example, two years ago everybody talked about mobile BI, as that's the new big thing and today mobile BI is already here, everybody expects it, so it's not a big issue anymore. I think maybe that will also happen to self-service BI. It will be incorporated and it will be a normal part of BI. I think it is very interesting that you are digging into the topic and then try to make it a little bit clear on what it is.	GM GM
59	TS	I think it would be interesting if you talk with some customers, some users from different perspectives. I don't know if this is your scope, but for example; "How does big companies look at self-service, e.g. IKEA?". "How do they view it, is it a threat or is it a possibility?" if you talk to someone like me or with someone at Qlik, we do of course know what self-service is. Of course, users might not know what it [self-service BI] is, it might be interesting to know how they see the scope of things.	

60	RC	Yeah, we also thought about this, and that could be future study, but it is not the scope of our thesis. Thanks for interview.	
61	TS	Ok, I would also like to read your thesis later. Thank you.	
62	DA	Sure, thanks for the interview, bye. "Glad påsk!"	

Appendix 4 Interview transcription of Qlik

QlikTech- 17.04.2014

Interview Duration: 54 min 23 sec

Murray Grigo-McMahon (MG) – Director of User Experience

Robin Carlsson (RC)

Doğan Alkan (DA)

Line	Speaker	Text	Code
1	RC	Can you explain your education-background and current role in the organization?	
2	MG	So my name is Murray Grigo-McMahon and I work at Qlik and I look after the User Experience for the new generation of product, QlikView.Next. My background is almost 20 years in Digital Media, and it started off from a Bachelor's in Communication Design and then went into a Master's in Multimedia. From then I worked for a long time in the web industry with both marketing, services and also with software. And the last five, maybe six years I have been working with analytics software and visualization software.	
3	RC	So what is your current role at Qlik?	
4	MG	So when I work with users Experience I mean that I help the team to design and understand the user interface for the software, so for QlikView.	
5	RC	So are you in contact with a lot of customers, partners, etc.?	
6	MG	So I set up the user experience practice at QlikView that means I build the team up. We have approximately ten people in the UX team there, so that is interaction designers, visual designers and there are also user researchers as well. QlikTech also has another area that we call the visualization team, which has spoken relationships with many of our customers that allow us to do assessments and evaluations in the early episode of the software development. User researchers go out and interviews with customers, and partners and developers within the internal part as well. So we have a lot of contact with as many people as we can. Personally I need customers, I need analysts, and I need	

		journalists and anyone who wants to talk about the product.	
7	RC	Ok thank you. Do you remember the history of self-service, and why the self-service term first was introduced?	
8	MG	No I don't. From my understanding, we at Qlik don't tend to use it that often [the term self-service], although it is the basis for what people in the industry as a hole talk about, self-service BI. We tend to talk about Business Discovery, and that's the space that we carped out – I think it was Gartner, as Gartner defined the sector around that, which is kind of a subset self-service BI space. And Qlik (or QlikView) was the company that defined that sector originally. So no one was talking about Business Discovery, and Business Discovery is not the strictly the self-service world. But, for most self-service is "Hey, here is the data, now go away and make your charts and analyze your data". There is now the data governance becomes the headache as all of those things come to play very-very quickly. With the Business Discovery idea, here is an easy way for developers to create dashboards and applications to analyze data. "Now go away and use an associate engine and their capability to use those tools that has been made for you, to continue to ask more questions". Because the way that QlikView works, the in memory logic, the associate engine and the adhered, that means it is not a series of queries. So you are not hitting a huge wall of like firing up a hundred rows of SQL queries, to wait for a month for them to come back – it is instant in-memory. So, we open the doors to business discovery and it kind steps sideways from this self-service thing [self-service BI]. It's there, it's underlying business or sector label for us, but we talk about business discovery. And I think that we will continue to talk about that in the future, I don't think that we want to position ourselves as self-service. But I know that it has been mocking around for a good amount of years.	SC GM
9	RC	Do you think that the term self-service differs from different vendors, like Qlik and Tableau?	
10	MG	So, Tableau and QlikView are always getting up together, because people can create charts and dashboards from the tool. I think that QlikView, that we try to encourage build the applications. So, build this app for a bunch of users, so go out and understand your audience, understand the people, the need, what their needs are, design the application to satisfy those needs. That has to be put into their identify. That's a fully flexible application that can do all the matter of things. It can go from being a single set of dashboard to a couple of charts on, to	UT IO TC

		an incredible rich interacting experience with lots of logics inside it, basically a piece of software. What's my experience, I don't do tend to look at it very often, but my experience with Tableau is from the end-usage part that it's given over to other people, it has to be just a dashboard. When you are using Tableau yourself as an analysts or someone who knows what he is doing, then it is very-very rich and you can keep analysis, creating new charts and your own stuff, but that kind of tool for other people that aren't as tech-savvy as you, it's just a dumb dashboard. And the tradition of Qlik is about people making a software application for other people to use.	UT
11	RC	So this brings us to the next question. What is the motivation for self-service, if it was that users should be empowered? Why do they want users to explore more?	
12	MG	From QlikView's point of view, we push it even further, we won't have self-service to be way more strict, we want users to be able to (and when we mean users - we talk about users as we mean business users – not developers) – ok, so we model their sort of ecosystem and think of them as an ecosystem – when you put QlikView into appointment into a cup, and particularly the new generation of it, you put a QlikView deployment in and there will be a range of users, from people doing ETL work creating data models, creating a new data layer, works clean and discover, make sure it's manage etc. – To enable it essentially, these people [designers] are creating applications to solve specific tasks; understanding the data, understanding the measuring of the data, so which KPI, how to measure them, and what the policies are at the company for measurement. Down to the business users, people need to consume that data. But also, that's what we want to back up with more, so that they [business users] can create the back-end needs and control spaces. So that they can be enabled to build their own charts to analyze their own approaches to do their own thinking – because we always been certain at Qlik – when you start the analysis part, basically – what is the next question? What's this new thing I have discovered? It's like the old way of reporting is static of course. So, you run this job, you get back a bunch of numbers that you consume –and you are like "Alright, new question". Then you have to run another job to another report, and then you come back. There is a point of QlikView ecosystem and the idea of QlikView itself [the product] is important as there is "Ah, a new	GM GM UT TA

		question, I will try to answer it now. I could just keep going, keep looking and keep investigating, keep sense checking, do real analysis rather than just read a report where I'm not necessarily really sure where it comes from, or what's underline - I can't sense check the number. So, for the next generation of Qlik, we've got a control blind differences, where it's got particular measurement dimensions, or fields that have built into the database, cleaned and compared and calculations on top in particular extra fields. They [the extra fields] have been constructed by persons who knows what they are doing, and knows what was has to be measured. Then I have business users, a community that distributes this to the community so that other users can construct their own applications, and charts and tables. So from a dataset with a few charts, or a few dashboards that they can start asking new questions; "But what if I turn it this way or look at it with this set of information on it" – which is self-service. But kind of beyond self-service, because it's partial, it's got this little governance on it, and it's really detail precision for making real charts. The other side of the back when you put the collaborative session on it – so if then you take imaging you got, people in the system building their own dashboards or pieces. Even in a totally controllable way. Then, you might want to tell a story about them, you might want to present them or to share them, you might want to take a dashboard that you've done, or enable it as a sheet in an app. And you can take that and go; "Ok, I'm going to share this with the members in my team, because I think this solves the problem better than the sort that I was given". But it is still safe in the way it's using right calculation, with the right fields, you still access the right data that is being managed and governed from a server solution – from the trusted developer. There is a lot of who creates what, and shared trust, management, governance has to come into all this, and otherwise you get people doing calculations. Just think if you take a data model, you might have particularly in Qlik's world, because we take data from multiple sources and build a model from that. You might have, maybe 300 fields and they may have really easy inherent names dependent on which data source they come from. They [the data] may not have any sense at all - any build, which build, the right one to do it, and some build look almost identical the way they interact and the developer and the trusted people in the ecosystem, these people creating the unique key apps and the data model, they know which one it is, so they define that as the main view in this particular app. So the end-users (business users) never need to go looking or know that or	GM CO SC

		be worried about the statements and all things. Now, companies like, how are they now called.. Business Objects and the people working with that, have always thought about the huge metadata layer, and their approach to do it - which is pretty much self-service BI, the goal behind the data and all things – now you have to go through all that data and create metadata layer in the same way which the business people bold and specify what, which takes months and years of work (!), which is really difficult to manage and problematic to look after as well [in the traditional approach]. QlikView has always been "oh, you don't do it in the app, no complex needed". You don't have to define the entire corporation from a view; "so this application and then you design it for that" a make a rapid application which is much more agile way of working, that doesn't take that much time to create, you put it out there, you work, you test it, or you can change it, or throw it away.	GM
13	RC	If you relate these more rapid use to [the firm's] strategies, why do you think that they need it?	
14	MG	I think it comes from the people ground actually, in a flow of their ordinary work, that they need to ask questions and needs the information. If you code this kind of traditional reporting approach to it, whereas someone goes off and define what this thing contain up from. They spend a long time in doing it, then they create a scheduled release where it does something overnight, or over the week because we've walked in places where... Like walking out of the door and ask for the business problems. Looking at their system initially, and they will have four or five weeks between getting their information back. We could turn that around into four to five hours. And that's what happened with the decision is that we can take them more quickly, they need that information right now, as the information can change over time. So, on the other hand, One of their customers which was a printing company, they were looking at which was a monthly reporting system, well great, and they were literally going to fire someone, since they had a huge dip in their services in the end of the month. And it made the reports queue that data, making them think that they had seriously a really bad projection. But it was a blass in that, and it came complete in the next month. They didn't have any ability to look across over those two months, because that report had not been filed yet. So that's the speed over hundred the data to look at either side of that point; "can I zoom out a little bit [?], can I zoom in a little bit [?]". That kind of need, the need to sense check the stuff you are seeing all of that time, you tend	GM TA IO

		to do that quite often thought, if you think about any kind of real analysis, you don't just follow a single path, you always go higher. So that pretty much include, right now I am going to rewind – now I am actually going to check "Was I right? Where did I make the states etc". I am a collaborative in this piece of analysis. You know, is this correct, these assumptions, a review is difficult with the statics report approach. It is much better if you can continue the solution so that you can ask questions. The problem is that the business strategy enabled service-people to work and understand from a very, very immediate need – as we use internally to analyze sales teams and analytic need to. All the collects of the sales managers, far out to "Do I have access to the leads generation tools, to can I see what is available now, and why are they walking to a meeting, or even in a meeting these things change." So in that kind of company it means seconds, specifically at the deepest.	TA
15	RC	Ok I think we've got the answer for the question. How would you describe that the usage need differ between small, medium and large companies?	
16	MG	I think it's not so much about the usage or the need, because the business users whether a small company or in a large company has the same need. "I need this piece of information now, so that I can make the decision in time". And that's the kind of need they have for these things, so they make the right decision. Now, whether they are a big or small company, then it steps in to the 'who are allowed to see it'. And is this the right thing for them to see, and what if they can see someone else's data of the other things which they are not allowed to see, and it comes into the whole governance part. And having a good system and a good structure, to be able to manage that; who sees what, when they see it. Making sure people are not using the hidden data and reveal things that shouldn't be revealed, of the critical issue in that certain industry. There is obviously as much as you heard at the presentation from Podio who talked about transparency. People who situated Buffer, so that everybody could look into everyone's salary, now in most organizations that would not going to fly, even within sales; you have Sales Managers for one Region but he will not be able to see his peers sales, so, but their boss can see both of them. So with that kind of governance around the data is incredibly important in the bigger and more structured companies.	GM TA DC OC SC
17	RC	Who is going to get which information, how do you collect such	

		information?	
18	MG	So that parse, in our world the developer play the role of a world area, defining these applications that answer the same question but of a different slice of the data. So regional analysis of sales is a perfect example for that, being able to have a single app, but if I am the country manager for Sweden I get tons of information all the Swedish sales rack, so all of that versus the manager from Germany. And it's been about switching the language, the currencies and all of those things. We have to build all that into the application.	OC
19	RC	Good example, thank you.	
20	DA	How does the self-service affect IT-support? How is the IT-support structured to support self-service?	
21	MG	So when you say IT-support that can be very broad. If they have to support every single app and every single dashboard that people produce, that is not going to apply, right [?]. They would be overwhelmed. Particularly when the quality of that software and information can go very-very bad. If you think about; I just make something up in Excel, I could stick a wrap around that and call it an application and share it with everyone. For IT that was expected to support that would be horrible. IT in general has been to organizations for a long while, and thought themselves as gatekeepers, and we even have a persona in there in a modeling, which is about them as system administrators. There are very much the not first questions that always is answered no, "you can't run that, you can't do this thing". And traditionally it has been a problem as well, we are talking about people who want to be able to build down the applications and publish them. But now, a better move, there is a shift as IT realize that they cannot be the gatekeepers they always want, that coldness is a fortress of security. It is a myth that is falling apart over the place, they start shift across industries to be more out, and we talk about the lock keepers instead. People that, they have to stop them, you can have access to this. And there are less code styles around it, it's much more about – "Oh you bring your own device, you can use that system or systems. It is now your responsibility to look after it". Whereas it comes this support on the individual pieces, the AX software and in the QlikView software as well. IT support would make sure that the app is actually up and running. So, the server is there and the infrastructure that supplies it is there – as we have administrator roles that look after the actual delivery of the services itself, making sure the roles around	SC SC GM SC SC

		security are in place, the apps a published etc. Then the applications themselves have the ability for people to build help into them. So there is a help in general for how to work with QlikView as a tool. But if you build an application you need to consider users and the range of them. Even we who are building software at QlikView have [several person] a four business users, persona as business users: one of them we call the *casual user*; another one we call *peripheral*, which is just pick up this thing ones in a blue moon, might check one and another. *Casual user* is very much the traditional consumer of dashboards, they open single sheets, they do look at the numbers, they get back to excel, and do the simple job. Now we have business users that are people who want to ask more questions, they want to create their own stuff. And then we have *sense makers* who are essentially your true analysts in a company – who actually create new data sources and add data into existing model, build more advanced visualizations. Now, all of those people need support in what they are doing. But the *peripheral* user – needs support on the actually things that they are looking at, so does the *causal user*. They need someone to take them through the tool that they have been given, and support upon that – and that becomes with the responsibility for the person who filter in the application - the developer. The ambitions of the *sense makers*, they become more around they need that support from the app beyond that, it could be that they need the content set for them in the dimensions; "What are these fields, what is this KPIs". They might often think like "Well, how do I create charts", so, as of what has to happen and supposed to work. But from a traditional IT support thing, it comes back only if while things seems not working, this is fail. You cannot expect IT support institutions that you sit there, and understand all the features of that software as well.	UT UT SC CO UT OC
22	RC	So is it not about the support of the actual data analysis and the decisions, rather than support for IT Infrastructure and the applications itself?	
23	MG	I think the support needs to be about IT support in the institutional world, has to be about delivering a service - and that's all. I think the application and the software itself has to do the work of how you use this thing [the BI software]. They shouldn't need to go to a centralized IT support for that [support in how the applications work]. Now we use a community as a strong source of that as well, we allow members to become a place of that, to go and ask questions about how to build	OC CO

		things and that they extended collaborative space. In the QlikView we talk about the labor skills of people in the system, and that is what we do as humans. We are more likely to go over and ask someone we know "Can you do something?", than go on to IT support. Because we know that we are not going to get much back much from the IT support in a large corporation. But at the pro QlikView, they worst way is to follow through the procedure, instead of asking the first or second line in all that kind of madness. Whereas if I know that kind of guy some desk floors down and has done this before, Í am going to ask him how. Because that is what we do as humans, we use the resources that we have closest.	CO CO
24	RC	Who do you think about risks in the decision quality, if the decision makers pick the data themselves, and design the dashboards themselves?	
25	MG	So if you are picking the data yourself, and you design the dashboard. You need to know what you are doing; you need to know what the data is; and to search the right one; you need to be aware that you may not be able to get all the data; there might be another data source out there. That is why we kind of have the stage approach at Qlik, where you have experts building up the data layer. And then you have developers who build the application for so [with emphasis] specific questions that needs to be answered, for the context which is e.g. in sales, this is charts and that you know. We have someone that build that with the right kinds of charts and analysis in it. Then we view if other people can extend [the application], because they have something of a context of the work, it's got a concluded solid way of thinking. We don't expect everyone to be grabbing data and make analysis, because it is going to be hard to get it right, even to create a descent charts is hard enough, they alone try to pick the right data and transform it in the correct way; and use it. So, we understand that there are different roles for different people which step in into different phases. If you allowed pure self-service then it's just pick your own data to try and build something – you can get into a very-very lodgy areas where you pick bad data sources or just the wrong fields that are built in the database.	IO AS UT SC UT
26	RC	Is there any risk do you think, or do you have any concerns [regarding self-service] that users pick the wrong visualizations?	
27	MG	I think the risk is to rely on a single visualization. So, if you allow users to create visualizations, you need to enable them to create multiple	IO

		visualizations. If you say that I can only take a table and you can only create a bar chart, then that's always going to hiding something true in the aggregation that is going on. So, you need to rather easily move things into different views, see data in different ways, for that's where analysis really come to life. If I can look at something from - this shown in a bar chart or if I can click it through, to I have an idea of a line chart to see something else. Changing the view of it can actually change my understanding of it and rebuilt new things. So, there is a risk in forcing them to make a single view, unless someone really defined that view as the best way to analyze things. But I strongly believe that users can understand things in different ways. You can have a different mental over every individual. So, I might [as an example] feel much happier by having information in a bar chart than in a scatter plot, or maybe someone give me a parallel coordinates char and I have no idea of how to read it – to my disadvantage. I need to find another way to present that data.	TC TC AS DC
28	RC	So it depends on which person it is, interesting.	
29	MG	That is also the hardest thing in when people [designers] create the application, to open up the creativeness by themselves. Or if I am an developer, how[with emphasis] do I know what every single one of them, thousands of users – want that specific dashboard and application, fields most comfortable for reading [?]. I can't even guess that. And I need to enable them to make the decision themselves. For a many years in Qlik we had a very fast type of change of buttons in the app. If so that a developer couldn't find on the charts, now developers can define it in a list of chart that was viewable with specific data, like: plot chart, line chart, a table. They just cycled through [with a laugh in lack of hope] to bring that back home.	UT GM IO
30	RC	We talked about these *Personas* before, where you talked about different users. Can you mention which kinds of users you have distinguished?	
31	MG	Within the Business states, we've got approximately fifteen segments of user groups that we are working with. "This is QlikView, and where are we going?". This is an Business Discovery as we usually say the BI demos, it's our world. And we have in the business user part; *peripheral users*, *casual users*, *ambitious users and sense makers*. And that can be seen in the literacy continual technical skills as well, and needs based on their business roles. The *peripheral* user just picks up the output of the system in once and a while, and this is a very	UT UT AS GM

		a snapping behavior or it is consuming what others have created. The *casual users*, they are very much consuming what others have created but based on regular basis. This is some of passive use that is given a certain application or a dashboard to go and look after and answer specific questions for their daily or weekly things. Now, the *ambitious users* are once they are actively interrogating use for the information that the application, they are literally doing more with the application and analyze that special piece of insight that crystallize forward, [you know] the next innovation that carves the next money out of the customer, whatever it might be. And what the sense makers are really doing, they are sort of thinking about this – the proper data to analyze like; “Ok, so what opportunities are in the business that we should analyze and take a closer look at or find a new opportunity to change business movement forward". So there is a huge spectrum of skills, active use and opportunities in the data layer. And for us [at Qlik] they spand from people that just are using those users who are only checking their mobile once and a while at home, to walking around and sell a tablet, to sit in front of a multi-screen at this huge workstation. That’s just the people usage that traditionally we mention as the end-users. That space alone is hugely complicated. Then you step into the developer world, there we have four *personas* there that are our user groups. And the user groups are producing widgets that are charts with application content and managing what they are, they enable it to people who understand the business to build what they need. They start to build up the occasion that they need – what different kind of users is there, how they should be measured. How it fits with other applications within the system [not QlikView's ecosystem, rather other technologies]. Then we have the *problem solver* group, who are those who work a lot on the data side. “How do I get this, how do I transform it, how do I make sure this is not rubbish, how do I make this run properly, how do I make sure that those pity in here, which data web services can I connect to, what regular do I need to manage the data part [?]”. Then we have the number of which are the *data scientists.* This is someone we don’t even use the product, but they are integrated with it because they may set up certain R statement in the background, that send out scoring into our system. So that’s in our developer pool. Then we have the administration and guidance area, where we have the S*trategy* and.. [Murray is thinking for a moment], Oh yeah, there is three or four areas as well, were people like our *Architects* are in, they build the BI system out for the entire company’s needs. Down to the	UT GM TC UT UT UT AS UT

		people who remote our services, like an optional support system that run tasks, check that the servers are loaded and deal with those daily updating. There can be quite a big variance in users and users' needs with very different latitudes.	
32	RC	I just want to ask, do you have any documents of this that we can access, which describes the users?	
33	MG	I do have personas and I do have user groups. They are strictly internal, and sort of NDA [Non-disclosure agreement] stuff documents. I can if you come in [to Qlik's office in Lund] we can take a trip and show you them. And I can show you example of them. But we are not very keen in sharing them publicly. Because they are kind of description of our types of users, they are not real people. So we have to manage those instead of showing them to the public. But we can give you a broad description of them.	
34	RC	Ok we can discuss this later in that case. To continue, do you think that the explorative usage differs when using different devices?	
35	MG	I think the interaction paradigm change and differ tremendously. We talk about natural analytics, a lot in the QlikView.Next, and we have rebuild the product from a touch first perspective – so that it feels more natural on an iPad or a Smartphone. I think that the way you analyze data – your expectations of performances stay in both places, e.g. I want to change immediately and I just want to be continually exploring it and using it … Because there is no holdup onto it. With desktop you tend to get into the, (you know) excelerate the multiple screens and multiple views at the same time. Whereas with an iPad it's much more focused and it's much more about swiping through and browsing, then drilling in a little bit, then browsing and browsing, but it's in a contained space. And we've been working a lot around how to enable multiple screens and using multiple devices at the same time, so this is in the new version of product. We can have a series of dimensions to just control from your iPhone, you can constantly be looking at another screen and to be able to touch those experiences and then join them and pick them up better than before. So yes, it changes, but it is more around your analysis intentions are still the same.	TC TA TC IO
36	RC	Would you say that the self-service enable users to pick different data sources, is it possible on the smaller devices like the tablet, Smartphone etc.?	
37	MG	It should be possible, but the problem is which sources have services,	

		and how they serve you. But if we say that the data is already in place, if someone already modeled it for you – then the analysis of it is the only thing you care about - is the data becomes more natural on the iPad or a Smartphone. I just want to see what's happened with this [the data], (you know) what has happened with this right now. Now, if you have the ability to create charts as well, then you can continue asking those questions and you can pick them back up when you come to your workstation [a desktop computer]. To be enable to say that I am looking at this data model and I know that it is defined for me – but I want to add this extra piece of data that I just discovered on top of that (like a table of something). That's a really interesting space, but it is incredibly difficult as if you have a model and a piece of data, the data has to be ready and have been mashed that together with something else - and making it make sense. The machine has to be incredibly smart. But we are getting there, with stuff like that, but it is very-very tricky.	DC TC TA DC DC
38	RC	Do you think users want self-service BI capability, or do they want to have already defined dashboards for them?	
39	MG	Most users just want the outcome, right; ultimately they just want to be told what they need to – now. What's the best decision to make? But that's what differs between users – I don't even that one thing that tell me, but we know that analysis is needed, we know that we have to look at this information, and consume it and actually interrogate it. So depending on where they are in their user range. Some just want to look at the number, others actually want interrogate those number, others still want to see if they can find new opportunities with those numbers. So it's not ok for users to miss issues. You have to get down to that specifics [issue] and I think that the BI industry itself hasn't really thought that much about; they haven't thought that much about the user consumerization side. If you look at a consumer product, they have mediated personas which they designed for specific personas, they understand that personas (or persons). They really think about that. Whereas in the BI industry you develop that from an IT point of view, which has been good from a developer point of view. So business users in the other end are welcome to become end-users, yet the users (the others) won't have to think about people. Now that's why we use personas, we have names of personas, so we talk about Adam and Rachel, does this really work for Adam [?] is this what he is trying to answer [?]. We have those kinds of measurements that developer	GM UT UT

		can fight about, someone can just say- “I don’t agree, I would hate it”. It is a really good way of emphasize what actual people actually will be using the product.	
40	RC	Interesting. This kind of bring us to the last question, it is actually our research question itself; How do you think that these new capabilities (self-service, that users can do more). How do you think this affect/influence the actual development of dashboards, in terms of analysis and design? If you think about the developers.	
41	MG	From our point of view we look at developers that facilitate this, you need to be able to create a talket [?] of something that different users can work with, not just create a static dashboard. But you can create a static dashboard, but adding any other pieces that make them explore further and to take it further, and we are also trying to build that into our software, we talk a lot about ad hoc analysis on existing dashboards. You may have a view of (let me think), e.g. sales over time; cross regions; many certain type, and been given that, been delivered that. But if I break out new that there are a variety of cycle extra – then they don’t just take that and make up a new visualization of the problem around that question. It is actually the relationship between the over track charts than over multiples, over seasons or regions. To be able to do that, as was an extension of what was given to them [the users], that’s what counts. Having enough thinking within the application to start with, so I will be fine - I can bring up dimension to calculate this, I will bring up a calculation of this thing and it will be stored in the background, or the technology itself in the future could be smart enough to go: “Ok, you got stuff with time here, probably you would like a calendar, you are probably going to look for cycles of things, and you are probably going to look after these questions”. And with larger systems users may generate that information, and you can generate this information and find that information from the using of it – so there is a whole world of really interesting possibilities coming up from just the end-users. But the machine has to be damn much smarter than it is today.	DC DC IO
42	RC	Do you have anything else you would like to add, something that we should be aware of in this respect?	
43	MG	If you are interested in the user part of it, to talk about the users as personas – there is plenty of good resources out there that probably	

		can give you a view. I don't know where what academic background you have; you might have some original books about Persona by Alan Cooper. That stuff kind of stuff still guide us, and I still believe strongly in all of that approaches. I think it is important when building software, and nesting where software is around. It should stop being about technology and be from the people perspective.	UT
44	DA	Except these interview questions I would like to question one thing. You have mentioned communities for users; do you know any specific community for self-service BI in order to support users to use the functionalities?	
45	MG	We have a community at Qlik. We have like 60 000 users in the community, and that's everyone from using free downloads, to the large infrastructures. And we try to generalize that, you know we have a lot of partners as well, and relationships with customers in the community. So you have to build the community around this thing. And the next generation of the BI product will be looking at having social, collaborative built into it. It's just like you cannot avoid it, it help business users' work as well.	
46	RC	So I think we are done with the interview.	
47	DA	If you have any other persons you think of, that could be useful for us to interview – we would of course appreciate this.	
48	RC	Yeah, we will send you a transcript later, so you can have a look on it, and you can decide yourself if you want to participate with your name or to be anonymous in the interview. Or if you want to delete something.	
49	MG	Yeah, I have to check if there is anything as we've got a quite strong legal team. I will not go through all of that, but I will at least check if there is anything about the upcoming release.	
50	RC	We understand this, that's why we want to send it to you as well. [Everyone laughing a little bit]. Ok, thank you very much. We will stay in touch.	
51	MG	Good luck. Bye	

Appendix 5 Interview transcription of Qlik

Interview with Qlik- 24.04.2014

Interview Duration: 37 min 11 sec

Vinay Kapoor (KP) – Product Manager

Doğan Alkan (DA)

Robin Carlsson (CS)

Line	Speaker	Text	Code
1	RC	Hi	
2	DA	Hi	
3	VK	Hi	
4	RC	I think we can talk about our research before interview [talking about the background, problem area and research motivation].	
5	VK	Yeah, ok.	
6	RC	I think we can start. Is it ok we can record the interview so we can transcribe?	
7	VK	Yes, sure. That's fine.	
8	RC	So the first question is a little about you. Can you explain your background and current role at Qlik?	
9	VK	My background is as an engineer. I have an engineering degree in Computer Science. I started working actually as a software developer in India. I moved to mutual several positions: working as a engineer, senior software engineer, architect project manager. I have moved into Sweden about ten years ago. I have worked a lot with multinational and worked a lot with outsourcing and spent my time as sales as well. I came back to products to Qlik, so I can go back to engineering side. What I am doing right now is that I am product manager for mobile and social at Qlik, which means I am the responsible for creating strategy for the mobile product or the social product, and also making sure that it gets executed. So basically a product manager is like, a kind of CEO that could do everything you need to do for the product to get it out to the market.	

10	RC	So you contact in customers a lot?	
11	VK	Yes, I work on both R&D side and the customer's side. I am talking a lot with customers, talking a lot with partners, reading a lot of market researches, understanding what competitors are doing and formulating the requirements. So working in R&D is to make sure it gets implemented or trying to get implemented.	
12	RC	Ok, it seems interesting. When have you used the term of self-service BI the first time, do you remember the history and motivation with self-service?	
13	VK	So the first time I came in touch with this theme is the outside of Business Intelligence. Self-service was a big team with Mobile. So I have a background in Mobile so I have worked two my carrier only on mobile devices. Maybe mid- or early in 2000, there were a lot of workers on self-service and mobile for users because the R&D team was used to work with mobile that you have to call to the contact properly with single thing, every small thing. If you have find out how much money we are spending, you have to contact to your operator. So there was self-service in mobile or in telecom [branch]. So users could do things on their own [in mobile]. For example, if you have an iPhone, you can do with an App and see how much data you used, what is your current wireless and etc. And that what I came to BI was sort of similar concept here. With the traditional reporting work of Business Intelligence, the users or the people are treated to be users of the report as the last receiver in the team. And there is a lot of work that is going on in preparing team. It is IT department that prepares everything, all the queries; they design the reports; they decide what visualizations go. They sometimes talk to the users but not so much. After they have done their work, they sort everything and prepare for the user. So the user is a receiver and there is not much possibility for the user to make any change or affect the changes. So users receive the things in the different types [reports]. If you have different requirements or if you have questions, you have to go back to IT but they are usually busy. So self-service in BI context is about that user is being to be able to answer their own questions and being able to decide what they want to see it, how they want to see it on their own without having to go back to IT or developer in organizations.	TC GM OC OC SC
14	RC	Thanks you. If you think about the customers how do you think this all of self-service affects their business strategies? How is related to their	

		business strategies?	
15	VK	So it is very user driven from strategy perspective that was the answers to this question. One is purchasing strategy of software but that's one side of things. So typically to pass software in large companies, it was purchased by IT departments who pushed it out. IT decided what software they will buy and they have a software strategy; and then they will push this strategy to the users. And this [self-service or users] is not like that. You have your own devices, people bring their own applications, people like using the applications. So purchasing of software is very business user-driven. So people like it, for example I use a lot Evernote [app]. So we have Evernote's licenses because there are lot of people here like using Evernote. So this is very user-driven. That is one side of strategy which is purchasing strategy. The other strategy is the execution of company strategy. What self-service does is giving to people the information they need, when they need, in the form of they need, in order to be able to make better decisions. So that makes a better communication of the results and the goals. In BI, you have more flexibility for the users, to be able to do things by themselves. So this is about the strategy being executed in a more efficient way.	OC OC GM
16	RC	Do you think about that self-service is more viable is certain organizations, with specific size? Does it differ between small, medium and large organizations?	
17	VK	Difference is actually that, the people who work in small or big organizations are still people. People do not change because of that they work in a small or a big company. They have pretty much the same BI. Their needs are very simple and people like to be free. Freedom is a very basic need of people. So they don't like to be tighten down by IT departments to software and devices that they have already purchased for them. So it is not the question of small or big organization, it is the question of flexibility. And in small organizations typically there is more flexibility, in large organizations there is less flexibility. So what happens in large organizations is that a few people typically pick up something that they really like and they will start using it within their department, and then the installation grows. At Qlik we call it landed expand and we do that a lot. We landed in small departments in very large company and then they expand by selling to the other departments and grow from there. So I think that's the difference.	SC GM OC SC OC

18	DA	Ok. If we talk about IT support, how would you describe the IT Support for decision makers in organizations? What do you think about IT involvement in self-service BI?	
19	VK	Yes, that's very good question. Like I said typically in the past when you had IT-driven reporting, IT department's job was everything from purchasing the software, preparing reports, designing reports and making sure that they get delivered. In self-service BI, the good thing is that IT's role is limited to managing and enabling: they don't have to write very complex SQL queries for every single requirement that the user has. They do not have to go and design the new report for every single user who has a new requirement. They can focus on making sure that there is a good infrastructure for delivery and they enable that kind of service that people do by themselves. So IT department's role goes away in the sense, it moves from being a creator to being enabler, which is something that is easier for them. IT department is typically sharp stop when the company they need to do cut-stuff the first for cut-stuff for IT. So they have already low stuff and it makes their job to be a little bit easier.	SC SC SC
20	RC	Continuing a little bit with IT support. How do you think the support for the decision makers changed? Are they going to IT and asking or are they going someone else?	
21	VK	So it depends a little bit on what kind of organization you are talking about. So in a small organizations it is typically the IT person, the user, the developer and everybody has such a role of developer, so it is not so much there in small organizations. But in large organizations, what happens is that, if when it is about the self-service BI, people go to IT only if they have requirements to be enabling. So performance is low, and they need more servers, I mean, people do or need more servers but typically they will go to IT department when they have problem. They will not go to IT department for self-service BI to ask for a new report or new visualization because they can do it themselves. So it makes IT's job a little bit easier, and it's said that in sort of having to support the every user's need. They can support the basically infrastructure.	CO OC SC
22	RC	Do you have any like specific scenario which describe self-service BI? Do you have a specific example?	
23	VK	Yes, there are several examples there with self-service and users. We have one example that we use. I think it is about public website there	

		we have a customer who had a cosmetics chain and they had the several million dollars worth of the product about shipping and it was a cosmetic product. They had a supplier team. One of the suppliers was in Japan and it was very small supplier. It was producing something which is very specific that only that supplier produce, which was [lost signal in Skype]. I was talking about that example. We had a customer which is a cosmetic team and they produce some cosmetic. One of the components was coming from a very specific manufacturing in Japan. That supplier that they had was the only one produced that. This component or this product was used in a cosmetic product that was about large in the market. They had a pretty large marketing campaign for that product. When tsunami hit Japan, their supplier was hit pretty badly. While they were some of the people who are decision makers on the supplier side, they had started looking for the impact of this tsunami on their supplier team. They noticed through the visualization they were using in QlikView. They had this very specific component [signal problem in Skype]. lost multimillion dollars. They were able to cancel the campaign and they saved lot of money. And this is a good example of self-service. They would never have been able to answer that question, if this was report that was statically delivered by the IT department. This was a dynamic visualization that was self-service and they actually asked questions by themselves to the report and answered them.	GM
24	RC	Ok, thank you. How do you think that self-service BI will affect the quality of decisions?	
25	VK	There is a simple answer for that make them better [everybody laughs]. You have better data, you have possibility cross-query information. If you find something strangely one you can dig people to, you can go to or jump to another different tool data. In another details. You can create your own visualization. [Lost signal in Skype]	DC
26	RC	So you talked about how quality of decisions can be improved. Do you see any risks about self-service for the decision makers?	
27	VK	The only risk is that there are always users. You know the product: you have innovative users, early adopters, early majority, late majority, and laggards. And you have the passive users who do not want to change. And the risk is that if you have users, a lot of users who do not like to change, and then self-service can be difficult for change, and you need to make sure that rule out is sort of, it is a right education that was for the users. But once people talk about self-service BI, there is really	UT

		adopted on side and it makes only better. So the only risk in organizations is that there are later adopters, late majority who do not want to change.	
28	DA	Thanks, I think we can move on with technology.	
29	RC	We have a question regarding the technology.	
30	DA	How can you distinguish the use of different devices as you are mobile product manager? How have you distinguished the use of different devices, and does self-service BI have differ on the such devices?	
31	VK	So I need to be a little careful of what I talk here because this is related the product privacy and not everything that is related to the public information. But I can say some general information and ask me more questions if it does not make sense. So one things that I can say that the user have a lot responsive of these things in order to be able to distinguish between devices. So there are techniques, tools, which are using responsive. So depending on the few dashboard size, you can distinguish if you are on the PC, iPad, or Smartphone and etc. Instead of designing the dashboard or product for each device specifically, which means that instead of designing for an iPhone or iPad, what we do is we design the product that is responsive, which means that depending on whichever the size you are on, we give you more or less in to mention in the product so it calls progressive discursion. For example, if you have a bar char, and if you are on a small screen like Smartphone. What you want to see the different bars and how these are tagged each others. You do not necessarily want to see each individual value, you do not need to see all the points on the exact in the device access. Because you do not have different dimension. But if you expand the bar char and if you are on the desktop, you can progressively disclose more information and you can add more data core. So we added this in this product and that all was visualization and they are all responsively. And basically that was one thing. The other thing is that we build the users skills, for example creating information, or deleting information, we try to evaluate it if this is really useful on every device. So on the Smartphone you are not going to create a new visualization or create a new app, the more like you do that you consume it and it is called snacking behaviors on these devices. People like the snacks on a mobile device. When you are on a desktop, you like to create. Desktop is a creative device. So we try to differentiate the user cases and the cool users skills on a Smartphone, like snacking, so we keep add consumption. We allow the people to	TC IO AS IO TC

		consume the data more easily. Not create visualization, those are for the desktop, and that's basically how we do this. This is just an example and there are of course many more.	
32	RC	So you think it is the same in the QlikView.Next for this perspective that on the mobile devices, consuming and creating? So this perspective is the same?	
33	VK	The QlikView.Level the product is not the Touch First or Mobile First. It is a completely different product. QlikView.Next is very Touch and Mobile First technologies. So the things are lot better in QlikView.Next. when it comes to Mobile or Touch devices. Because we are very detachable.	TC
34	RC	So it is totally different.	
35	VK	Yes.	
36	RC	Can you distinguish any different user groups in terms of skills? Are there any specific analytic skills is expected in order to operate self-service?	
37	VK	We work with personas a lot in the product. The persona is a user experience term which allows to define who the user is and very specific profile that kind of user. For example we have users work as consumers, users work as creator and collaborators. These are all different kind of persona we have in the product. And we have some focus personas: primary persona that build the product for, and the others that are enabling. For example, IT guy, we have persona for that who is enabler or other developer who is enabler. So we use persona tool for the different parts of the product to define what the product should do for each persona.	UT
38	RC	In terms of analytical skills they need is there any way to distinguish these?	
39	VK	Yes, for example we have personas. We have one persona that the user is very excel user, there are other personas that people have like a persona that user use a lot of analytical products in the past, and as moving to QlikView, or using the QlikView as part of the analytical experience. Then we have a persona for somebody who does not know using analytical product and they just know that they are looking at the data. They cannot understand that it is a product. So we have the personas for different analytical skills. And obviously we don't define the product that can satisfy everyone. So we have primary	UT AS

		persona and secondary persona which we design for.	
40	RC	How would you describe the user's motivation to operate self-service like to pick the data themselves instead of serving by IT?	
41	VK	So it is called freedom. It is very simple. Typically people look at consuming that and questions. If I look at data, a chart and it is related to something that I am working with, I have obviously question. It is frustrating, like looking at sheet of paper and you cannot ask questions to the sheet of paper. It is very frustrated. If you have a question, you have to walk to the IT department and then "Hey, I have this question I cannot answer." They are going to tell you that "Ok, sit and write the question and we are going to give to you the report with the SQL query". With self-service, you are going to get instantly by writing from your computer. So it is much better for the user.	GM GM SC GM
42	RC	But if the data does not exist in the software and they still have to go IT?	
43	VK	The IT department is enabler and has prepared the data. There is of course things that you need to do and there are developers and other people who work with data. The good thing with QlikView is in-memory product. So the amount of all preparations you deal or you have to do for the data is very little in comparison to the other products. As long as you have a data source that will support, you can more and less click and import it instead of that in other product that you have type very complex SQL queries and you have to join, and you have to go somebody who is an expert on SQL to even bring the data. By QlikView, business users bring the data from Excel sheet by themselves without having to go to IT.	SC IO
44	RC	So I think we come to the end of the interview. How do you think about this self-service concept? How do you think that this affect the Life cycle of BI, in terms of analysis and design?	
45	VK	If you look at traditional products, there is lot more focus on developer and design of BI dashboard and very little analysis. What happens here in traditional products is that 70-80-90 % of the effort that has been spent in the life time of the dashboard. It has been spent in cleaning the data, bringing the data, doing SQL queries, designing the dashboard and then developing the dashboard. The only internal personal problem that IT spent in the product is actually for the analysis of the life cycle. I am talking the more spent time, not spent money. So you have 10 % of the time that you spent in the entire	SC GM TA

		product is actually analysis. And in self-service, there is very little designing that developer could do some designing and development. So we have personas for developer and for the dashboard. But it has spent a lot more time analyzing and asking question and answering which is what you want the people do. You buy analytical product, so people get ask and answer the questions, not so there are some people who are defining very complex visualizations, sort of point. The point is not the visualization; the point is that the information that you get, and the analysis you do and then the decisions you make. So it is much better that life cycle is more moving towards to the analysis side, and decision making rather than designing it.	TA
46	DA	[After summarizing the interview] Do you have anything else to add which you think is important?	
47	VK	I think QlikView is trend which is you know self-service is becoming a large sort of trend in the BI. What we call that this is discovery, and Gartner calls data discovery. It used to be a niche product with a BI two-three years ago, now it is faster growing within BI. According to Gartner you can find this on web report, this is the place for BI vendors, so it is the future for sure.	GM DC
48	RC	I have one more question. Self-service or business discoveries is viable. But still the standard report system is required or what do you think about that?	
49	VK	So standard reporting solutions are, there are still the last segment of the market but it is being replaced by self-service BI. So the future of BI marketing is self-service. There will be of course usage of reporting as in partner. There are usage of like that but they are becoming fewer. It is shrinking.	
50	RC	Ok.	
51	VK	Nice talking guys.	
52	RC	Thank you, bye	
53	DA	Thanks, bye	
54	VK	Bye.	

Appendix 6 Interview transcription of Qlik

Interview with Qlik- 25.04.2014

Interview Duration: 42 min 08 sec

Ingemar Carlo (IC) – Project Management team

Doğan Alkan (DA)

Robin Carlsson (CS)

Line	Speaker	Text	Code
1	RC	Hi	
2	DA	HI	
3	IC	Hi	
4	RC	How are you?	
5	IC	Thanks I am fine. You?	
4	RC	Thanks, we are fine as well. I think we can start the interview. Can you explain your background and current role in the organization?	
5	IC	In my working life, I had a background as a software developer in a small company. I worked there for about 6 years before I joined QlikTech. I joined QlikTech as a technical consulting in the field as someone implementing QlikView for customers, and I did that for about 8 years. About 6 years ago I joined the R&D organization. First as a Program Manager someone who commissions projects for the QlikView development. The last couple years I have been in the organization that was broken out of R&D as a Product Management team. So I am responsible today for a couple areas in the future version of QlikView.	
6	RC	So to sum up that you have 8 years experience in software development and,	
7	IC	6 years in software development, and 8 years as a consulting implementing BI solutions in the field, 6 years working in the R&D organization and product management.	
8	RC	Ok, nice. Do you remember the first time heard the term of self-	

		service?	
9	IC	That is a difficult question. Perhaps the first time I have heard the self-service in the big context, I think it is talked about; was perhaps when we got the requirement to deliver QlikView as a portlet or a web part in portals. But I heard the term of self-service before that, for sure, but maybe not in that the typical context.	
10	RC	So, what have you heard about it?	
11	IC	I think, in some point maybe this is three versions ago during the life cycle of QlikView, if we are going back maybe (how many years could that be) - probably around the time I joined the R&D organization, we had more customers who wanted to integrate QlikView into their portal systems: QlikView Web sphere, Liferay, SharePoint. That is where started more about the need for self-service.	
12	DA	However, do you remember the motivation why the users or developers mentioned the self-service?	
13	IC	I think the motivation or the reason why the self-service started coming more because our BI product started moving more into the enterprise space.	
14	RC	How do you think that the strategy's among your customers in the organizations? How do you think the strategies working with BI has been affected by self-service, or as it has been changed in recent years?	
15	IC	It is probably not so much that it is changed. I think the deep of self-service is something that I have seen since the day one, so since 1990's. But the I think the add-in to portals and so on, has been something that has made the requirements for clearer for out development department, that we need to support this [self-service] somehow.	GM
16	RC	So, it has been the customers or who has requested self-service?	
17	IC	That is a good question. I think there is a multiple sources of these requirements. We hear this from the customers and we also hear this from the analysts on the market, like e.g. Gartner, Forrester and they talked a lot about self-service.	GM
18	DA	What do you think that self-service is more viable for certain organizations, with specific size? Does it differ between small, medium and large organizations?	

19	IC	I think it is not so much the size of the company, that's is much more the nature of the business of the company, and the profile of the users of Business Intelligence tools. I have seen so many different cases and I have seen that big companies where there is a huge need of self-service in their organization, and it is completely conflict with what the IT's strategy is internally in the organization. And then we have case which is completely the opposite, that smaller companies where they are in synch, and big companies where they are in synch and so on.	OC
20	DA	Ok, so we have talked about IT. [everybody laugh] So the next question is regarding IT support.	
21	RC	How would you describe that IT support is working with supporting the decision makers? How should they support decision makers?	
22	IC	For many years the business like QlikView, the best way to get in the company was within each department's strategy. Try to sell to the business regardless of IT, and then from there, the software goes viral and spreads inside the organization. Of course if we had a strategy like that, you get comment and conflict with the IT. Over the years, to balance selling the product, we developed our product portfolio to include tools that has put the IT more control of data. For example it took many years before we had a real tool that could help to insure data governance within parts of the organizations, that put IT more in control, more in ownership on what parts of BI platform they expose to the users.	SC SC
23	RC	How do you think this governance of information, how has it been changed?	
24	IC	It is very hard to speak generally about, I mean each company has own strategy when it comes to governance. What I have seen many times even though there is a designated strategy for data governance, it does not work in practice. I have seen that over and over again. The reality is that the critical information needed by the company is getting within many sources. For many of these sources it could be very difficult for the business users to get access to these sources, and sometimes it is harder for them to get the information they need from IT, than if they would just go for it on their own. This conflict demonstrates between business and IT which I have seen over and over again.	SC DC CO
25	RC	How do you think if the user are using the self-service, like they serve	

		themselves and more reports what they want? Does this change somehow how the IT Support is working or where are they going to if they need help?	
26	IC	I mean that depends a lot on the profile of the users. If you are user who has no knowledge of the underlined data sources then you need to be served with something that is ready for you, where all the indicators are given. But if you are user who understands where the data sources come from, and also trustworthiness for of the data - then you might have a little easier way be able to even define the indicators on your own. This is different kinds of the self-service, where you are given the choice of which visualizations you want to see, or where you are allowed to define the dimensions and measures of what you want to see. There is even level of self-service where your might be even allowed to start from the ETL process and you choose yourself what tables you want to read data from. And there is even a case where you are allowed to access information from the data source. How do you calculate your measures? Because from some systems the same measures can be calculated very differently. Let me just give an example of that, let's say if you want to look at the revenue figures, and you want to look at over period of time, but you have different dimensions in your data to measure time, it could be order dates, or the ship dates. And you are going to get very different results if you use depending on which date field you use. By self-service, you are allowed to choose your own definitions but they have to be consistent through the entire organization.	AS UT TC SC CO
27	RC	True, you have actually answered the next question if you had an example. Do you have any special business scenario like, do you remember any other customer and how they used this self-service or famous story?	
28	IC	I can give some examples. We had a customer; a giant customer in manufacturing and this was an organization where business users had a lot of personal freedom to choose how they wanted to visualize the data. But there was no real data governance going on and there was a nightmare for IT but business users were being served very well, because they could very quickly build their own visualizations, further their own conclusions, so they can make the decisions quickly. That is one spectrum. The other spectrum is business in the Pharma space where it is absolutely crucial that everyone is looking exactly the same metrics where IT has being total control of what people are measuring	GM OC TA SC

		because, if there is any discrepancy, they could make the wrong decision and they could have legal consequences. So that is why I said in the beginning – that it depends on the type of company we talk about.	DC
29	RC	Do you think that information can be different at different users? Is this problem somehow that the users can do more themselves maybe and they used different data to support decisions?	
30	IC	It is also what the data they access look like. So for example, in many cases before users are even allowed to analyze the data, they prepare the data warehouse for them. Building the data warehouse can be great in many ways because you prepare the data; and you are removing the inconsistencies; you cleanse it; you denormalize it; even though with a model it is very easy to clean and analyze it so it gives a lot of flexibility and it makes a lot sense. But then, guess what? You start asking the some questions that are outside of that pre-defined the data warehouse. So then what do you do? You are stuck. So how the data is prepared for you is hugely important. One of the nice things with the BI tools like QlikView that you have always a choice, you can go against and prepare data warehouse or you can go directly against to the transactional data. And that has both advantages and disadvantages. One of nice things is the day is very normalized and you have a lot more flexibility with how you bring in [the data]. You are not so constrained by pre-defined hierarchies if you have to go to data marts or data warehouse.	GM AS TA IO DC
31	RC	You talked about different kinds of self-service. How would you describe or categorize different users in BI?	
32	IC	Here we have a standard client that we call, and we design that standard designs by BI tool, and we create from number of different personas that we design for. That's how most of us, my peers work when they design the software. It is a little different because I am responsible for the APIs in QlikView. That means basically we want a platform to be as open as possible. Anything can be exposed to the API, it should be, that's how I try to work. I cannot have a single persona that is strictly of how it should work. My users can basically they can do anything imaginable, or they can do things that I have not imagined or even if I imagined that they want to do yet. So it is very different approach.	UT
33	RC	How would you describe that the use of QlikView or self-service	

		product? How does it differ between different devices like tablets, Smartphone or desktops?	
34	IC	I think there are many ways that usage differs. When you look at mobile devices they are coming from many sizes, and depending on what kind of mobile device you use you want a software to adapt to the screen size in an effective way. There is this trend that we have to design our software nowadays, that we have to work on multiple devices. It is used to be that we only run on Windows machines running on desktop workstations, but that is not the case anymore. We have everything from Smartphones to tablets, PC workstations to giant touch screens.	TC
35	RC	How do you think that this changed for the developers in the design of dashboard? How much do they think about now or comparing to the past or future? How has their work been changed if you think about different devices?	
36	IC	You mean the developers who build the software or the developers who build Apps?	
37	RC	The developers who build Apps.	
38	IC	There is a big paradigm changed going on right now. Almost everyone is used to building apps and developed that to be looked on a PC screen. That is no longer going to be the case.	TC
39	RC	So do they have to adopt the dashboards for everyone, every device they do? Does it differ between the devices?	
40	IC	There is a huge transformation that is going to be going on. It is going to be quite painful for some organizations to adapt. It can be so different how they embrace it.	OC
41	RC	I understand it is a little bit sensitive topic as well.	
42	IC	Yes.	
43	DA	We have not talked about risk.	
44	RC	Do you see any risk about users are capable of doing more software, like design dashboard themselves, picking the visualization themselves?	
45	IC	There is probably a risk, but for me it sounds more like opportunities, that the more freedom you give, people can design their own dashboards. For our business, it is not a risk, it is an opportunity.	GM

46	RC	So there is no risk?	
47	IC	Not from my understanding.	
48	RC	If they have insufficient skills in choosing the visualization, don't you see any risk?	
49	IC	If you are responsible for distributing an App and [I see where the words is going to] so of course software has to be adaptable: so you can turn of the features that you don't want people to use. If you are the responsible for how the App is published.	
50	RC	How do you think the users are motivated to actually serve themselves, to choose the dashboards, visualization by themselves in comparison with having it served by the IT?	
51	IC	It can be empowering, right. If they are able to find the information they are looking for and if they are able to make decision in App themselves, then it is very empowering.	GM
52	RC	Do you see any risk otherwise that users don't want to choose visualizations themselves?	
53	IC	I don't see the risk as you are asking it, I think people are naturally curios and it is instantly want to how access to the information they need for the daily work. The more freedom they have to choose the data that they need to make better decision. I think the most people can think that way.	GM
54	RC	So how do you think the change will be, because there was always a lot of standard report which the users had? Do you think that this is going to disappear and the users are only going to choose the visualization themselves or IT is still going to provide them with the dashboards?	
55	IC	I think IT departments of companies are going to provide very static dashboards to the users. For whatever reason it depends on business processes in a company. But the same time I think, there is a realization that the people have to be productive, they have to have access to the data they need to make the right decisions. And that's the model for most of the companies - give people the information that they need anywhere and anytime. Giving people the access to the information and simplifying their decisions, that is our mission.	SC TA
56	DA	Actually our problem area is based on giving people the access to make anything. If decision maker make a wrong decision based on the	

		wrong analysis it would be a catastrophically consequences because decision maker have thought it was the right decision.	
57	IC	I will turn around and let us say: What is the consequence of not making the decisions? [everybody laugh]. It is potentially more catastrophic. Of course there has to be right balance. The people has to have access to the data that is trustworthy; that is accurate. You know, “the old garbage in - garbage out” saying applies in every business. But if the business is confident that the data is accurate, is trustworthy, is valuable then making that valuable to the users, to make their own decisions should be positive for any organizations.	DC TA
58	RC	I think we have the last question now. How do you think this changes in the way that developer's work; how they collect the requirements from the users? How do they design the dashboards for users? How do you think that the work change?	
59	IC	One way that there is a change going on in that. It is much more useful to be built with HTML5, web development techniques today, than it was a few years ago. Few years ago any QlikView App would be develop using with very standard windows environment. Now that is not much the case. You have to have a better knowledge of the latest HTML5 and presentation techniques.	TC
60	RC	Does this also apply for those who develop the Apps for the users?	
61	IC	This apply also those who develop Apps, to a certain extent.	
62	RC	Ok.	
63	DA	Do you have anything else to add which you think is important?	
64	IC	I think maybe the other steps. We are consistently trying to make it easier for the users to serve themselves with the data from BI applications. What I mean is that a lot of things that you could get served, you have to do basic level of programming. We are always trying to lower the bar. So you should just be able to give the name of the source of the information that you want to access and start from there, and be able to choose the visualization that has the information you looking for at the most basic level.	AS DC
65	RC	So is it more work for the developers to describe the data, like metadata?	
66	IC	Yeah, I mean, Metadata can be described at different levels. Metadata is used, one level tool, to make sure to tell that you have the data	

		governance. It is also used to define what the dimensions are available for the end-users.	
67	RC	You have talked a little bit about self-service, in terms of what you should do, the ETL work or visualizations. You at Qlik also has your own term; Business Discovery. Do you have any thoughts about there is any difference between these terms [self-service and Business Discovery]?	
68	IC	When we talk about Business Discovery, we talk about the freedom to navigate through your data without being constrained by hierarchies in your data. So the difference with QlikView is that once you have a data model you can navigate through it as if all information was in a single table. Now that is powerful because you are never constrained by hierarchies	GM IO
69	RC	But you say that business discovery is more you change on the visualization with change on the data. How deep should it go? Is it ETL as well?	
70	IC	Business Discovery is performed after ETL. Business Discovery is the activity you do when you are consuming an App that is ready for you. You are navigating through your data and you will not only to be able to navigate through all data that was in one table - you are able to get the direct answer to your questions. And with QlikView you also see the data that is not associated with your question. That is also very powerful. Because it provides you with this information assent, that you at least make new discoveries all the time.	IO
71	RC	Thank you for the interview. Bye	
72	DA	Thanks. Bye	
73	IC	Bye.	

Appendix 7 Interview transcription of Affecto

Interview with Qlik- 24.04.2014

Interview Duration: 36 min 21 sec

Sandra Sakratidis (SS) – Consultant/ Practice Manager

Doğan Alkan (DA)

Robin Carlsson (CS)

Line	Speaker	Text	Code
1	RC	Hi Sandra.	
2	DA	Hi	
3	SS	Hello	
4	RC	[Short introduction regarding our research].	
5	SS	Ok.	
6	RC	Is it ok to start interview?	
7	SS	Yes, we can start.	
8	RC	Can you explain your education and background, and your current position at Affecto?	
9	SS	Yes, I'm educated in Economics and Information Technology in Sweden and in Australia. My role now is Consultant Manager at Affecto. I have been worked with Business Intelligence for 15 years in different kind of roles. Within Project Management, Development, Education and other kind of roles with Business Intelligence.	
10	RC	Have you always been at Affecto?	
11	SS	No I have been at Affecto for 7 years and before that I worked for Logica, or WM-data that was the name at that time, and also worked at Atos Origin as consultant.	
12	RC	Ok. So totally it is 15 years within Business Intelligence.	
13	SS	Yes.	
14	DA	Do you remember when, and why the self-service term first was introduced? And do you remember the motivation?	

15	SS	The first time that I have heard about self-service BI, it might be perhaps two years ago, I think. But at that time, most of our customer did not know what self-service BI and what it was for. It was just like buzzword in that time before it became real. And now it is here, I would say and it has to become real for some of our customer.	
16	RC	So do you remember the motivation? What did they say about self-service?	
17	SS	The motivation was that it took a long time for the IT department to developed the questions from the users. It takes too long time to give users' a report or an application to use. It is a long lead time it took for the user to get right tool and information. They wanted to shorten that time. And I think this is the motivation that they can handle the data by themselves in a quicker way.	GM TA
18	RC	How do you think that self-service is incorporated into the companies' strategy for delivering BI?	
19	SS	I think that it [self-service] can come very handy for most company but not for all users. Because I think with this self-service BI, you need to have specific knowledge about the tool; you need to have specific knowledge about the information and about the data; and how they can be loaded. And that competence you do not have among all kind of the user. For example, the less experienced users or information consumer in organizations. They just consume the data, they just get report, run it and just look at the figures. In fact that, when you connect the information from other data sources and connect them to your organizational data - you need to know how to connect to find the data, both in a technical way and in an analytical way; how it is possible to combine the data [?]. And that kind of competence, I is not [appropriate] for all users have within an organizations, but for regular users or more power user, that have the kind of information and tools.	AS UT AS UT
20	RC	But how do you think this would change of the way of their work?	
21	SS	Well, they need to know more about the tools, they need more technical competence, and also they need to know the data, what they can combine and not combine. They need to know the analytical way how to analyze the data; how to display data. But also, I think users can be more flexible. It would be easier for them to do a smaller application or smaller solution. Because when the user goes to IT department and request a specific application or specific report, they	AS SC

		need to be very exact, and perhaps it maybe takes two weeks or three weeks to get something developed. When the report then gets back to the user, then they can say that "ok, this is not what we expected, and this is not anything we can use" and they can just throw it away and the business value, is like zero. But with self-service tools, they can develop their own application and do the small proof-of-concept when they combine that kind of data, look at the information and ask; “Is this something we can use broader within the organization, or is it not?”. Perhaps it is not and then there is no waste of IT resources, but if it is - that solution can be used broader within organizations. And they can go to IT department and they can qualify for the data and for users broader in the organization.	GM CO
22	RC	Thank you. We can go to next question because you have almost mentioned it. Which organization is viable for self-service BI like small, medium or large organizations?	
23	SS	I don't see any particular favor if they are big or small companies. I don’t have any answer for this question, if it is better for smaller or bigger companies.	OC
24	RC	So what do you think that some organizations go for self-service and some does not?	
25	SS	If they have a IT department that is like the bottleneck. Then they are more likely to demand self-service BI. IT departments with this kind of missing resources can be in both for smaller or larger organizations. Mostly they are in larger organizations, I think, but it could apply for both cases.	OC
26	RC	How would you think that IT support should support decision makers in organizations?	
27	SS	Within the self-service concept, I think they [IT support] should support in what kind of data, and structure and the data the user will use. They have a big and important role how to structure the data within their company. A framework that they have built up, so that the framework easily can be combined with external data. And also them [users] for how they can use self-service BI tools, like data discovery tool, and so on. That is sort of a new role for the IT department than they had before when they did not have any development role.	SC
28	RC	How do you think that the support for the decision making operate? In terms of self-service BI, does it affect whether the IT support is	

		centralized or decentralized in the organization?	
29	SS	That is a tricky questions, but it depends on how an organization is structure, because they need some [people] with the analytical competence and also some with the business competence. In my opinion, it is the mix competence between IT and the business that need to have this support decision. It is not a particular IT role or business role, it is mix of them.	OC
30	RC	Do you have a scenario how self-service BI should be used?	
31	SS	Well, I can mention for important cornerstones how to get successful within the self-service BI. The tool and technique you need to have good and easy to use a tool, like a data discovery tool and tool as we use for collecting the information and providing the information so it has to be useful tool. The performance is very important and you need to have a good performance. The environment that you need to involve with IT and technical environment needs to be in different layers, so the user knows what kind of data are quality-assured and not qualified data. Perhaps you can have like prototyping area or sandboxing area within the technical environment. So how you need to structure the technical environment that the user will ask, is that they are very clear of what kind of data we have here, what data are qualified and not-qualified. Because the data that the users collect by themselves with these data discovery tools, they are not qualified data in my opinion. Another cornerstone is how you steer the organization's roles and responsibilities. It is part of the data. That the assurance of data is on business or the IT, and so on. Those kind of things need to be set up or before they start the self-service BI project. They need to have a clear roles and responsibilities there. And also another thing is the competence as I mentioned.	IO TC SC OC AS
32	RC	You mentioned a lot of things we would ask later actually.	
33	SS	Oh, ok ok.	
34	RC	It is good [everybody laughing]. How do you think that the decision quality is changed with self-service BI? If decision becomes better or sometimes it is a risk.	
35	SS	That would be risk because the data is not always qualified within the self-service BI. If the data is not qualified then it is a big risk, of course if they are taking decision based on that. That is like very important with this the role and definition if the data is qualified or not. There is	DC CO

		need that this is communicated to the users.	
36	RC	How do you distinguish/categorize different user type as "default" or "typical" self-service BI users?	
37	SS	Yes, they are more like power users that are more familiar of the tool and are more familiar with the data. It is not for a simple user like an information consumer, it is more like for power users with the company.	UT
38	DA	How have you distinguished the use of different devices, and does self-service BI have differ on the such devices? How should self-service BI be used in different devices such as tablet, desktop or Smartphone?	
39	SS	When you use self-service BI, it is mostly with the tool where you can drill-down and consume some data; you can investigate data, slice-and-dice and so on. That is not the perfect match with the tablet and mobile phones because their area is too small to do that kind of analytics.	IO TC
40	RC	How sophisticated do you think that the technology (BI) differs on the different devices today?	
41	SS	For a standard reports and that kind of information it's ok. But I think there could be more features within tablet. That is for data discovery tool for laptops and computers, then I think that there are some great tools to use for the self-service BI.	TC
42	RC	Which analytical skills are expected by the individuals or different user groups who use self-service?	
43	SS	That is how to connect the data. Let's say, if you have your qualified data within your organization and want to connect that to external data that you have received from your client or company, how to combine that kind of data - you need to have that kind of skills; and how to understand the information that you received from the tools.	DC
44	RC	Ok, thanks. How would you describe the users' motivation to use the self-service in comparison with having served by IT?	
45	SS	I think that is one of the good things that they get more motivated to use and to do it by themselves. If they have tools that easily to present the data and if they have asked the data then it becomes get faster and easier. I think that is the good motivation for the user.	GM TA
46	RC	I think we come to the end here. How do you think about that self-service BI influence how the people work with analysis and design of BI?	

47	SS	I think having self-service BI in mind when developing the tools for self-service BI. You really need to focus on easy to use. It shouldn't let the users think too much, it should be obvious. When the data gets presented with kind of tools, it needs to be obvious what the meaning of the data is, like, if it is presented in the best way; It is the presented with the best colors; with the best kinds of graph for the information. If the right kind of information is highlighted and so on. Visualization is very big part in the data discovery tool.	IO TC
48	RC	How do you know this? How do you distinguish this visualization, like which graph is best?	
49	SS	We look very much on the visualization gurus like Stephen Few. Have you heard about him?	IO
50	DA	Yes	
51	RC	Yeah.	
52	SS	Most of our theory is based on findings and books	
53	RC	Do you know the method of creating persona, how to distinguish the users?	
54	SS	No.	
55	RC	So you have identifies the users such as?	
56	SS	Power users and information consumers.	UT
57	RC	Ok.	
58	DA	[Summarizing the interview]. Do you have anything else to add which you think is important?	
59	SS	I think it is how to get forward with the self-service BI; how to get start it is perhaps something is interest; how should the company get start with self-service BI? Is that something that you are interest in your study?	SC
60	RC	Yes.	
61	SS	I can just shortly get through that. The first thing is to get the road map; to define the road map; how do we work today and conduct the plan; and how we want to work in the future with self-service BI; and investigate potential tools. Do we have any tools in the organizations, or do we have to get out and buy new tools? The second thing is to define the processes. How should we organize within self-service BI	GM SC

		and role and the possibilities, and the change handling; implement the process and tools; to do road map within the organizations. It is more like a stage for users and open up with the target group. And then the few and last piece of throw up the work and improve on what you get feedback on. You have to look out the solution and the data are really satisfied with the solution. If they are not with that, they will know this is not valuable of this kind of solution. I think that is all the information I have for you.	OC
62	RC	Thanks. We got some perspective on how you work with it. I think this might be last question. Is self-service something that you usually talk about or you use other expressions, like data or business discovery?	
63	SS	We use the expression of self-service BI when we talk about this and we work and talk with customers. That is in self-service BI, one of the things are the tools. And the tools we mentioned is data discovery tools when we talk about self-service BI.	
64	RC	Ok. Do you think that there is different level of self-service BI?	
65	SS	Yes, I think that some levels of self-service; you can perhaps, only qualified data within the organization and I think that one kind of self-service BI that is used amongst the most of our customers by today and has been used in several years already. When they have qualified the data within the organization and they have used the reporting tool just to collect the information. That is one way of self-service BI, as they can get the information and do their own report. That's is on the very limited level I would say. The self-service BI when we talk about today is I think is more like combining the internal data with external data. That's the more the concept of self-service BI today.	IO IO
66	RC	Ok. So you say that it has changed over the time?	
67	SS	Yes, it has changed over time. The easier way that I have just mentioned is when we have only qualified internal data that has been with the organizations for several years already. That's self-service BI we talk about today; combining with external information - that is a trick I would say; especially how to combine it, what competence, and how do we get the data right. We have few customers that are working with this new kind of self-service BI and data discovery tools. They are more challenges within these kind of projects, when we combine the external data.	GM TC DC
68	RC	I think we should end the interview here. Thanks you, bye.	

Appendix 8 Group interview at Qlik

In this appendix, we will briefly summarize a group discussion we had with Qlik, in order to validate our some findings in the thesis. We started by summarizing a general unstructured discussion regarding frameworks, with some self-criticism to PACT. We have then described some points related to the PACT elements, a we wrote down (noted) during the discussion.

Date: 19.05.2004
Location: Qlik, Scheelevägen 26, Lund

Participants: Murray Grigo-McMahon,

Vinay Kapoor,

Doğan Alkan,

Robin Carlsson

General discussion regarding Interaction design and frameworks

As part of the unstructured interview at Qlik, Murray pointed out that there exist many frameworks within the User Experience (UX) field which are similar to PACT. And that frameworks typically are created by people working within specific fields, such as Service Design, Information Architecture etc, which are part of what people in the U.S more generally goes under the notion of UX. In general, frameworks often consist of the same or very similar elements. For example, the POEM framework by Tomi Davies include Proposition, Organization, Economic and Milestones. But they are partly the same as others might just include while describing People, Tasks and Context. Further, Murray pointed out that behavior models can be very useful, but can also be a bit limited in its scope. For instance, the firm Designit use behavioral models which works perfectly fine for them. But for users in BI that would be too narrow, as more elements should be regarded.

As a conclusion, it is possible to say that there is no single best framework to be used as tool for all designers. It can be concluded that each framework has own pros and cons, and thereby combination of framework can be considered as a solution. Persona is a useful Human Centric approach which is good if you design for many people at scale. However, as pointed out by Murray, in a small environment with few users, co-creation of dashboards might be the best way of designing, by sitting next to the users and fulfill all personal needs. Designer doesn't have to use persona, they can also use other tools, such as Behavior Models.

People

As part of the discussion, we asked the following question:
Which attributes do you think is most important when talking about People as personas?

When we talked with Murray about attributes which are important for dashboard designers to be aware of, i.e. to understand users' based on their personal preferences - Murray meant that Demographics (such as People's age, gender, place of living) is not important. He believe that demographics might be more useful for people working with marketing, but not very important for Business Intelligence. Within BI, more important attributes to study are people's behavior, role, attitude and aptitude. Methods for collecting information about people's requirement is most successful by interviews and observations. Except role, job, skills etc, the second most important attributes to gather information about, are probably behavior and mental models.

Activity

Do you regard the activities users are supposed to accomplish?

During the interview, Murray has explained that Business Intelligence or self-service, can be described as "business discovery", or as "data discovery" which Gartner articulate. Without us asking about it, Murray mentioned that cooperation also might exist among users. Users can learn new perspectives and be given new opportunities to discover business insight/opportunities without IT who before used a Datawarehouse, which could take up to six months to get the data done for consumption.. Today's people doesn't go to IT department in order to add new features on their dashboards, pointed out by Vinay Kapoor. This is also significant for the collaborative decision making since the time is important for the users, which is related to temporal aspects.

Context

Have you regarded in which context where self-service is more likely to be used?

Physical context is significant to discover data and Vinay Kapoor believes in that internet connections today is much faster in everywhere, even if the user holds the dashboard on mobile devices. Moreover, Vinay Kapoor added that they have test verification to measure this connection before delivering the BI tools to the users. This can be considered as a positive contribution with today's technology.

Technology

How much does Designers need to regard about various devices?

Different devices are much more common today, and Vinay Kapoor has pointed out that users take for granted that they can use different devices. Different devices complement each other, which is commonly known as multi-screen. Vinay recommended us to Google for this. Once the user create or design a dashboard in one device, they can continue their work in the other devices. For instance, giving an example of this situation, users can start by desktop computers and continue editing the dashboard in mobile devices. Vinay said that the mobile BI topic also has been explored by Olgerta Tona, and that he participated as informant in her research. The differences between devices is well-known in the industry and in the academic world.

Murray told that it is important to think about "Touch first" experience when designing. By this, he meant that designers should start designing by think about smaller screens first, and then enable more in-depth use at bigger screens, like a desktop computer. Otherwise designers might find it much more difficult, if they first develop a lot of functionality and then have to restrict it by screen size. Murray also recommended the following article as further reading; "*From Visualization to Visually Enabled Reasoning*" by Meyer et al. (2012).

References

Alter, S. (1991) *Information Systems: A Management Perspective* (1st ed.). Reading, Mass: Addison-Wesley Pub. Co. cop.

Benyon, D. (2013) *Designing interactive systems : a comprehensive guide to HCI, UX and interaction design* (3rd ed.). London: Pearson Education.

Boland, R. J. (2008) Decision Making and Sense making. *Handbook on Decision Support Systems (F. & Holsapple, C. W., 2008), 1*, 55-63.

Byström, K. & Järvelin, K. (1995) Task complexity affects information seeking and use. *Information processing & management, 31*(2), 191-213.

Chen, H., Chiang, R. H. & Storey, V. C. (2012) Business Intelligence and Analytics: From Big Data to Big Impact. *MIS Quarterly, 36*(4), 1165-1188.

Cooper, A., Reimann, R. & Cronin, D. (2007) *About face 3 : the essentials of interaction design* (3rd ed.). Indianapolis, IN: Wiley Publishing, Inc. .

Davenport, T. (2006) Competing on analytics. *Harvard business review, 84*(1), 98-107, 134.

Davenport, T. (2014) *Big Data at Work: Dispelling the Myths, Uncovering the Opportunities.* Boston: Harvard Business School Press.

Donaldson, L. (2001) *The contingency theory of organizations*. Thousand Oaks, California, USA: Sage Publications.

Eckerson, W. (2011) Analytic Architectures: Approaches to Supporting Analytics Users and Workloads. *BI Delivery Framework 2020.* Retrieved 2014-04-03, from http://www.vertica.com/wp-content/uploads/2011/04/analytic-architectures_Vertica.pdf

Endsley, M. R. (2001) Designing for situation awareness in complex systems. *Proceedings of the Second International Workshop on symbiosis of humans, artifacts and environment. Kyoto, Japan*.

Few, S. (2006) *Information dashboard design: The Effective Visual Communication of Data* (1st ed.). Sebastopol, California: O'Reilly Media, Inc.

Few, S. (2012) *Dashboard Design for Real-Time Situation Awareness*. Inova Solutions. Retrieved 2014-04-03, from http://www.perceptualedge.com/articles/Whitepapers/Dashboard_Design.pdf

Golfarelli, M., Rizzi, S. & Cella, I. (2004) Beyond data warehousing: what's next in business intelligence? *Proceedings of the 7th ACM international workshop on Data warehousing and OLAP, November 12-13, 2014*, 1-6.

Griffith, T. L., Northcraft, G. B. & Fuller, M. A. (2008) Borgs in the Org? Organizational Decision Making and Technology. Retrieved 2014-03-03, from http://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780199290468.001.0001/oxfordhb-9780199290468-e-5

Herring, J. P. (1988) Building a business intelligence system. *Journal of Business Strategy, 9*(3), 4-9.

Hosack, B., Hall, D., Paradice, D. & Courtney, J. (2012) A Look toward the Future: Decision Support Systems Research is Alive and Well. *Journal of the Association for Information Systems, 13*(5), 3.

Imhoff, C. (2005) What Do Customers Really Want? *DM Review, 15*(5), 12-13.

Imhoff, C. & White, C. (2011) Self-service business intelligence empowering users to generate insights. Retrieved 2014-04-25, from http://tdwi.org/Articles/2011/09/20/Self-Service-BI-Empowerment.aspx?p=1

Jenster, P. & Søilen, K. S. (2009) *Market intelligence: building strategic insight* (1st ed.). Frederiksberg, Copenhagen: Copenhagen Business School Press.

Keen, P. G. W. (1980) Adaptive Design For Decision Support System s. *ACM SIGOA Newsletter (ACM Digital Library), 1*(4-5).

Kieser, A. & Leiner, L. (2009) Why the Rigour–Relevance Gap in Management Research Is Unbridgeable. *Journal of Management Studies, 46*(3), 516-533.

Kirschkamp, A. (2008) Contingency Theory as an Approach to Explain Early Warning Behavior. *A Contingency-Based View of Chief Executive Officers' Early Warning Behavior: An Empirical Analysis of German Medium-Sized Companies*, 27-50.

Kvale, S. (1996) *An Introduction to Qualitative Research Interviewing*. California: Sage Publications.

Kvale, S. & Brinkmann, S. (2009) *InterViews: learning the craft of qualitative research interviewing* (2nd ed.). Los Angeles: Sage Publications.

Mann, R. I. & Watson, H. J. (1984) A Contingency Model For User Involvement In DSS Development. *MIS Quarterly, 8*(1).

Marakas, G. M. (1995). *The discovery-learning DSS: allowing for discovery in the decision process*. Paper presented at the Proceedings of the Twenty-Eighth Hawaii International Conference on System Sciences. Volume 4, pp. 72-81.

Marakas, G. M. (2003) *Decision support systems in the 21st century* (2nd ed.). Upper Saddle River, New Jersey: Prentice Hall.

McKeen, J. D. (1994) The Relationship Between User Participation and User Satisfaction: An investigation of Four Contingency Factors. *MIS Quanerly, December*, 427-451.

Meyer, J., Thomas, J., Diehl, S., Fisher, B. D., Keim, D. A., Laidlaw, D., Miksch, S., Mueller, K., Ribarsky, W. & Preim, B. (2010) From Visualization to Visually Enabled Reasoning. *Scientific visualization: Advanced concepts, 1*, 227-245.

Mintzberg, H. (1979) The structuring of organizations: A synthesis of the research. *University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship*.

Mintzberg, H., Raisinghani, D. & Théorêt, A. (1976) The Structure of 'Unstructured' Decision Processes. *Administrative Science Quarterly, 21*(2), 246-275.

Morse, J. M., Barrett, M., Mayan, M., Olson, K. & Spiers, J. (2002) Verification strategies for establishing reliability and validity in qualitative research. *International journal of qualitative methods, 1*(2).

Nicholas, D. (2000) *Assessing information needs: tools, techniques and concepts for the internet age*. London: Aslib.

Norman, D. A. (2002) *The design of everyday things*. New York: Basic Books.

Norman, D. A. (2004) *Emotional Design: Why We Love (or Hate) Everyday Things*. New York: Basic Books.

O'Leary, D. E. (2013) Big Data, The internet of things and the internet of signs. *Intelligent Systems in Accounting, Finance & Management, 20*(1), 53-65.

Payne, J. W. (1976) Task complexity and contingent processing in decision making: An information search and protocol analysis. *Organizational behavior and human performance, 16*(2), 366-387.

Porter, M. E. & Millar, V. E. (1985) How information gives you competitive advantage. *Harvard business review, 63*(4), 149-160.

Recker, J. (2013) *Scientific Research in Information Systems: A Beginner's Guide*. Heidelberg, Berlin: Springer.

Simon, H. A. (1993) Decision making: Rational, nonrational, and irrational. *Educational Administration Quarterly, 29*(3), 392-411.

Simon, H. A. (1996) *The sciences of the artificial* (3rd ed.). USA: MIT press.

Sprague, R. H. (1980) A framework for the development of decision support systems. *MIS Quarterly, 4*(4), 1-26.

Tona, O. & Carlsson, S. (2013). *An Evaluation of Potential Benefits of Mobile BI*. Paper presented at the European Conference on IS Management and Evaluation In Proceedings of The 7th European Conference on IS Management and Evaluation.

Weill, P. & Olson, M. H. (1989) An Assessment of the Contingency Theory of Management Information Systems. *Journal of Management Information Systems, 6*(1), 59-85.

Wingyan, C., Hsinchun, C. & Nunamaker, J. F., Jr. (2003) Business intelligence explorer: a knowledge map framework for discovering business intelligence on the Web. *Proceedings of the 36th Annual Hawaii International Conference on System Sciences, 2003*, 10.

Wood, R. E. (1986) Task complexity: Definition of the construct. *Organizational behavior and human decision processes, 37*(1), 60-82.

Vuori, V. (2006) Methods of defining business information needs. *Frontiers of e-Business Research ICEB+ eBRF, 2006*, 311-319.

Young, I. (2008) *Mental models: Aligning design strategy with human behavior*. Brooklyn, New York: Rosenfeld Media, LLC.