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Explaining the Continuous Use of BI Systems

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Abstract (Max. 200 words):
Business intelligence (BI) has evolved from mere management reports to powerful decision-making solutions, analytics and rich visualizations that have made organizations to gain intelligence and competitive advantage. Many organizations have reported successful BI adoptions. However, there are also failure stories where managers and IT departments have faced undesirable attitude, reaction or behavior from the end users after the BI adoption phase. In this study we aim to investigate what factors influence BI users to behave in the way they do. We use a proposed model which is a combination of self-determination theory of motivation, expectation confirmation theory, critical factors that are considered when implementing a successful BI system and factors that are perceived as beneficial for using BI systems. We use a combination of quantitative and qualitative methods as our research approach therefore for data collection we use questionnaires and also conduct interviews to enrich the data we get from the questionnaires. To analyze the collected data, we use SPSS, Excel and SmartPLS for qualitative data and Nvivo for quantitative data. The results from our analysis of empirical data highlights the important factors that organizations should be aware of to ensure the continuous use of BI systems.

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Gulnaz Jabarova

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Tables of abbreviations

Abbreviation	Definition
AVE	Average variance extracted
BI	Business intelligence
CR	Composite reliability
DSS	Decision support system
DW	Data warehouse
ECT	Expectation confirmation theory
EIS	Executive information system
ETL	Extract, transform, load
IS	Information systems
IT	Information technology
IQ	Information quality
OLAP	Online analytical processing
SDT	Self-determination theory
SEM	Structural Equation Modelling
TAM	Technology acceptance model
UTAUT	Unified theory of acceptance and use of technology

1 Introduction

In this chapter, we provide background information on this thesis work. This chapter provides an introduction to the problem area, narrows down our research focus by formulating the research question, explains purpose and delimitations of the research approach. The chapter also clarifies some key definitions used in this thesis paper.

1.1 Background

A rapidly growing business environment creates pressure and challenges among organizations by bringing a need for timely and comprehensive information. The ability to cope with development of IT and to manipulate with huge amount of information becomes a crucial factor for improving decision making process and outperforming competitors (Hannula & Pirttimäki, 2003). Business intelligence (BI) is a technological solution for processing and enriching information and facilitating organizations' decision-making capabilities (Ranjan, 2009).
BI has been designed to provide prediction, optimization and decision-making versatility in order to obtain competitive capabilities (Watson & Wixom, 2007). Organizations spend large amount of investment on BI because it enables them to gather and combine data from various sources and thus make better operational and strategic decisions (Negash, 2004). Gartner's (2013b) global survey on IT investment shows that BI related technologies are among top technology priorities for chief information officers. According to statistics of 2014, the total investment on IT increased only by 0.4 percent (Gartner, 2014b), whereas the investment on BI systems in the market increased by 7.9 percent (Gartner, 2014a).
Despite the increasing significance and huge investments on BI, organizations complain that BI systems do not provide expected results. The survey among 200 IT decision-makers shows that most organizations spend more than million dollars on BI systems among them 62 per cent of participants mentioned that users do not get expected value from BI (Bourne, 2009).

1.2 Problem area

Inability to gain expected results from BI indicates that end users fail to fully utilize capabilities of BI due to their limited understanding of factors that determine long-term benefits of it (Hallikainen, Merisalo-Rantanen, Syvaniemi, & Olivera 2012). According to Seddon, Calvert, and Yang (2010) unlike operational systems, evaluating the impact of BI is usually challenging due to fact that they are enterprise wide systems, where most advantages are long-term, indirect and hard to assess. Failure to see possible results and not being able to assess the capabilities of BI influence end users to discontinue to use the system (Seddon, Calvert, & Yang, 2010). Unwillingness of organizations to utilize BI after it has been

implemented may cost a lot for them. Therefore, investigating factors that shape end users' behaviour and attitude towards the system are crucial for both end users and organizations. It is also important to particularly consider factors that affect end users' behaviour in the post adoption period when end users are more familiar with BI. The extant IS literature insist that in order to understand behaviour of end users it is very crucial to consider continuous use of IS, when end users intensely use the system over a longer period of time for their daily tasks (Bhattacherjee, 2001; Kim, Chan, & Chan, 2007; Limayenm, Hirt, & Cheung, 2003; Thong, Hong, & Tam, 2006). The significance of continuous use of BI in the post adoption period presumes different behaviour from end users compared to its first-time acceptance/adoption period. While continuous use of other systems are examined and reported, continuous use of BI has not been explored yet.
The behaviour of end users can be formulated based on several factors. In our study, we investigate three factors that we found influence continuous use of BI. They are motivational, success and beneficial factors. All three factors with eight constructs are chosen by considering specific characteristics of BI systems.

1.3 Research question

As we have recognized and explained the problem area in the previous section, we propose the following research question for our research study:

- What are the major antecedents to BI continuous in organizational settings?

1.4 Purpose

The purpose of the study is to examine how the continuous use of BI systems is affected by the factors that are seen as beneficial when using BI tools, factors that are considered as critical when building BI systems, and motivational factors. To achieve this, we are going to build a model using BI success factors, BI beneficial factors and motivational factors as constructs and test the relationship between these factors and continuous use of BI systems. The aim is to provide organizations, which have already adopted BI an insight on how end users behave based on these factors. It is also to provide them with areas that they can improve on as the success factors and beneficial factors depend on the BI processes of the organization.

1.5 Delimitation

The core of the study is examining behaviours in a post adoption phase therefore the focus is only on organizations which have already adopted BI and not the ones that are in the implementation phase of BI or planning to adopt BI. The study is also limited at studying behaviours of end users, which means it is limited to individuals' perspective of those users. The paper investigates BI in general, without considering different kinds of BI such as prescriptive or predictive and it is not limited to a specific vendor. According to Eckerson

(2003), well-designed BI systems are adaptive by nature therefore we will also be focus at some technical factors that influence end users' behaviour.

1.6 Concepts and definitions

Post adoption behaviour
Jasperson, Carter, and Zmud (2005) define post adoption behaviour as the "behaviours made by an individual user after an IT application has been installed, made accessible to the user, and applied by the user in accomplishing his/her work activities" (p. 7). Post adoption comes after initial adoption stage with the intention to continue to use the system (Huh & Kim, 2008). At this stage, IS becomes an inseparable and integral part of an organization (Saeed & Abdinnour-Helm, 2008). In this study, the post adoption behaviour indicates that users are proficient with the system and can easily manipulate and work with it.

Continuous use
According to Kim (2009) the continuous use "involves one's ongoing interactions with the same application over time" (p. 3). Unlike continuous use, post adoption indicates a period of time (post adoption period), when users are proficient and expert to work with the system. On the other hand, continuous use indicates how often users use systems: daily, monthly or once a year. If users use a system on daily bases, it indicates continuous use. If a system is used once a year or rarely used, it is not considered continuous use. Both terms mean behaviour and use regarding to the system in the period when system has become an integral part of the company and users' working routine.

Usage
According to Goodhue and Thompson (1995) usage is defined as "the behaviour of employing the technology in completing tasks" (p. 218) and as the "extent to which the information system has been integrated into each individual's work routine" (p. 223). In our study, usage is different from continuous use. Usage is explains a user who has just started using a new system/tool and does not have any experience. In this case, a user has not decided yet if he/she 'likes' the system and will want to use it in the future.

2 Literature review and proposed model

This chapter provides theoretical background on business intelligence and continuous use of it. It includes an overview of previous research related to our research question in which related topics and theories about BI, continuous use of BI and factors that influence post adoption behavior of BI users are discussed. The literature studied forms basis of the proposed research model design and scopes out the key data collection requirements and the design of research strategy.

2.1 Business Intelligence

Business intelligence (BI) includes technology that collects data and uses it effectively to increase business performance. According to Gangadharan (2004) BI enables employees, suppliers and partners to access the data they need for their jobs, analyse it and share that data with others. Consequently, BI assists organizations to look deep into all aspects of business operations to reveal ways for additional revenue or cost reduction.

The deployment of BI helps organizations to use historical and real time data for different analysis such as predictive analysis, and allows end users to have an impact on organizational objectives in the process of making different level decision (Watson, 2009). The ability to even have a small impact on decision making process gives end users the power to improve Key Performance Indicator, and hence it becomes valuable for organizations to obtain competitive advantage.

2.1.1 Definition of BI

As a term, BI was coined by Howard Dresner in 1990s, to cover various information technology (IT) based systems that help organizations to manipulate huge amount of data from internal and external sources (Power, 2009; Watson, 2009). Gartner (2012) defines BI as an umbrella term that includes the applications, infrastructure and tools, and best practices that enable access and analysis of information to improve and optimize decisions and performance. According to Azvine, Cui, and Nauck (2005), BI is a medium used to improve business capacity by providing powerful assistance for decision makers.

According to Jourdan, Rainer, and Marshall (2008), the representation of BI is associated with both a process and a product. The process consists of techniques that organizations deploy to develop valuable information, or intelligence, which will later help to compete with other companies and succeed in the global economy. The product is the information that will assist organizations to predict behaviour of their "competitors, suppliers, customers, technologies, acquisitions, markets, products and services, and the general business environment" with high accuracy (Vedder, Vanecek, Guynes, & Cappel, 1999, p.29). The word 'intelligence' in BI is defined as "a process of ethically collecting, analysing and disseminating precise pertinent,

specific, opportunistic, predictable and actionable information about the business environment, competitors and the organization itself" (Cavalcanti, 2005, p.7). However, intelligence is not only associated with information (Kahaner, 1997). It has deeper meaning beyond information, such as "interpretation, 'insight', intuition and even knowledge that make the final product of intelligence something more than simple information" (Cavalcanti, 2005, p.7). The point of intelligence starts with the process of converting data, knowledge, and information into intelligence as a final product (Cavalcanti, 2005).

2.1.2 Evolution of BI

With the advent of new computer features and data storage technologies, more data was generated, as there were more places to store it. This induced creation of the first computer applications which were able to produce reports that summarize the processed transaction data and that consequently led to the development of the first decision support system (DSS) (Power, 2009). Over time DSS evolved and expanded, and created opportunities for new applications such as executive information systems (EIS). Competition among organizations led to more advanced data storage systems called data warehouse (DW). DW could store huge amount of decision support data that is crucial for reporting and online analytical processing (OLAP). DW helped to reduce time required to access data and made it possible to store data in a single location (Heinze, 2014). Along with the DW, other elements of BI were developed such as Extract, Transform, and Load (ETL) tools.

In 1990s, many large organizations had already adopted enterprise applications. To be more versatile, developers started to look for new ways that innovative IT could be used such as in strategic enterprise management, control of customer profitability, improve performance and better business processes such as budgeting and business planning. However, organizations did not know how to manipulate the information they had on the DW for analysis and decision making so as to improve their performance and profits (Williams & Williams, 2007). Now that technical aspects of BI were refined, it was time to ensure that organizations can gain profit and improve their performance by using BI.

According to Drucker (2001), in the last century organizations are reengineering direct labour and BI is a new powerful tool that has been brought to business to gain competitive advantage. Effectively executed BI systems can help organizations to compete with others, and at the same time improve profits and performance. The executive vice president of Wachovia Bank states: "Wachovia's competitive position depends upon our ability to use information faster and smarter than our competition" (Davenport, Harris, De Long, & Jacobson, 2001, p.44). His comment proves that in order for organizations to compete, they have to think how they can use IT in general and specifically BI.

2.1.3 Benefits of BI

According to Negash (2004) organizations gain the following benefits by using BI: faster and more accurate reporting; improved decision-making process; improved customer satisfaction; savings in IT; and increased revenues. Deploying BI gives advantageous to both organizations and end users. In a like manner, Moss and Atre (2003) mention five categories of BI benefits: an increase in revenue; an increase in profit; improved customer satisfaction; a reduction of costs; and an increase in market share. According to Watson (2009) assessing BI benefits are

more challenging than for operational systems because of the “soft” nature of some benefits, such as more and better information and decision-making.
By using BI, users can quickly understand complicated information and consequently make better and faster decisions, and efficiently reach business objectives. The main benefit of BI is to increase efficiency and effectiveness of the organization. Additionally, it gives faster access to the information. Other benefits include flexibility of the users when they create reports. BI provides many benefits to organizations such as enhancing communication among departments and giving opportunity to organizations to respond quickly to changes in financial conditions, customer preferences, and supply chain operations. BI also accelerates decision-making process by acting quickly and correctly on information before competing businesses do. It also helps to improve customer experience by timely and appropriate response to customer problems and priorities (Hočevar & Jaklič, 2010).

2.2 Theoretical background

Our proposed model is a combination of self-determination theory, BI success factors, BI beneficial factors, satisfaction and BI continuous use as a dependent variable. The reason for including self-determination theory is to show what motivates users to continue using BI systems. In this study we look at competency and relatedness, which can motivate a user to continue using BI because they either feel competent and effective when using the system or using the BI system makes them feel valuable. Also there is a possibility of getting a promotion or recognition at work when an employee is competent and that is something that can possibly drive the employees to continue using the BI systems. BI success factors and beneficial factors are included in the model because they provide an insight on what the BI systems are used for, its capabilities and the status of the BI data. We therefore could not use an existing model, as we wanted to include factors specific to BI and other existing theories.

2.2.1 BI continuous use

In the last several decades, organizations made huge investments in the information systems to improve performance and to be ahead of their competitors. Consequently, many studies have been devoted to examine adoption and use of IS (Agarwal & Prasad, 1997; Cooper & Zmud, 1990; Hu, 1999; Venkatesh, Morris, Davis, & Davis, 2003). Bhattacherjee (2001) points out that while examining initial acceptance of IS is important as a first step to the success, the long term success of IS depends on its continuous use rather than its first-time use. Bhattacherjee (2001) explains continuous use as “long-term use of IS” in contrast to “initial use or acceptance”(p.352). One of the first studies of post adoption behaviour and continuous use was conducted by Bhattacherjee (2001). According to Saeed and Abdennour-Helm (2008), at the post adoption period "IS is infused within the organization and becomes an integral part of the work system" (p.3) and at this period users' behaviour show intention to continue using the IS.

Looking at BI, there are few studies that study the continuous use of BI systems (Audzeyeva & Hudson, 2015; Bischoff, Aier, Winter, & Haki, 2015; Deng & Chi, 2012; Han & Farn, 2014; Li, Hsieh, & Rai, 2013). Audzeyeva and Hudson (2015) examine continuous use mechanism in terms of maximizing the benefits of BI applications. Bischoff, Aier, Winter, and Haki (2015) investigate the influences and factors affecting the continuous use of BI

systems using a mixed method investigation. They conclude the study by confirming that there is a significant influence of trust on how the users perceive the usefulness of BI systems and it opens a future research study opportunity for those who want to focus on trust and continuous use of BI. Deng and Chi (2012) study the behaviour of using BI systems by developing a view of system use problems in organizations. Their findings show that the constructs interact differently in initial usage of BI systems and continuous use. Han and Farn (2014) extend the IS continuous model which considers a habit driven behaviour as a construct. They examined the role of empowerment by finding a relationship between the structural empowerment and psychological empowerment. A finding from that analysis is that psychological empowerment is influenced by structural empowerment and acts as a pure moderator between pervasive BI systems continuance intention and continuance usage behaviour. Another finding from their study is that habit has a direct effect on pervasive BI systems continuance usage. Li, Hsieh, and Rai (2013) investigate two post acceptance usage behaviours which is routine use and innovative use. They use motivation theory to explain the usage behaviours and investigate the impact of three types of intrinsic motivations (intrinsic motivation toward accomplishment, intrinsic motivation to know, and intrinsic motivation to experience simulation) and perceived usefulness on both routine use and innovative use of BI systems.

Despite the increasing significance of BI systems many organizations fail to exploit full capabilities of BI, which becomes an issue to explore long-term benefits of BI in the literature (Hallikainen et al, 2012). It is crucial to explore continuous use of BI in the long-term post adoption period. That is because benefits and influence of BI may not be seen in the short period of initial acceptance. There is still a gap in the literature as there is no explicit definition of continuous use of BI system. Therefore, while referring to continuous use, we follow the definition given by Bhattacherjee (2001) who explains continuous use as "long-term use of IS" such as BI, which indicates that users are using BI for a long period of time and know all features and capabilities of BI systems.

2.2.2 BI success factors

Researchers that have done studies on assessing the success factors of BI systems state that information integration and information accuracy are among the important and critical success factors (Işık, Jones, & Sidorova, 2013; Eckerson, 2003; Giovinazzo, 2009; White, 2005). Işık, Jones, and Sidorova (2013) define information integration as linking various systems in an organization with their applications or data so that value can be created above and beyond provided by each individual system. Information integration between BI and other information systems in an organization is a critical factor for evaluating BI success (Işık et al., 2013; White, 2005). Organizations need to ensure the success of the information integration, as it is critical to manage BI performance and ensure reliable results (Işık et al., 2013). Having different systems linked means that users have access to various information for decision-making or analysis. Hočevar and Jaklič (2010) have assessed benefits of BI systems using a case study and one of their findings is that information integration is one of the benefits for users as it makes it easy for them to have unified access to various data in different business units.

Information quality is also an important success factor for BI and it refers to the consistency, cleanliness, relevance, accuracy and comprehensiveness of the information (Eckerson, 2003; Giovinazzo, 2009). BI systems are implemented to help with the decision making therefore

providing inaccurate information to the users can only result to poor decision-making (Işık et al., 2013). One of the factors that mostly contribute to inaccurate information is the data source, the errors are not easily seen in the source because of how the data is structured and stored and when the information is aggregated in a BI system the errors are amplified. Establishing data governance procedures and involving users by allowing partial ownership of the resolution increases the confidence in the BI system (Giovinazzo, 2009). Watson (2009) confirms the importance of information quality by stating that information quality problems must be attended to by the organization as they affect credibility and usefulness of BI.

2.2.3 BI beneficial factors

According to Carver and Ritacco (2006), benefits of BI are divided into four categories; measurable, indirectly quantifiable, non-measurable and unpredictable benefits. Since the focus of the study is based on users' perspective, the only benefits that will be looked at are the non-measurable ones as they look at the improvement of work quality, motivation of employees and knowledge sharing between the employees (Carver & Ritacco, 2006). In addition, Carver and Ritacco (2006) state in their study that users believe that non-measurable benefits are more worthy than other benefits. BI benefits are hugely dependent on how BI is used in an organization. Therefore, these capabilities of BI can be viewed as beneficial; ad hoc analysis and querying, enterprise reporting, OLAP, mobile BI, real-time BI, operational BI, cloud and software as a service BI, open source BI, collaborative BI and location intelligence (Rouse, 2014).

Extant literature on benefits of using BI systems in organizations has shown that increased productivity, customization and advanced reporting are some of the factors, which are often perceived as benefits by most users (Hočevar & Jaklič, 2010; Scholz, Schieder, Kurze, Gluchowski, & Boehringer, 2010; Watson & Wixom, 2007). Advanced reporting includes data visualization used to design dashboards, reports and performance scorecards that provide insights and are easy to understand. Some of the reports are interactive reports and allow users to understand the analysis provided and also understand the underlying data used to build the reports. It is possible to interact with the reports through drilling down the reports, performing slice and dice OLAP analysis, using time series to go through a large data set and use conditional formatting to set data alerts (James, 2010). Graphic visualization of data, ability to drill down reports, possibility to export data to Excel and improved communication through the use of reports are perceived as beneficial and important by users (Hočevar & Jaklič, 2010).

According to a study done by Hočevar and Jaklič (2010), increased productivity is viewed as the ability of BI systems to provide analytical and intelligent decision support and also be able to produce reports and analysis in shorter time. There are different possibilities of analysis and decision support depending on the BI tool chosen by the organization. Scholz, Schieder, Kurze, Gluchowski, and Boehringer (2010) have studied benefits and challenges of business intelligence adoption in small and medium sized enterprises. They conducted factor analysis to deduce the perceived beneficial factors of BI systems. They reveal that one of the benefits of using BI system is that business decisions are improved through accurate data analysis. Hočevar and Jaklič (2010) state that OLAP technology, which is a technology behind BI applications, offers quick and simple execution of complex analysis therefore allowing users to perform more productive tasks. Users are able to perform predictive analysis and ask "What if" questions, which can help in making strategic questions (Watson & Wixom, 2007).

Personalized dashboards are often needed and used by executives as they only contain relevant information that assists the executives in making decisions quickly (James, 2010). The dashboards contain summary information and easy to grasp KPI which allow the executives to understand the information without wasting time on unnecessary information (James, 2010). Customization is also possible for other nonexecutive end users by using self-service BI tools. The self-service BI offers users to perform ad hoc queries, analysis and create personalized reports without needing assistance from the BI support (Strom, 2016). The less time spent on supporting BI users, the more time the BI team has for development projects (Hočevar & Jaklič, 2010). Therefore, the benefits provided by using BI systems can be viewed as important factors that can influence the continuous use of BI systems by end users.

2.2.4 Self-determination theory

Self-determination theory (SDT) has two types of motivation; intrinsic and extrinsic. Extrinsic motivation is defined as the perception that users will want to perform an activity because performing the activity is perceived to be instrumental to achieving outcomes that are valued and distinct from the activity itself such as performance bonus or promotion (Davis, Bagozzi, & Warshaw, 1992). Intrinsic motivation represents actions taken by individuals because of genuine interest and satisfaction in the activity itself (Davis et al., 1992; Gagné & Deci, 2005). Perceived usefulness, perceived ease of use and perceived enjoyment are constructs in a UTAUT model and were built by integrating the TAM model with intrinsic and extrinsic motivation (Venkatesh et al., 2003).

Self-determination theory is made up of two theories: Cognitive evaluation theory and organismic integration theory. Cognitive evaluation theory examines human behavioural motivation driving factors and the conditions that affect internal motivation and organismic integration theory examines conditions that affect extrinsic motivation (Lee et al., 2015). SDT proposes that the adoption of intrinsic motivation or the internalization of more self-determined types of extrinsic motivation depends on the satisfaction of three basic psychological needs: the need for relatedness, competence and autonomy (Roca & Gagné, 2008). Competence is defined as the individual's desire to interact effectively with the environment so as to gain a sense of competence in producing desired work outcome. Autonomy is defined as the desire to engage in activities of one's own choice. Relatedness refers to the desire to feel connected or a feeling that one belongs in a certain group (Vallerand, 1997).

Akbari, Pilot, and Robert-Jan Simons (2015) studied whether online platforms such as Facebook can be an effective environment for learning by analysing differences between a group learning through Facebook and a group learning face-to-face in a classroom using self-determination theory. Their study results showed that effects of competence and relatedness enhanced learning outcomes. Lee, Lee, and Hwang (2015) study if there is an interaction between the factors that motivate the use of technology and different types of motivation. They investigate if there is a relationship between human motivation and technology acceptance when extrinsic motivation and intrinsic motivation are sequentially introduced. In our study we use only relatedness and competence as the motivational determinants to investigate if there is a relationship between human motivation and continuous use of BI systems.

2.2.5 Expectation confirmation theory

Expectation Confirmation Theory (ECT) is a widely used theory in the IT literature to study post-adoption satisfaction as a function of expectations, perceived performance, and disconfirmation of beliefs (Anderson & Sullivan, 1993; Dabholkar, Shepherd, & Thorpe, 2000; Oliver, 1980; Patterson & Spreng, 1997; Tse & Wilton, 1988). Although the theory was first used in the psychology and marketing literature, it has since been adopted in several other scientific fields, which are mostly consumer research and information systems. ECT was originally used to explore both pre-behaviour (expectation) and post-behaviour (perceived performance) variables instead of only pre-behaviour.

Satisfaction was first defined by Locke (1976, p. 1300) as "a pleasurable or positive emotional state resulting from the appraisal of one's job". That definition was extended by Oliver (1981) as 'the summary psychological state resulting when the emotion surrounding disconfirmed expectations is coupled with the consumer's prior feelings about the consumption experience". In Bhattacherjee's model, satisfaction is a strong indicator of users' intention to continue using IT (Bhattacherjee, 2001).

Satisfaction degree is one of the factors that influence continuous use of IT. Some papers suggest that user satisfaction is an indicator for successful implementation of IT (Wixom & Todd, 2005; Zhao & Balakrishnan, 2009). In the both ECT and Bhattacherjee's model, satisfaction is the key motivation factor for the continuous use (Bhattacherjee, 2001; Oliver, 1980). Many empirical studies show that satisfaction has a positive influence to the continuance intention (Kuo, Wu, & Deng, 2009). Users tend to use BI more frequently if they are satisfied with their past experience. Applying ECT to the study of users' post-adoption behavior in the BI context is appropriate, because users' behaviour affects their continuous use of BI. First users have an expectation and if that expectation is met in a positive way, then users are satisfied. If that expectation is met in a negative way, users are dissatisfied.

2.3 Identifying the literature gap

Due to significant influence of continuous use on the long-term viability of BI systems, for our research we look into the factors that influence end users' post-adoption behavior. In the current literature TAM and UTAUT are two most often used models to study users' behaviour. An important limitation of the literature, however, is that, those models cannot be applied for our research. UTAUT model uses behavioural intention as an indicator of the technology use behaviour (Venkatesh et al., 2003). However, our research specifically investigates post adoption behaviour, which is formulated after the system is accepted. TAM model studies behaviour of users in perspective of technology acceptance and intention to use (Chuttur, 2009). Like UTAUT, this model concerns the early stages of technology when it has not been adopted by users. Consequently, both models explain pre-adoption period, when the system has not been adopted or become an integral part of the company and users have just started to use it. Our research, on the other hand, looks into the period when the system has already been adopted and it is used routinely. This difference makes it impossible for us to use TAM and UTAUT as our research model.

Another important research focus of our study is to investigate technical nature of BI on continued usage behaviour. According to Orlikowski and Iacono (2006), there is no

conceptual model that will capture all usage and technical contexts of a certain system. While searching for literature about BI, we found that there is no paper that combines continuous use and specific characteristics of BI systems. While a lot of IS research defines usage of prior IT innovations, BI and its interaction with end users has neither been thoroughly discussed nor investigated. Thus, we investigated characteristics and usage of the BI as it plays an important role in explaining end users' behaviour (Benbasat & Zmud, 2003). Thus, to address those research gaps in the literature and contribute to the study of post adoption behaviour of BI end users we provide our own model, which will be presented in the upcoming section.

2.4 Proposed model and hypotheses

2.4.1 Motivational determinants and BI continuous use

Lee et al. (2015) investigate in their study if there is a relationship between motivation determinants and IT acceptance constructs which are perceived enjoyment and performance expectancy. They hypothesize that relatedness, competence and autonomy significantly influence perceived enjoyment and performance expectancy. The results reveal a non-significant relationship between competence and perceived enjoyment and shows a relationship between the rest. Akbari et al. (2015) study show a direct relationship between motivation determinants and learning outcomes: the higher the motivation, the higher the learning outcomes. As discussed already in the theory section, our study only focuses on relatedness and competence. We believe that if a user is competent as using the BI system then he or she will continue using the BI system. Also when a user perceives being in a group of BI users as being valuable in a company then the user will continue using the BI system. We therefore hypothesize:

H1: Relatedness has a positive effect on BI continuous use.
H2: Competence has a positive effect on BI continuous use.

2.4.2 BI success factors and BI continuous use

Getting user perceptions about the importance of success factors is critical as that assists in ranking which ones are more important in an organization. Reliable information is critical in BI systems as one of their basic functions is to deliver information (Salmeron & Herrero, 2005). Bischoff et al. (2015) discuss and test the impact that information quality of a BI system has on users' trust and how trust affects continuous use of BI. Information integration is as important as information quality in BI therefore, we hypothesize a significant influence between the success factors and BI continuous use.

H3: Information quality has a positive effect on BI continuous use.
H4: Information integration has a positive effect on BI continuous use.

2.4.3 BI beneficial factors and satisfaction

Chen, Soliman, Mao, and Frolick (2000) investigate underlying factors of end-user satisfaction with data warehouses. In their study, end user satisfaction is a dependent variable that is influenced by three factors (user support, coverage of user requirements, data accuracy). In this study we also treat satisfaction as a dependent variable that is influenced by

the BI beneficial factors. According to ECT, productivity is directly influenced by pre-adoption expectations, and in turn directly influences post-adoption satisfaction. The benefits that are gained due to using the BI systems are therefore tested to see how they influence satisfaction.

H5: Increased productivity has a positive effect on Satisfaction.
H6: Advanced reporting has a positive effect on Satisfaction.
H7: Customization has a positive effect on Satisfaction.

2.4.4 Satisfaction and BI continuous use

According to the concept of ECT model, system's continuance usage will be influenced by users' satisfaction with the system (Hsu, Yen, Chiu, & Chang, 2006). In this model, satisfaction is affected by advanced reporting, customization and increased productivity. Oliver (2001) studied the continuance usage of information system. He pointed out that users' continuous use is mainly resulted from satisfaction gendered after usage in reality. The following hypothesis is therefore proposed:

H8: Satisfaction has a positive effect on BI continuous use.

The figure below is an illustration of the proposed model with its constructs and relationships between them.

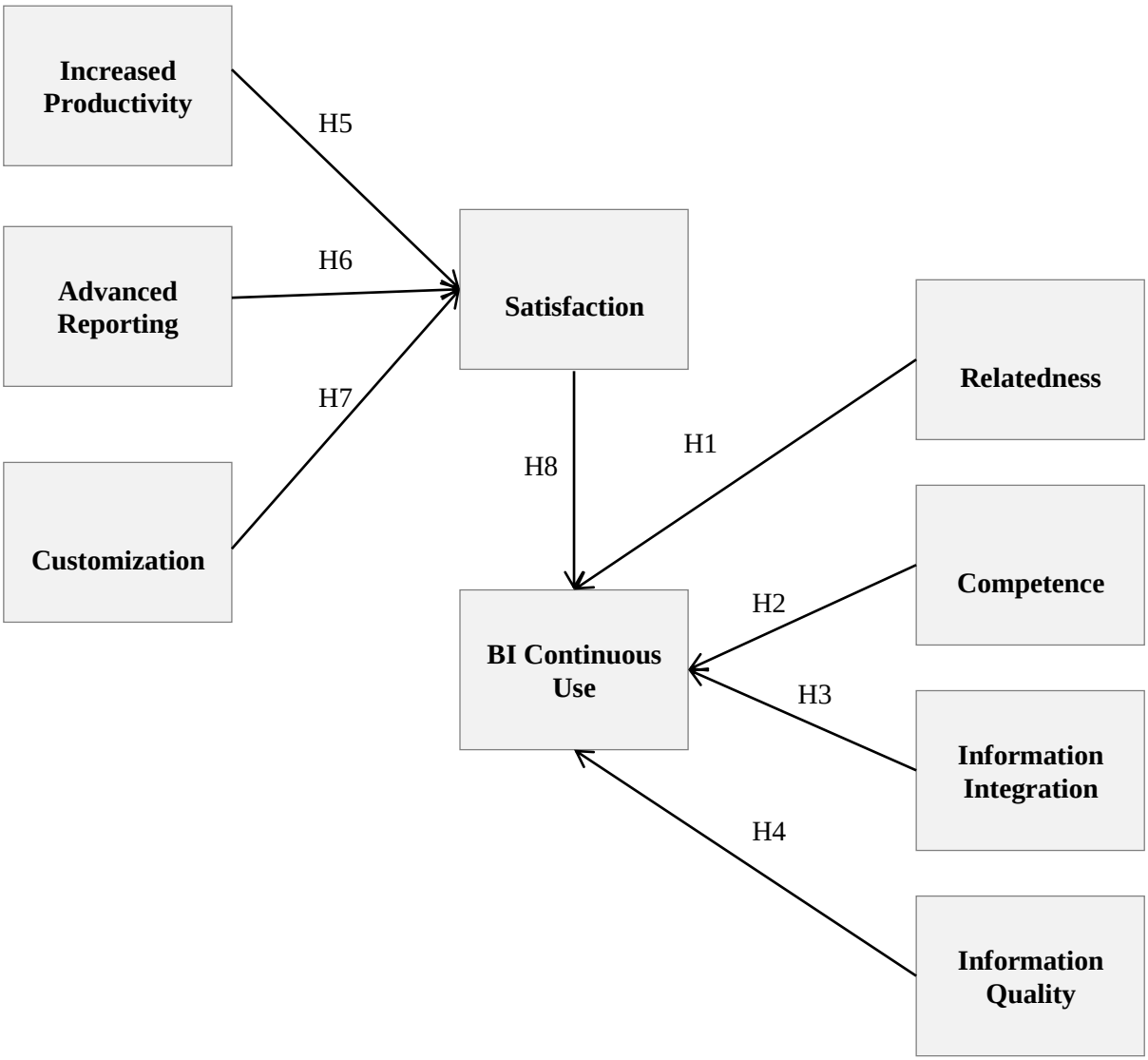


Figure 2.1 Proposed research model

3 Research methodology

This chapter provides a detailed description of the research process and research design that we followed in our study. For this research, we used a survey and semi-structured follow-up interviews, which we describe in detail below. The outline of the chapter includes the research strategy, design of survey and interview questions, describe data collection process, as well as techniques used for analyzing the data. Finally, we conclude by describing research quality and ethics.

3.1 Research strategy

The main goal of our research strategy is to choose the research method that helps to answer our research question within the limited time. Additionally, when selecting suitable strategy for our research, we chose the method that would best contribute to our research. For that we used a combination of quantitative and qualitative approach.

According to Creswell (2014) use of both qualitative and quantitative method in the research helps to draw stronger conclusions by combining different research methods: "this mixing or blending of data, it can be argued, provides a stronger understanding of the problem or question than either by itself" (p. 264). Therefore, to have a stronger conclusion, we used survey for the quantitative method and semi-structured interviews for the qualitative method. In our research quantitative data was collected and analysed first, and then based on the findings from the survey, interview questions were formed and qualitative data were collected and analysed.

Quantitative method was used to test our research model that determines the extent of influence that the identified factors have on continuous use of BI. In general, quantitative method includes a set of techniques to answer the research question with the help of quantitative data (Recker, 2013). To collect quantitative data we used an online survey. The qualitative method was used as a supplementary source to better understand why certain factors have more influence on continuous use of BI than others. That is why this method was conducted after the quantitative data was collected and analysed. Consequently, qualitative data was used to enrich the data received from the questionnaires.

3.1.1 Research process

Our research process (Figure 3.1) started with reviewing existing literature. Initial literature review was done to form our research question, which is following: what are the major antecedents to BI continuous use in organizational settings? According to Bhattacherjee (2012), literature review has three main purposes: (1) review current state of knowledge in the area of interest; (2) identify influential authors, theories and current findings in that area and (3) find a gap in the area of interest. Thus, after the research question was formed we started

with reviewing existing literature by searching keywords such as ‘business intelligence’, ‘continuous use’ and ‘post adoption behaviour’ to gain more information about BI, continuous use and different models related to them. We used different sources such as Google Scholar, ACM Digital Library and LUBsearch to look for different articles and papers. Once we found sufficient amount of articles, we went back to look at their citations and search for them.

Literature review helped us to (1) explore specific features related to BI, and (2) identify factors that influence continuous use of BI. We found that even though the subcomponents of the research question such as “continuous use” and “business intelligence” were heavily discussed, however, the combination of those two concepts were not. Consequently, the gap in the reviewed literature was identified and our research model was formed. This led us to conduct empirical study, which includes survey and interviews. The findings from both sources were analysed after which conclusion was formed.

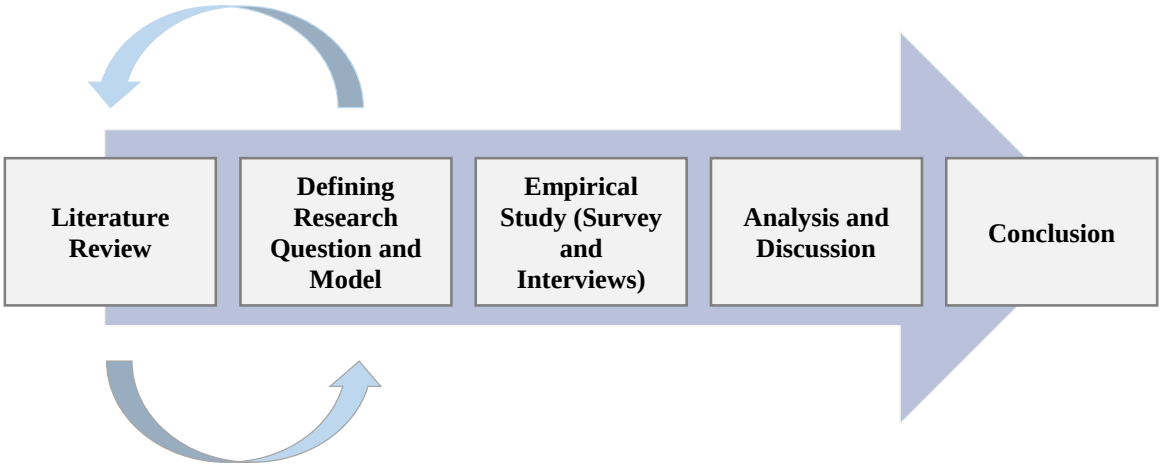


Figure 3.1 Research process

3.2 Development of survey and interview questions

3.2.1 Design of questionnaires

According to Bhattacherjee (2012), one of the golden rules when designing a questionnaire is assuring the respondents of their confidentiality and also being transparent about what the responses will be used for and how they will be used. Therefore, the questionnaire has an introduction that informs the respondents who we are, what we intend to use the data for and how it will be reported. The questionnaire includes structured questions and unstructured question.

The questionnaire is divided into three parts. Bhattacherjee (2012) states that the best practice when designing a questionnaire is to start with nonthreatening questions therefore the first part is a collection of demographic questions. Users are asked about their roles, experience of using BI, age and gender. The demographic data is analyzed so as to get an insight on who the BI end users are in the organizations. The second part of the questionnaire is a collection of questions based on the proposed model. We formulated the questions using the literature

review and in some cases we reused the questions that have been used before as they have been validated already. We have 34 measurement items for each construct and therefore in the questionnaire each factor or construct will have 34 questions. Since the study aims to understanding the factors influencing continuous use of BI, we decided to rate the answers using Likert scale since Likert scale items allow more finely tuned responses (Bhattacherjee, 2012). We have used five point Likert scale, which ranges from "strongly disagree" to "strongly agree" and also allows respondents to give a neutral response.

The last part of the questionnaire is an open-ended question, which allows the respondents to add suggestions, remarks or comments. The responses from this section will be used to assist with the interview questions. The questionnaire design is simple and easy to use.

Table 3.1 Constructs, definition of constructs and measurement items

Construct	Definition	Final questionnaire items
BI Continuous Use	It refers to the behavior of users regarding using the BI system intensely over a longer period of time for their tasks (Bischoff et al., 2015; Han & Farn, 2014).	**USE1**: I intend to continue using the BI system (Han & Farn, 2014). **USE2:** In future I will be relying on BI to perform my tasks (Hoehle et al., 2012). **USE3**: All things considered, I expect to continue using the BI system in the future (Han & Farn, 2014).
Satisfaction	The degree of satisfaction that the users feel when using BI systems (Chen et al., 2000).	**S1**: The BI system satisfies my work needs (DeLone & McLean, 1992). **S2:** The information provided by the BI system is adequate (Chen et al., 2000). **S3:** I am satisfied with the insights that are provided by the BI reports (Chen et al., 2000).
Relatedness	Feeling that one belongs in a given social milieu (Vallerand, 1997).	**RE1:** Working with the BI system gives me an opportunity to interact with others within the organization (Lee et al., 2015). **RE2:** I feel close to the people I work with while using the BI systems (Lee et al., 2015). **RE3:** Using the BI systems to make decisions makes me feel like a valuable member of the organization (Lee et al., 2015).
Competence	Individual's sense of competence in producing desired outcomes (Vallerand, 1997).	**C1:** I have mastered the skills necessary to use the BI system when doing my job (Venkatesh et al., (2003). **C2:** I am better than others at using the BI system (Lee et al., 2015). **C3:** I am confident at using the BI system (Lee et al., 2015).
Information Quality	Refers to the quality of information provided by the BI system (Wixom & Todd, 2005).	**IQ1:** The information provided by the BI system is always accurate (Chen et al., 2000). **IQ2:** The information is always updated (DeLone & McLean, 1992).

		IQ3: The information provided by the BI system is easy to make sense of (DeLone & McLean, 1992).
Information Integration	Refers to the diverse information provided by the BI system that can be accessed in one place (Wixom & Todd, 2005).	**II1:** I am able to access data of different sections of the organization by using the BI system (DeLone & McLean, 1992). **II2:** The information provided by BI systems provides me with a broad view of the organization (DeLone & McLean, 1992). **II3:** The information provided by the BI systems is relevant to my work needs (Chen et al., 2000).
Customization	It refers to the ability to customize reports or dashboards using BI systems (James, 2010; Hočevar & Jaklič, 2010).	**CU1**: I am able to create reports that show only information that is relevant to my work (Chen et al., 2000). **CU2**: I am able to create my own queries to get a better understanding of the data (Chen et al., 2000). **CU3:** I enjoy creating my own reports (Venkatesh et al., 2003).
Increased Productivity	It refers to enhanced productivity and time saving benefits that the BI system provides (Hočevar & Jaklič, 2010; Watson & Wixon, 2007).	**IP1**: Using the BI system improves my work (Venkatesh et al., 2003). **IP2**: The information provided by the BI system assists me in making better decisions (Chen et al., 2000). **IP3:** The BI systems are able to offer quick analysis on complex tasks (Venkatesh et al., 2003). **IP4**: I am able to produce reports in shorter time by using BI systems (Scholz et al., 2010.
Advanced Reporting	It refers to the reporting capabilities provided by BI systems (Watson & Wixon, 2007).	**AR1:** I am able to export my reports to Excel or to another system (Scholz et al., 2010). **AR2:** I am able to drill down on the data using the reports (Scholz et al., 2010). **AR3:** The reports design makes it easy for me to understand the information provided (Chen et al., 2000).

3.2.2 Pilot testing

Pilot testing is aimed at detecting potential problems in the questionnaire design. This could be the wording of the questions or the relevance of the questions (Recker, 2013; Bhattacherjee, 2012). Bhattacherjee (2012) mentions that pilot testing is an important part of the research process that researchers tend to overlook. According to Recker (2013), when performing pilot testing the surveys must be sent to people who have similar characteristics to the target group that the final survey will be sent to. Therefore, we decided to send the questionnaire to a small sample of 10 people. We received feedback of comments, suggestions and concerns on how we can improve the questionnaire and the time it requires the respondents to fill in the survey. The common problems that the respondents mentioned were:

- Redundant questions
- Length of the survey

- Presumptuous questions
- Wording of questions

We reformulated the questions to eliminate presumptions and to make the questions clear. To improve the length of the survey, we limited the questions per construct to 3-4 questions so as to still maintain the validity. After improving the questionnaire, the final version was sent to the organizations for distribution.

3.2.3 Administration of questionnaires

Before sending the final questionnaire, we contacted the companies since we wanted to conduct the interviews as well. Therefore, in each company we had a representative that we sent the final survey to so that it can be distributed within the company. Bhattacherjee (2012) states that there are different categories of questionnaires: group-administered surveys, self-administered mail surveys and online surveys.

For our study, we decided to conduct online surveys because of the nature of our study and the convenience offered by online surveys. The questionnaires were designed using Google Forms so as to ease up the process. We shared the survey link to the companies' representatives who then distributed it to the BI end users within the companies and the responses were automatically stored in a spreadsheet as participants responded to the survey. A few reasons explaining why we chose online surveys is that they are inexpensive and they are able to reach any geographical area (Bhattacherjee, 2012).

3.3 Design of interview questions

After collecting quantitative data using the survey, we conducted follow-up semi-structured interviews in order to gain more information about users' motivation to continuously use BI. The purpose of conducting interviews was to gain insightful knowledge on the subject and answer to our research question. According to Recker (2013) qualitative method is also called interpretive research method and consequently, follow-up interviews helped us to interpret the data collected from survey and not to be limited to the constructs that we found in the literature.

Before conducting interview, we created an interview guide, which is a list of potential questions that we prepared in advance (Kvale & Brinkmann, 2009). Questions were formulated based on the findings from the survey and the literature. The interviews were semi-structured as we wanted the interviewer to have flexibility in asking questions that may arise during the interview and also allow a bidirectional discussion on the topic (Recker, 2013). Hence, our interview questions were not limited to ones that we prepared in advance. The questions were open-ended, which helped interviewees to be more flexible and open in answering them. An outline with the interview questions has been attached as Appendix VI.

Our interview guide consists of three parts:
Part 1. Introduction and general questions. In this first part, we introduced ourselves and briefed the interviewee on how the interview will be conducted. We also asked the interviewees if they will be okay with us recording the interview. After introduction, we asked

interviewee about their background including work experience, role to warm up the discussion.

Part 2. Main questions. It includes questions about the BI system specific to the interviewee's company, what it is used for, to what extent and the interviewee's frequency of use. The questions asked in this part were formulated around our research model and findings that we got from the survey.

Part 3. Conclusion. In this part, we thanked them for their time and assistance and asked if we can contact them later for the follow-up questions.

3.4 Participants

3.4.1 Survey participants

As our research is formulated around BI, our target population was limited to employees of companies that use BI systems. More specifically, we are focusing on BI end users, who may or may not have technical skills and may operate at any level within the company. We are not limiting our target population with specifying what kind of device or software they use. Thus, target population includes only people who have experience in using BI.

Taking into consideration all the above mentioned factors, we started with creating a list of companies that use BI from online sources, which we will explain in more detail in the section 3.5. The survey was sent to approximately 49 companies from which 8 companies responded to us and 4 participated in our survey, thereby scoring a 16 % response rate. The companies were given approximately ten days before we started to collect all data and start with analyzing it. The more details on our participants we will provide in section 4.1.

3.4.2 Interview participants

Our selection of interviewees is based on the survey results. When we sent emails requesting for a distribution of our survey in the company, we also requested time for interviews. From the survey results we chose 2 companies that participated and offered time for the interviews. The companies we chose are operating in different industries and one is using an in-house BI team for development of BI systems whereas the other one is using an external entity. The list of interviewees from both companies with their roles is shown in the Table 3.2 and we have also provided a profile of each respondent with details pertaining to their work.

Table 3.2 Interviewees profile overview

Interviewee	Industry	Country	Position	Type of interview	Duration
Interviewee 1	Financial Services	South Africa	HR manager	Phone interview	15 min
Interviewee 2	Banking	South Africa	Business	Phone	10 mins

			Intelligence analyst	interview	
Interviewee 3	Banking	South Africa	Financial accountant	Phone interview	11 mins

Interviewee 1 is an HR manager at a small Financial Services enterprise in South Africa, which is a subsidiary of a large international company based in Germany. She has 11 years' experience within the Human Resources environment and has spent the last 5 years with the current employer. In her role, she is responsible for the successful implementation of the HR Strategy and the smooth running of day-to-day HR operational activities. Regarding the use of BI tools, she has worked with the current HRBI tool for 1 year and other variations of BI tools for 6 years prior. The current tool is on an Oracle platform, developed and managed by an external entity.

Interviewee 2 is a Business Intelligence analyst at a multinational retail and commercial bank in South Africa. She has 8 years' experience within the banking environment and has been working for the last 8-9 months in a Finance risk and compliance team. In her role, she is responsible for supporting branches with compliance. Regarding the use of BI tools, in her new role she has been using MyBI system and other variations of BI tools for 7 years prior. The MyBI system is a BI system built on a Microsoft platform and the front-end has been developed with Qlikview. The BI solution was developed and it is maintained by an in-house BI development team.

Interviewee 3 is a financial accountant at a multinational retail and commercial bank in South Africa. She has 2 years' experience of working in a Balance sheet compliance management team. In her role, her main responsibilities are providing support to the branches, monitoring high risk accounts and fraudulent activities. Regarding the use of BI tools, she has been using MyBI solution for 2 years. The MyBI solution is built on a Microsoft platform and the front-end has been developed with Qlikview. The BI solution was developed and it is maintained by an in-house BI development team.

3.5 Data collection

For our data collection we conducted both online survey and individual semi-structured interviews. In our research, quantitative data is dominant and the qualitative data plays a secondary explanatory role. Our data collection process consists of two phases: quantitative phase and qualitative phase (Figure 3.2).

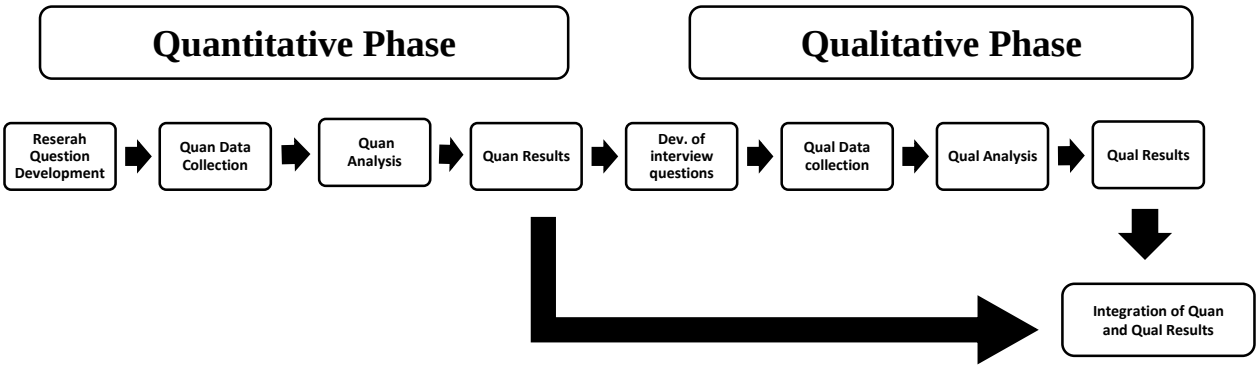


Figure 3.2 Data collection process (Hayes, Bonner & Douglas, 2015)

After literature review was done and research question was formulated, we created our research model. To test our model and find out impact level of each construct to the continuous use of BI, we started with a quantitative research (Recker, 2013). Therefore, to investigate how factors that we identified from the literature influence continuous use of BI and in what extent, we decided to do a survey first.

To find companies that use BI, we searched for them online in Google and Linkedin. We identified few companies in Sweden and in South Africa, which use BI tools for several years. The data for the quantitative phase was collected through online questionnaire, which was sent to company representatives via email. Unfortunately, we did not receive many responses from the companies in Sweden. Some of them either did not respond to our email at all or some responded that the policy of their company does not let employees to share information. After the first phase was accomplished, we formulated questions for the follow-up interviews based on the survey results. While the survey helped to measure the extent of influence each construct has, conducting interviews helped us to answer to the 'why' question and find out if there are other factors that have influenced continuous use of BI that we did not identify from the literature. The length of interviews was approximately 10 to 15 minutes. Interviews helped us to enrich our findings and provided additional information that will be helpful in the future studies in this area.

In summary, in our research we accomplished both quantitative and qualitative research. Thus, in the data analysis section collected data is analyzed in two different ways and conclusion is derived by using both type of data.

3.6 Survey data analysis

After all the data was collected, the next step was to analyze it. As was mentioned before the first phase of our data generated from the questionnaire. Consequently, first phase of data analysis was quantitative data analysis. According to Bhattacherjee (2012) quantitative data analysis can be done in two ways: 1) descriptive and 2) inferential analysis. Descriptive analysis used to statistically describe and presents constructs, and inferential analysis refers to testing theory and hypotheses (Bhattacherjee, 2012). In our study, both types of analysis were used with the help of the tools such as Excel, SPSS, SmartPLS and AMOS.

Before analyzing the data, it is necessary to consider few steps such as data preparation, which includes data coding, data entry, manipulation of missing values and data transformation (Bhattacherjee, 2012). To collect quantitative data, we used Google Form, which saves collected data into Excel format. Once all data was saved in Excel file, we had look at the missing values. In order to keep sample size of the collected data, we applied process called imputation with the help of SPSS, which can make an unbiased estimation of the value (Bhattacherjee, 2012). Imputation refers to a process replacing missing values with an average value of the respondent's responses (Bhattacherjee, 2012). The data on the Excel file was marked with the words from 'strongly disagree' to 'strongly agree'. Thus, we applied data transformation technique to transform those words into numerical representation respectively from 1 to 5.

The first part of the questionnaire consisted of demographics information, and we used descriptive analysis to analyze data. Descriptive analysis was used to interpret data such as participants' position, experience and gender. In the second part of the survey, we used both descriptive and inferential analysis. Univariate and bivariate analysis of the descriptive analysis were used. Univariate analysis was used to check the frequency distribution, the mean and the standard deviation of each construct's item, as well as the overall mean of each construct (Bhattacherjee, 2012). Bivariate analysis was used to check the interrelationships between the constructs, consequently we conducted a bivariate correlation statistical analysis (Bhattacherjee, 2012).

Finally, we applied inferential analysis by using Structural Equation Modelling (SEM) technique. SEM includes combination of factorial and regression or path analysis, which was used for testing our initial hypotheses (Creswell, 2014). After hypothesis test, the statistical significance and the path coefficients among constructs were measured.

3.7 Interview data analysis

According to Kvale (1996) data analysis should start during the interview. Otherwise, it can be late to think about how data will be analyzed after the interview. Thereby, before conducting actual interview we already had a plan of how we are going to handle the collected qualitative data. Our data analysis consists of two steps: 1) interview transcription, 2) coding and analyzing.

The next step after conducting all interviews is a transcription process. Transcription implies to the process of converting all oral conversion into written text (Bhattacherjee, 2012). While transcribing data, we tried to be as precise as possible because the quality of the results may be decreased if the data is not properly transcribed. Additionally, we transcribed data right after the actual interview as still remembered the interview.

After transcribing all data, we used software called NVivo to analyse unstructured data like our interview transcripts. The software was used to divide the data into fragments and then putting these fragments into categories and sometimes subcategories. The used categories for the interview transcripts from this study included criteria behind software adoption, extent of consideration of other options, acquisition decision, acquisition, software acquisition plans and future suggestions. We then analyzed the interview results based on these categories.

3.8 Quality and ethics

3.8.1 Reliability

Reliability indicates the degree to which construct or model is consistent and reliable (Bhattacherjee, 2012; Recker, 2013). It means that if we measure the same construct several times, each time the result will be the same. Different techniques were used to test reliability of the qualitative and quantitative methods (Bhattacherjee, 2012). To follow the definition of reliability, our paper includes a complete description of our research process, sources of our data and our findings (Benbasat, Goldstein, & Mead, 1987). For the quantitative approach, to ensure our survey works, we sent a pilot testing to ensure that collected data could be easily accessed and analyzed later. Besides pilot testing, we followed internal consistency reliability approach, which was evaluated by Cronbach's Alpha statistical method (Bhattacherjee, 2012). The results of this test are presented in the Chapter 4.

For the qualitative method we followed instructions to provide reliable data (Bhattacherjee, 2012). One of the most common mistakes in the interview comes from poorly worded questions or asking ambiguous questions (Recker, 2013). To avoid this problem, we used simplified wording that respondents would easily understand and we carefully formulated our interview questions that were directly related to our research, which included open-ended questions rather than direct questions. To enhance reliability of our research, we made sure that all data from the respondents was recorded and transcribed in full (Creswell, 2014). The phone interviews were recorded through a mobile phone. To make sure that our recording tool works we tested it with one of our friends. Then we checked the quality of the recorded data to make sure that the recorded voice was clear and easily transcribable later. All transcribed data is attached to our thesis paper as appendix VI, VII and VIII.

3.8.2 Validity

Validity describes whether collected data represents what researchers are supposed to measure (Recker, 2013). According to Zohrabi (2013) validity is a reliable way to evaluate quality of the study. Validity is divided into two types: 1) validity of the measurement and construct validity and 2) validity of hypothesis (Bhattacherjee, 2012). Different techniques can be used to test validity: convergent, concurrent discriminant, and predictive validity (Recker, 2013). The issue with the construct's validity may arise if a questionnaire item is not clear and ambiguous (Recker, 2013). Thus, to avoid this problem we used convergent and discriminant validity tests. To evaluate the convergent validity, the average variance extracted (AVE) was used (Creswell, 2014). For the discriminant validity we applied formula suggested by Fornell and Larcker (1981), which compares the square root of AVE for each construct with the relation to the constructs in our research model.

To measure validity of the hypotheses three approaches can be used: 1) internal, 2) external and 3) statistical conclusion validity (Bhattacherjee, 2012). In order to ensure external validity, which concerns with generalizability of the study, we distributed our questionnaires and interviewed people from different types of organizations and departments.
Merriam (1988) recommends six methods for internal validity, of which we followed some of them. Triangulation refers to strengthening the validity of findings by collecting data from different sources (Zohrabi, 2013). In our research both qualitative and quantitative data were

collected, which helped to increase the validity of our study. Additionally, peer examination was done, which refers to reviewing findings by few non-participant people (Zohrabi, 2013). To accomplish peer examination of our thesis paper, collected data was examined by our supervisor and few fellow students in order to know their opinions on our interpretation of results.

Another way to improve validity is to avoid biases. It can be done by collecting, analyzing and interpreting data accurately and objectively. To avoid possible biases, we first stated our goal in the beginning of the paper such as our purpose and challenges. Additionally, we interviewed totally three people, which also was sufficient for our research to draw valid conclusions. Furthermore, biases may occur while researchers form interview questions and when they interpret the results (Recker, 2013). Before the interviews, we prepared questions that do not reflect results that we expected, they were formed impartially without advance predictions. During the interview we did not state our opinions on the topic for the interviewees and always kept our neutrality while asking questions.

3.8.3 Ethics

Ethics are principles that guide researchers to define what is right or wrong within a research community (Bhattacherjee, 2012; Recker, 2013). Ethical behavior includes following certain rules such as responsibility, accountability, liability and due process (Recker, 2013).

Voluntary participation and informed consent. In the introduction part of the questionnaire and before conducting interviews we informed participants that their participation in our study is voluntary and they are free to withdraw from the study at any time. We also informed participants about the purpose of our research and how the collected data will be used.
Anonymity and confidentiality. According to Bhattacherjee (2012) anonymity implies that readers of the paper are not able to identify who filled in the survey or participated in the interview. To preserve anonymity of the respondents we emailed our survey to one representative of each company asking him/her to distribute the survey. Consequently, we were not able to track who filled in our survey. Participants were also informed that we would protect their anonymity and confidentiality.
Analysis and reporting. During data analysis and reporting, we considered ethical guidelines provided in Bhattacherjee (2012). The guidelines include presenting objective data and reports, even if they are unexpected or negative. Thus all findings and reports are based on the data that we collected without any alteration.

4 Empirical data profile and analysis

In this chapter, we describe results of survey and interview analysis. First, we present demographic profile and usage of the survey participants followed by evaluation of reliability and validity measurements. Then in the following sections, we provide descriptive analysis, path analysis, open question analysis and the interviews analysis.

4.1 Demographic profile and usage

4.1.1 Demographic profile of respondents

Our results from the demographic findings (Appendix II) show that the number of total participants was 72, with 41 male participants, which represents 56.9% of the total participants. The female participants were 31, which is 43.1% of total. The demographic part also included a question finding out the industries that our participants are working in. The results show that 46 participants (63.9%) work in a banking industry, 11 participants (15.3%) in financial services, 9 participants (12.5%) in a manufacturing industry and 6 participants (8.3%) work in the oil and energy industry. Regarding participants' organizational role, 36 people (50%) work in the middle management level and the other half are non-managers and professional staff.

4.1.2 Usage information of the respondents

Determining their experience with using BI system and usage frequency was also important. Consequently, 55 participants (76.4%) answered that they have experience with BI more than 3 years, 11 (15.3%) said they have experience between 1 and 3 years and 6 people (8.3%) have less than 1 year experience. The last question in the demographics part was created to determine how often users use BI systems. 62 people (86.1%) answered that they use BI systems almost every day, 8 people (11.1%) use BI systems at least once a week and 2 people (2.8%) of total participants use it at least once per month.

4.2 Measurement assessment

In order to draw accurate conclusions, it is very crucial to assess both reliability and the validity of the used measurement items and constructs. For the validity assessment, convergent and discriminant validity were applied. To test reliability, we used internal consistency reliability.

4.2.1 Internal consistency

According to Mitchell (1996) internal consistency is one of the most widely used concept to evaluate reliability. The concept is used to test reliability between items of the same constructs (Recker, 2013). In this study, internal consistency was estimated with the Cronbach's alpha. The coefficient of Cronbach's Alpha usually ranges between 0 and 1, and coefficient above 0.7 is considered acceptable (Mitchell & Jolley, 2012). Cronbach's Alpha helped to measure the internal consistency reliability of all hypothetical factors. In Figure 4.1 we can see that the value of Cronbach's Alpha is 0.945, which indicate high measurement reliability.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.945	.950	28

Figure 4.1 SPSS reliability statistics

Table 4.1 includes Cronbach's Alpha values for each construct. The value of each construct ranges from 0.731 to 0.890, which is higher than recommended threshold value of 0.70. The results indicate that the model of this study has adequate measurement reliability.

Table 4.1 Cronbach's Alpha and composite reliability scores

Construct	Cronbach's alpha	Composite Reliability	AVE
BI Continuous Use	0.82	0.891	0.732
Satisfaction	0.853	0.911	0.775
Relatedness	0.817	0.89	0.729
Competence	0.797	0.891	0.734
Information Quality	0.731	0.799	0.574
Information Integration	0.79	0.877	0.705
Customization	0.802	0.884	0.718
Increased Productivity	0.863	0.907	0.71
Advanced Reporting	0.89	0.929	0.813
Criteria	**>0.7**	**>0.7**	**>0.5**

4.2.2 Convergent validity

For the validity test, construct validity was used to measure if constructs accurately measured the outcomes that they were supposed to measure (Recker, 2013). In our study, construct validity was assessed by convergent and discriminant validity. Convergent validity shows how measured item is close to its theorised construct (Recker, 2013). To assess convergent validity, we used Average Variance Extracted (AVE) and composite reliability (CR) (Fornell & Larcker, 1981). According to Henseler, Ringle, and Sinkovics (2009), to ensure convergent validity, the value of AVE should be at least 0.5 and the value of CR should be more than 0.7. Additionally, AVE should not exceed CR. The results show that the value of AVE for each

construct ranges from 0.574 to 0.813. The results of CR ranges from 0.799 to 0.929 and value of CR for each construct is higher than the value of AVE. Thus, the results show that our research model has adequate measurement validity

4.2.3 Discriminant validity

Discriminant validity is used to show the extent to which the measurement items do not measure another construct that they are not designed to measure (Recker, 2013). This validity shows that one construct is different from other constructs. To measure discriminant validity, we followed two steps given by Agarwal & Karahanna (2000). First step includes showing that indicators load on their respective construct much stronger than on other constructs. To validate our research model, we conducted Confirmatory Factor Analysis (CFA) which estimates item loadings and cross loadings. The CFA analysis is presented in the Table 4.2.

Table 4.2 Confirmatory Factor Analysis results

	AR	USE	C	CU	IP	II	IQ	RE	S
AR1	0.838	0.713	0.417	0.468	0.589	0.541	0.408	0.465	0.245
AR2	0.942	0.629	0.372	0.604	0.766	0.568	0.369	0.379	0.472
AR3	0.921	0.492	0.285	0.556	0.719	0.576	0.514	0.424	0.501
USE1	0.655	0.898	0.465	0.401	0.659	0.661	0.461	0.376	0.441
USE2	0.418	0.766	0.269	0.354	0.423	0.346	0.275	0.411	0.381
USE3	0.542	0.895	0.434	0.443	0.445	0.508	0.331	0.407	0.287
C1	0.391	0.467	0.921	0.486	0.499	0.607	0.313	0.708	0.383
C2	0.165	0.244	0.743	0.494	0.379	0.423	0.252	0.537	0.329
C3	0.359	0.441	0.896	0.417	0.486	0.526	0.309	0.494	0.533
CU1	0.707	0.428	0.366	0.781	0.498	0.472	0.408	0.41	0.375
CU2	0.466	0.443	0.439	0.903	0.535	0.475	0.227	0.435	0.544
CU3	0.422	0.308	0.546	0.854	0.486	0.405	0.201	0.594	0.402
IP1	0.714	0.581	0.422	0.481	0.811	0.771	0.483	0.463	0.476
IP2	0.721	0.577	0.403	0.595	0.799	0.719	0.518	0.546	0.387
IP3	0.611	0.491	0.455	0.485	0.857	0.651	0.597	0.457	0.761
IP4	0.651	0.477	0.512	0.502	0.899	0.746	0.539	0.598	0.666
II1	0.514	0.424	0.454	0.298	0.615	0.768	0.556	0.221	0.417
II2	0.489	0.512	0.631	0.482	0.671	0.838	0.475	0.707	0.575
II3	0.578	0.595	0.472	0.527	0.815	0.907	0.617	0.522	0.548
IQ1	0.221	0.076	0.109	0.301	0.306	0.351	0.703	0.136	0.225
IQ2	0.223	0.241	0.217	0.285	0.373	0.391	0.713	0.239	0.226
IQ3	0.499	0.451	0.338	0.235	0.632	0.635	0.892	0.442	0.492
RE1	0.251	0.313	0.765	0.461	0.487	0.509	0.341	0.791	0.381
RE2	0.337	0.341	0.413	0.406	0.401	0.318	0.235	0.852	0.316
RE3	0.522	0.484	0.583	0.548	0.618	0.646	0.484	0.915	0.448
S1	0.428	0.413	0.571	0.481	0.686	0.584	0.334	0.482	0.918
S2	0.345	0.263	0.221	0.295	0.499	0.406	0.448	0.246	0.764
S3	0.481	0.439	0.451	0.582	0.687	0.608	0.485	0.428	0.947

According to the Henseler et al. (2009) the loadings of the construct have to be more than 0.7 to be considered valid. The results show that all items have high loading in respect to their

constructs. Consequently, all constructs were kept in our model. Second step involves comparing the value of AVE with the inter-construct correlations, with the consideration that square root of AVE has to be greater than inter-construct correlations (Fornell & Larckel, 1981). In the Table 4.3, the diagonal elements (square root of AVE) are greater than the numbers below, which indicates high convergent validity.

Table 4.3 Inter-construct correlations

	AR	USE	C	CU	IP	II	IQ	RE	S
AR	**0.902**								
USE	0.646	**0.855**							
C	0.378	0.469	**0.856**						
CU	0.611	0.466	0.528	**0.847**					
IP	0.779	0.612	0.537	0.598	**0.842**				
II	0.628	0.615	0.615	0.531	0.841	**0.841**			
IQ	0.478	0.429	0.342	0.317	0.639	0.653	**0.758**		
RE	0.454	0.457	0.675	0.558	0.605	0.592	0.429	**0.854**	
S	0.482	0.433	0.491	0.531	0.718	0.616	0.471	0.452	**0.882**

4.3 Descriptive analysis

In this section, we analyze and discuss descriptive analysis results of the items that were used to build the questionnaire. A table with mean and standard deviation of each item and overall mean of the construct can be found in appendix III.

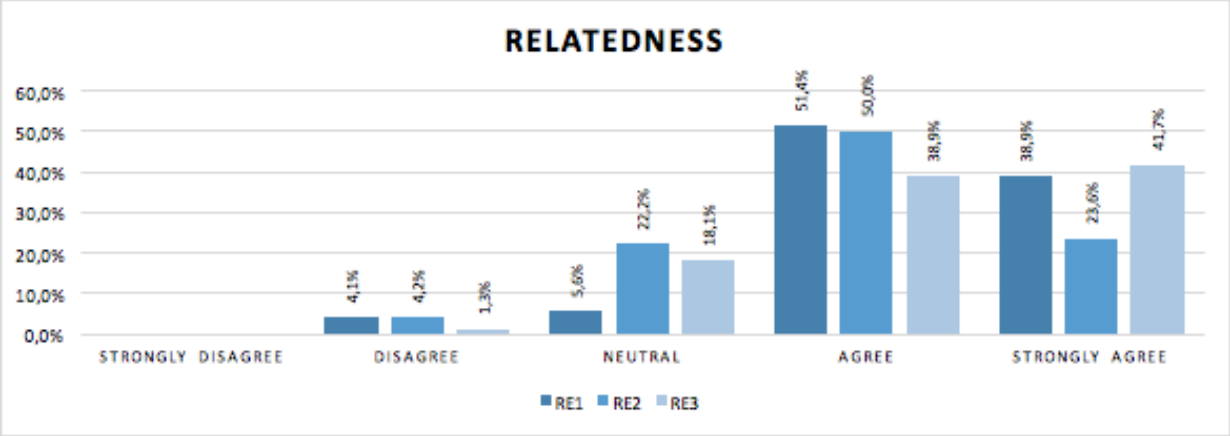


Figure 4.2 Responses (%) on relatedness

The overall mean for relatedness is 4.13% and it can be viewed as a moderately strong factor that affects the users to continue using the BI systems. Looking at each item, RE1 has the highest mean value of 4.25 followed by RE3 with 4.21 then RE2 with 3.93. When users were asked if working with BI system offers them an opportunity to interact with others in the workplace, 90.3% of the respondents either agree or strongly agree and only 4.1% disagree. In response to whether they feel close to people they work with while using the BI system, 73.6% respondents either agree or disagree and 4.2% disagree. The last item was to find out if the users feel like valuable members of the organization because they use they BI systems for

decision making and 80.6% either agree or disagree and only 1.3% disagree. For all relatedness items a neutral response was given by respondents ranging between 5.6% and 22.2%.

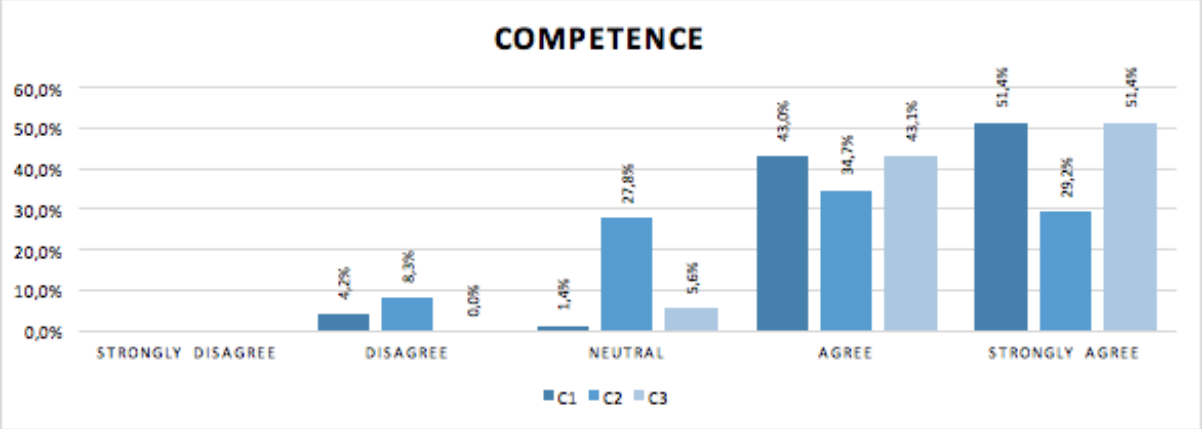


Figure 4.3 Responses (%) on competence

The overall mean of competence is 4.24. A high number of people responded with "strongly agree" or "agree". No respondents strongly disagree with any of the items related to competence. Looking at each item, C3 has the highest value of mean (4.46) which reflects the confidence users have on themselves when using the BI systems. As shown in Figure 4.3, there are no respondents who disagree, 51.4% of the users strongly agree and 43.1% agree that they have confidence in using BI systems. Only 5.6% responded with "neutral". C1 item has a mean value of 4.42 and it measures if users feel they have mastered the skills necessary to use the BI systems. 94.1% respondents agree or strongly agree that they mastered the skills necessary, 4.2% disagree and 1.4% are neutral. The last item which is C2 with low mean value of 3.85 measures whether the users feel they are better at using the BI system compared to others. 63.9% respondents either agree or strongly agree, 27.8% responded with "neutral" and 8.3% disagree.

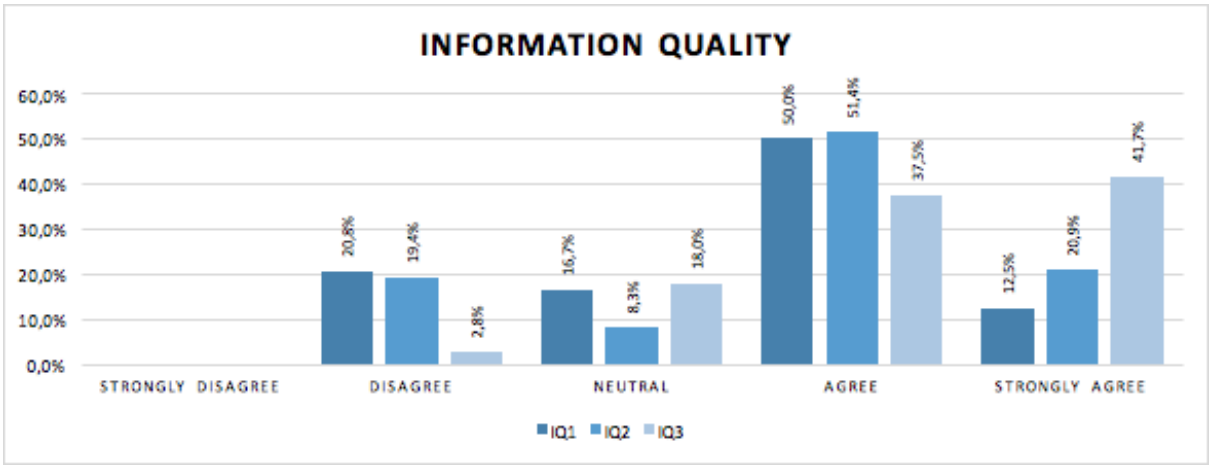


Figure 4.4 Responses (%) on information quality

The overall mean value for information quality is 3.82 and it is lowest compared to other factors. This shows that a relative number of users have a negative attitude when it comes to

information quality of the BI systems. The mean values for the individual items used to measure information quality are 3.54 for IQ1, 3.74 for IQ2 and 4.18 for IQ3. The first item which is IQ1 measures if the information provided by BI system is always accurate and 62.5% respondents strongly agree or agree whereas 20% respondents disagree. There are 16.7% respondents that neither disagree nor agree that the information is always accurate. In response to whether the information is always updated or not, 72.3% responded with strongly agree or agree and 19.4% disagree. 18.3% responded with "neutral" in regards to the second item. The last item measures whether the information provided is easy to make sense of and 79.2% strongly agree or agree whereas 2.8% disagree. As seen in Figure 4.4, the last item has 18% users who responded as "neutral".

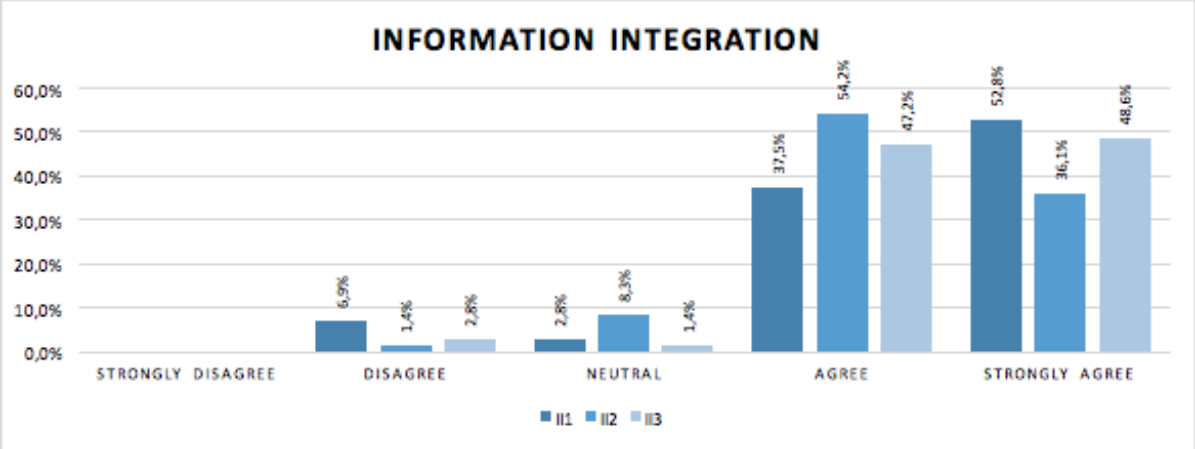


Figure 4.5 Responses (%) on information integration

The overall mean for information integration is 4.34. This factor looks at the combined diverse information that is delivered by the BI system. The mean values for individual items are 4.36, 4.25 and 4.42 in that order. As shown in Figure 4.5, the first item was used to determine if the users can access data of different sections of the organization and 90.3% responded with "strongly agree" or "agree", 2.8% responding with "neutral" and 6.9% disagree. In response to whether the information provided by the BI system provide a broad view of the organization or not, 90.3% respondents strongly agree or agree and only 1.4% disagree. 8.3% neither disagree nor agree therefore chose the "neutral" response. In response to the last item which determines the relevance of the information provided by the BI system, 95.8% strongly agree or agree, 2.8% disagree and only 1.8% responded with "neutral".

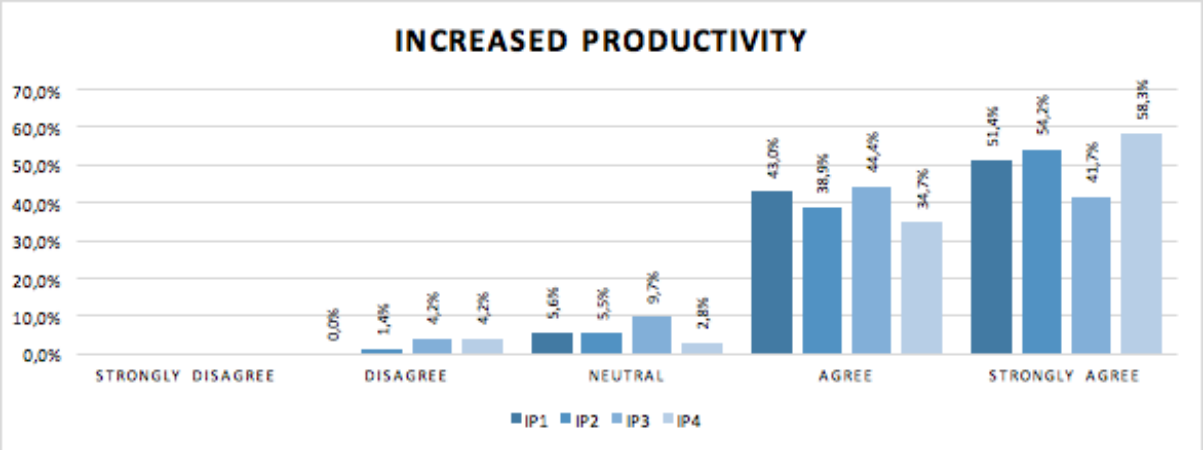


Figure 4.6 Responses (%) on increased productivity

The overall mean for increased productivity is 4.41. The mean values for items are 4.46 for IP1, 4.46 for IP2, 4.24 for IP3 and 4.47 for IP4. The first item determines if the work gets improved when using the BI system, 94.4% strongly agree or agree and the rest responded with "neutral". In response to whether the information provided assists the users in making better decision, 93.1% either strongly agree or agree, 5.5% are neutral and 1.4% disagree. Responding to whether the BI systems offer a quick analysis on complex tasks, 86.1% responded with "strongly agree" or "agree", 9.7% responded with "neutral" and the rest with "disagree". In response to the last item which measures time saving when producing reports, 93% users strongly or agree, 2.8% responded with "neutral" and 4.2% disagree.

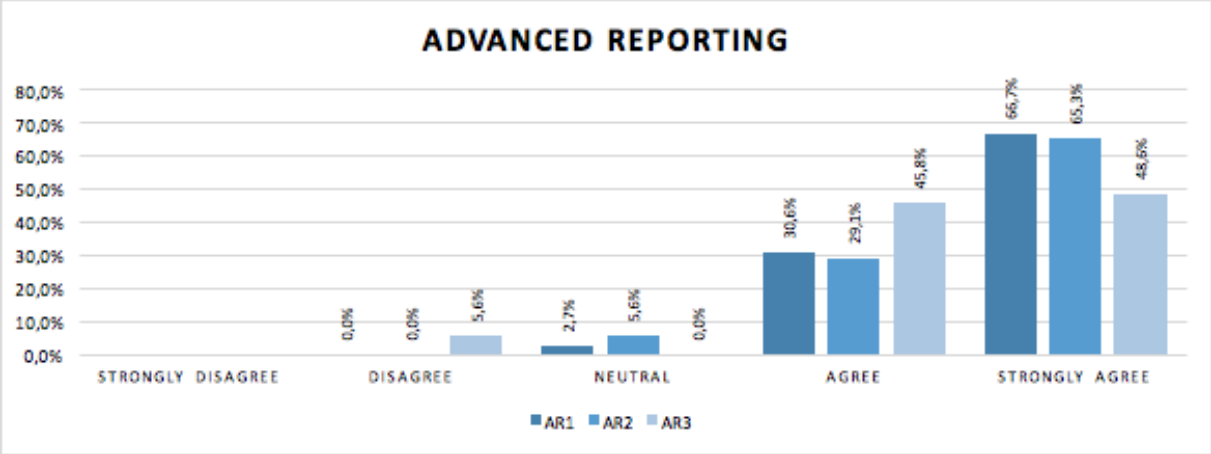


Figure 4.7 Responses (%) on advanced reporting

Advanced reporting has a high mean value of 4.54. This is a reflection of advanced reporting capabilities that BI systems offer and that this factor strongly affects the continuous use of BI systems. The mean values for the individual items are 4.64 for AR1, 4.60 for AR2 and 4.38 for AR3. The first item measures if users are able to export BI reports, 97.3% of respondents either agree or disagree and 2.7% respondents were neutral. The second item determines if users are able to drill down on the data, 94.4% respondents agree or disagree and only 5.6% responded were neutral. The last item determines if the reports design makes it easy to understand the information provided, 94.4% responded with "strongly agree" or "agree" and 5.6% disagree.

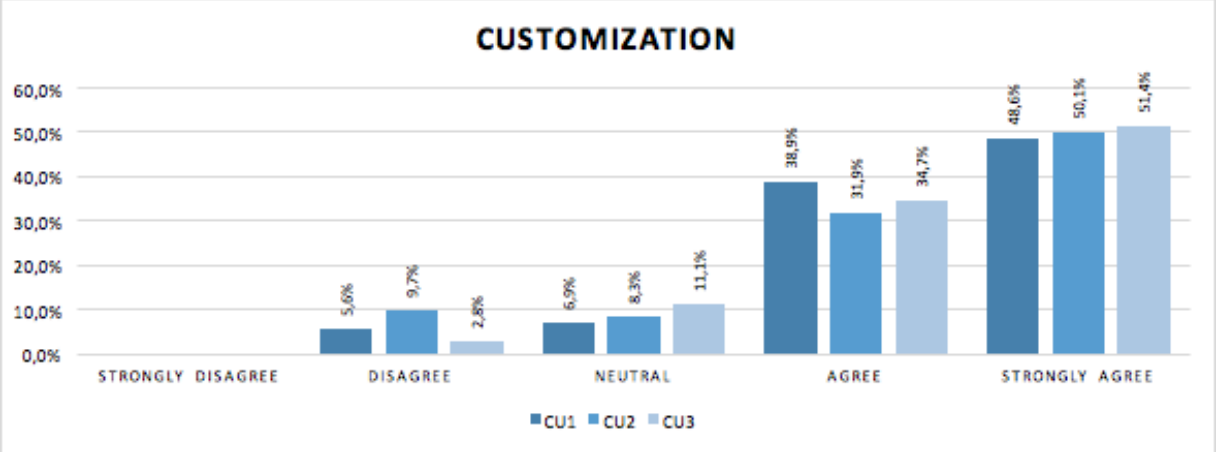


Figure 4.8 Responses (%) on customization

The overall mean for customization is 4.29. The individual mean values are 4.31 for CU1, 4.22 for CU2 and 4.35 for CU3. The first item measures if users are to create their own reports to show the information they want, 87.5% strongly agree or agree, 5.6% disagree and 6.9% are neutral. The second item determines if users are able to create ad hoc queries, 82% strongly agree or agree, 8.3% are neutral and 9.7% disagree. The last item determines if users enjoy creating their own reports, 86.1% strongly agree or agree, 11.1 % are neutral and 2.8% disagree.

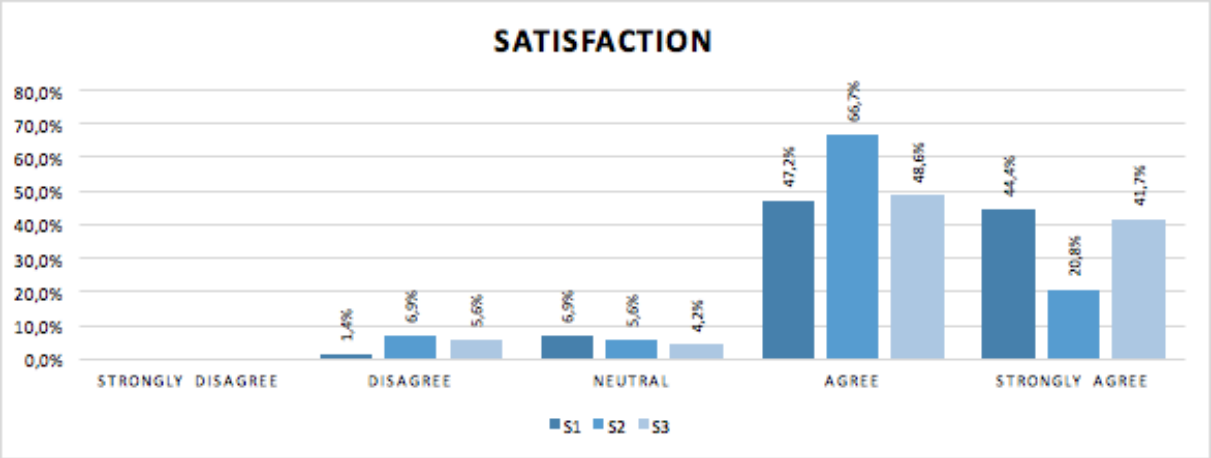


Figure 4.9 Responses (%) on satisfaction

The overall mean value for satisfaction is 4.21 which reflects that users are satisfied by the BI systems to a large extent. The individual mean values are 4.35 for S1, 4.01 for S2 and 4.26 for S3. In response to the first item which determines if the BI systems satisfy the work needs, 91.6% strongly agree or agree, 6.9% are neutral and 1.4% disagree. The second item measures the adequacy of the information provided, 87.5% strongly agree or agree, 5.6% are neutral and 6.9% disagree. In response to the last item which measures if the users are satisfied with the insights provided by the reports, 90.3% strongly agree or agree, 4.2% are neutral and 5.6% disagree.

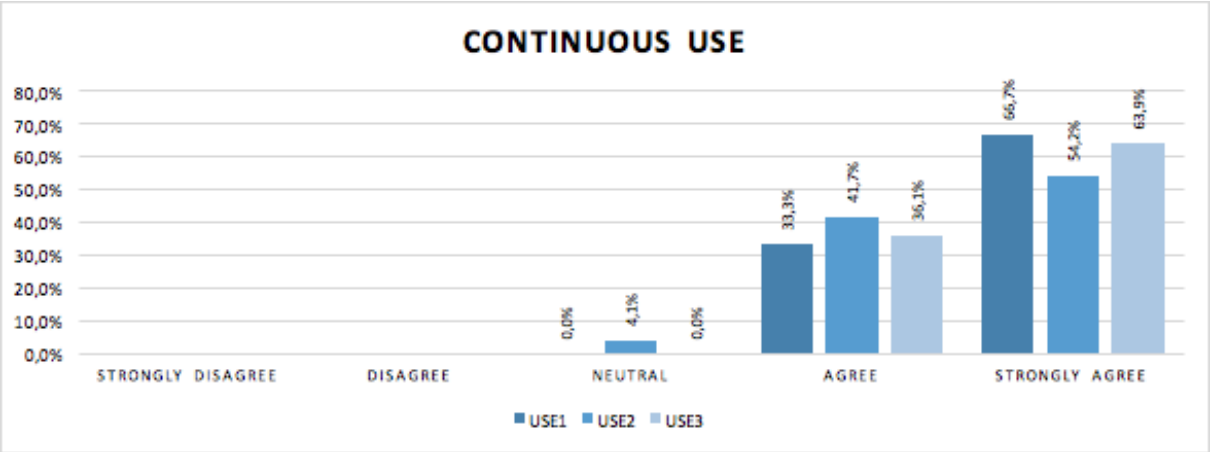


Figure 4.10 Responses (%) on continuous use

Continuous use has an overall mean value of 4.60 and it has the highest mean value compared to other constructs. There are no respondents who strongly disagree or strongly disagree therefore showing a positive attitude towards continuous use of BI systems. The individual mean values are 4.67, 4.50, and 4.64 respectively. In response to the first item when users were asked if the intend to continue using the BI system, 66.7% respondents strongly agree and 33.3% agree. In response to the second item which measures if users will rely on the BI systems for their work in future, 54.2% strongly agree, 41.7% agree and 4.1% are neutral. The last item determines if users expect to continue using the BI systems with all things considered, 63.9% strongly agree and 36.1% agree.

4.4 Path analysis

We performed path analysis with SEM technique using Smart PLS. This technique helps to test hypotheses from the proposed model and calculate coefficients within the model. The visual representation of path analyses for our model is presented in Figure 4.11 (More details on Appendix VIIII).

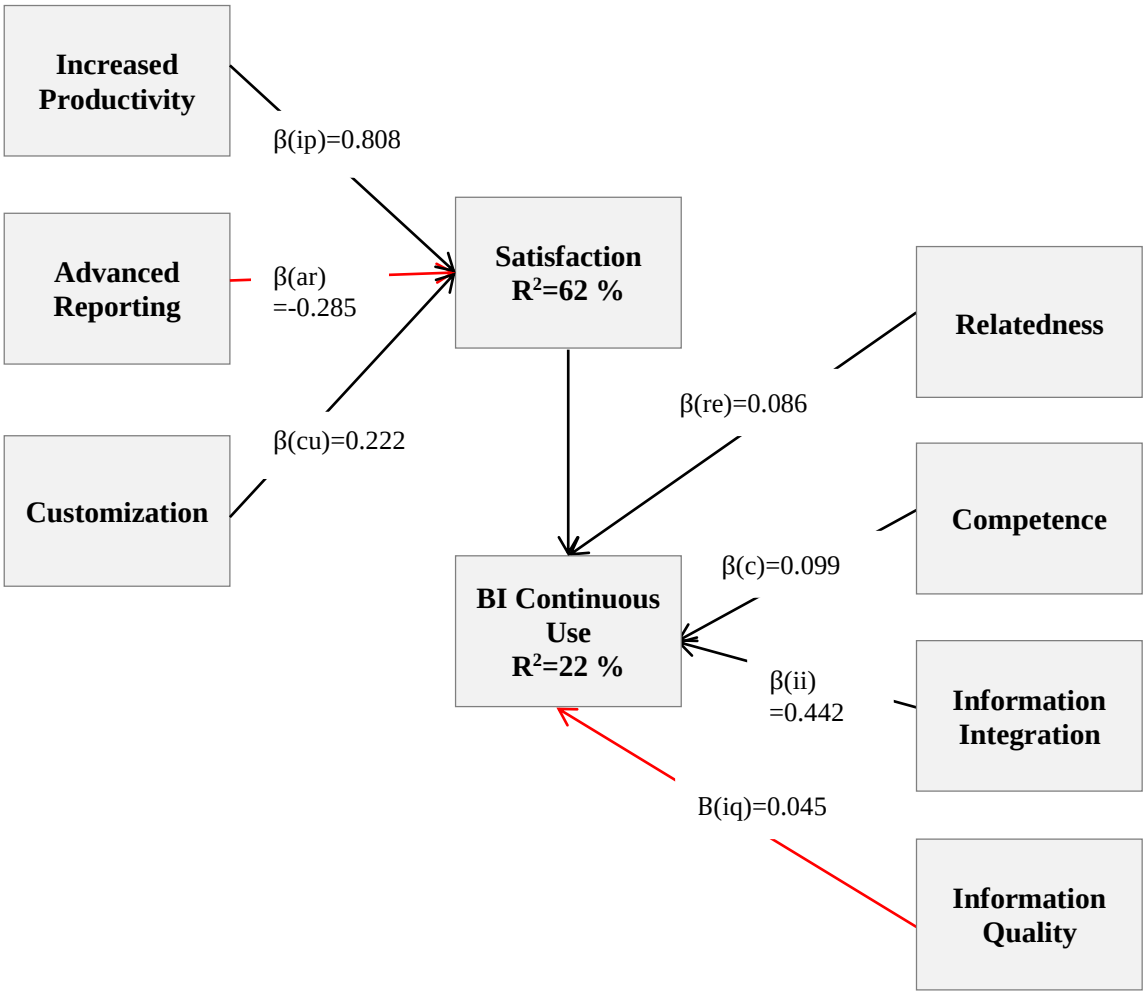


Figure 4.11 PLS model analysis results

In Figure 4.11, lines with arrows represent tested hypotheses with the direction from independent to the dependent variables. All of the presented relationships are statistically significant at a 0.05 level. Bold black lines indicate that hypothesis statistically significant. On the other hand, red lines indicate hypothesis are not significant, as $p > 0.05$. Thus they are not supported. The values in the middle of the lines standardized path coefficients (Beta or β), which show to what extent the independent variables impact dependent variables. In our model path coefficients show to what extent each factor influence end users' continued use of BI. Positive coefficient implies that the independent variable has positive influence on the dependent variable, whereas a negative coefficient shows that the independent variable has negative influence on the dependent variable. Additionally, the square of R on the S and USE address the proportion of variance that is explained by their independent variables. Additionally, the proposed model contains two regressions, which are presented in the Table 4.4.

Table 4.4 Summary of regressions

Path Analysis	Independent variable	Dependent variable	R^2
Regression 1	Customization (CU)	**Satisfaction (S)**	**62%**
	Advanced Reporting (AR)		
	Increased Productivity (IP)		
Regression 2	Satisfaction (S)	**BI Continuous Use (USE)**	**22%**
	Competence (C)		
	Information Quality (IQ)		
	Information Integration (II)		
	Relatedness (R)		

In regression 1 (Table 4.4), three hypotheses (H5, H6, H7) address the causal relationships among customization, advanced reporting, increased productivity and satisfaction. According to the results of path analysis (Figure 4.12), CU and IP have significant and positive effect on S, with $\beta(cu)=0.222$, $p<0.01$ and $\beta(ip)=0.808$, $p<0.01$ respectively, and thus support both H5 and H7. Consequently, customization and increased productivity will have positive impact on BI users' satisfaction. Among these two, IP has a stronger impact on S compared to CU. On the other hand, AR is not statistically significant ($p>0.01$), thus AR is rejected. In total, CU, IP and AR can explain 62% of the variation in S.

We can see that S acts as both dependent and independent variable in the analysis. In the Regression 2, S acts as an independent variable. The Table 4.4 indicate that in total there are five independent variables connected to USE. The path analysis (Figure 4.12) shows that four independent variables (C, II, RE and S) have significant and positive effect on USE, which indicate that H1, H2, H4 and H8 are supported. Supported items are statistically significant at $p<0.05$ (95% confidence level) at least. The causal relationships between USE and IQ is not significant ($p>0.05$), at 95% confidence level. Thus, H3 is rejected. Although, descriptive analysis shows that respondents had strong relationship with IQ, it cannot be included as an influential factor on BI continuous use.

Among those four supported factors, II is the most influential factor, followed by C with path coefficients $\beta(ii) = 0.442$ and $\beta(c) = 0.099$ respectively. Consequently, information quality

and competence are two factors that will influence end users continue to use BI systems. On the other hand, S (β(s) = 0.052) has the least influence on USE compared to other three. It means that satisfaction is not a primary factor for users to continue to use BI systems. In total, the explanatory ability of C, II, IQ, RE and S can explain 22% of the variation in USE.

Table 4.5 Summary of hypotheses test results

Path & Code	Hypotheses	Path coefficient (β)	Results
AR → S	H1	-0.285	REJECTED
C → USE	H2	0.099	SUPPORTED
CU → S	H3	0.222	SUPPORTED
IP → S	H4	0.808	SUPPORTED
II → USE	H5	0.442	SUPPORTED
IQ → USE	H6	0.045	REJECTED
RE → USE	H7	0.086	SUPPORTED
S → USE	H8	0.052	SUPPORTED

According to the results in Table 4.5, six out of eight hypotheses are supported in this study. The advanced reporting and information quality are rejected, which indicate that those factors cannot be identified as influential factors on continuous use of BI.

4.5 Open question analysis

The survey had an open question that asked the respondents to comment or add anything that affects them to continue using the BI system. Since it was not a mandatory question, not all the respondents gave comments. We have summarized them since some of them are similar, the summary is shown in Table 4.6.

Table 4.6 Open question responses

Positive	Negative
Ease of use	Dirty data
Rich insights	Highly restrictive
Great report designs	Unified view/merging of reports
BI self-service	Delays in data update.

We have split the comments into negative and positive comments and the comments are based on the BI systems of the users' organizations. Starting with the positive comments, the respondents commented that the reports design is great and the reports are easy to use once you get used to the structure and format. In addition to that, respondents feel that the reports offer rich insights, which assist them in decision-making. Respondents also mentioned that BI self-service is important for them as that offers flexibility and less restriction.

The negative comments reflect the issues that respondents' organizations have. Most of them complained about data inaccuracy, which also reflects in the descriptive analysis. The issues

are that data is inconsistent and there are sometimes delays in updates. They also comment that the BI tool is capable of delivering accurate data but the issue is with the processes. The same applies with restrictions, there are users that are frustrated by the BI systems they feel that it is highly restrictive and the blame is put on the software vendors. Another comment that was shared is that users waste time by working on several reports which have data that can be merged into one report. BI users also commented that there are instances where the source data is not in synch with the BI system due to delay in data updates.

The qualitative results reflect in the comments made by BI users. Therefore, if these issues could be fixed by the BI development teams within the users' organizations then users would show a more positive attitude towards information quality.

4.6 Interviews analysis

As mentioned before the interview questions have been formulated based on the survey results and the open question results. We will analyze the topics that are common in all interview responses. Those topics are information quality, information integration, customization and general thoughts on what is exceptional and what can be improved.

4.6.1 Information quality

In the interviews, we asked the participants what they think about the data accuracy, as it is one of the issues that survey respondents complained about in their comments. One participant mentioned that she sometimes works with sensitive data and has to verify the information she gets from the reports. There are repercussions in having inaccurate data as the participant also mentioned that " *the data does not get imported on time and because there are certain rules on the system you find out that branches get charged if they reflect out of policy"* . In this instance it shows how the data affects the decisions made based on the available information. There was some degree of satisfaction from another participant, as she did not make a negative comment when asked about data accuracy. One of the interviewees had an interesting view as she argued that the source systems should also have processes and rules in place to make sure that the data that is pulled by the BI processes is of quality, she stated that " *so in terms of data quality I can say the argument could be that the capturing is not standardized.* ".

4.6.2 Information integration

In response to information integration related questions, participant 2 and 3 were satisfied with the information provided. Participant 1 mentioned that they have an issue with segmented reports resulting in working with several reports just to get a unified view of the information. She further mentioned that *".. you spend a lot of time getting information from various reports and like I said sometimes the standard of capturing is not the same."* Which means there is enormous time spent on sorting out the information for it to be useful.

4.6.3 Advanced reporting

All the participants were satisfied with advanced reporting capabilities that are offered by the BI systems. In participant 1's company they recently had a BI tool upgrade and changes, which affected some of their reports. She mentioned that some of the flexibility that came with the reports has been taken away and it was one of the important features for her as she mentioned: *"You can't be that rigid otherwise the tool becomes useless"* .

4.6.4 General thoughts

The participants expressed positive comments about things that are of benefit when using the BI systems. When we asked participant 1 if there are things that she feels are working regardless of the improvements that the BI development team should work on, she stated that *"For me it's the fact that I can pull reports, I can make any selection and pull reports and also that its real time data."* . Participant 3 had issues with advanced reporting capabilities taken away and she regards a good BI tool as *" .. the one that gives you the ability to create your own reports."* . The constant innovation and improvements by the development team was appreciated by participant 3 stating that *"Well, ok the qlikview model is constantly being improved so I guess that is impressive for me."*.

5 Discussion of the main findings

This chapter discusses the main findings from the empirical study collected regarding continuous use of Business Intelligence systems. In this chapter we discuss results from both survey and interviews. Both results will be used to draw a general conclusion and consequently answer to our main research question.

5.1 Competence and relatedness

Descriptive analysis shows that end users have strong positive attitude on competence. It indicates that end users have high knowledge and skills to produce desired results with BI systems. Our findings support Lee et al. (2015), who states that competence motivates users to continue to use the system that they are good at. Strong attitude towards competence may also be an indication that end users have experience with BI systems. The hypothesis test showed a positive, but not strong influence of competence on BI continuous use ($\beta(c) = 0.099$). The importance of the need to feel competent and be able to achieve desired results motivates people to continue to use BI system. People who feel more competent will more likely want to use the system in the future.

Descriptive analysis on relatedness shows positive attitudes, but not as strong as in competence. This indicates that feeling that one is valuable for an organization and being accepted by peers and BI managers influence end users' willingness to continue use BI systems. Users want to feel connected with others and want to get their peers' support while using technology.

The hypothesis test showed a positive, but less strong influence of competence on BI continuous use compared to competence ($\beta(r) = 0.086$). The results indicate that despite relatedness positively motivate to continue use of BI, the influence is weak. Organizations still have to work on increasing end users' interaction with their peers or managers by showing them some support and. Thus, BI managers have to consider relatedness along with the technical aspects of BI systems, because some users already have experience with using BI systems and they can share with their experience with colleagues, and therefore form opinions about BI systems. The interview showed that participants are highly skilled and they feel competent in working with BI. During the interview we found that interviewees are part of the BI teams and individually contributing to the work. Participants also mentioned that they are making decisions with BI. Both survey and interview results show that for the continuous use of BI, competence and relatedness of the end users are very important.

5.2 Information quality

According to descriptive analysis, information quality has the lowest mean value compared to other constructs. Most users did not strongly agree to IQ items that were used to measure the influence of information quality on the continuous use. The analysis results show a dissatisfaction of the information quality that they get from the reports or information provided by BI systems. As part of the interviews, we did a follow up to find out why this factor is not considered an influential factor. During the interviews we recorded negative comments regarding information quality provided by BI. Interview analysis shows that the issues mainly related to low data accuracy, unmatched formats because of different sources and different types of BI tools, and also delayed data. From the interviews, we realized that the issue is an organizational issue, not a BI tool issue. It is poor data handling processes and maintenance procedures that the organization's BI development team will have to improve so as to make sure that accurate, consistent and timely information is delivered to their users (Işık et al., 2013).

It is clear that information quality should be a priority in organizations as it is key to decision making and affects the credibility of the work produced from it. To improve agility and keep up with the fast paced needs of the business, organizations use BI. Therefore, it is crucial for organizations to pay attention to the information quality issues.

5.3 Information integration

By examining survey results, we found that respondents have a strong positive attitude towards information integration. The results indicate that end users easily access relevant data from different departments of an organization. As evident from the hypothesis test, information integration affects BI continuous use ($\beta(ii) = 0.442$). Information integration motivates end users to continuously use BI. The finding in this study proves prior research about information integration to be a key factor which contributes continuous use of IS (Popovič, Hackney, Coelho, & Jaklič, 2012). Having access to the required information is crucial to end users because it helps to access information anytime without additional time or efforts.

During interviews, replies regarding information integration were various. One interviewee was satisfied with integrated information provided by the BI systems. Another participant mentioned that for them getting required information across departments is a very complicated process, sometimes it is not even possible. Same as with the information quality, mentioned issues on information integration may arise from organization's inability to build a sophisticated system. By considering both interview and survey results, we can say that despite positive attitude towards information integration, it is a complex process and organizations have to work on it if they want end users to be productive and satisfied with the tool, and consequently use BI continuously.

5.4 Advanced reporting

Descriptive analysis shows that participants are very satisfied with the advanced reporting. This is related to BI systems providing advanced reporting functionality for the end users. This helps users manipulate data easily or change format of the reports. Current BI systems offer functions that are hard to accomplish or not even possible to perform with any other systems. Considering those capabilities of BI, we expected high effect of advanced reporting on satisfaction. However, hypothesis test shows that our study cannot prove that advanced reporting has positive effect on satisfaction, even though respondents had strong positive attitude about it. Thus, the result of this study cannot provide sufficient evidence to draw any conclusion on the effect of advanced reporting in affecting satisfaction of BI end users. During the interview, we wanted to learn more about advanced reporting and why it failed to be successful in our model. Thoughts on advanced reporting were controversial. Some claimed that they recently upgraded the system and they are satisfied with reporting capabilities of BI. At the same time, with every upgraded version BI tools have advanced features and every time end users has to learn them. Others complained about that advanced reporting features restrict users manipulate with reports. Interviewees also mentioned that they can easily export reports to Excel file and email them, which satisfy their needs. Despite some positive comments regarding advanced reporting, both survey and interview results indicate that end users are not satisfied with it. Thus, BI managers have to consider complaints and solve them in order to increase end users satisfaction.

5.5 Increased productivity

The survey participants recognized that they are satisfied with the increased productivity provided by BI. Participants agreed that BI systems improve their work, assist in making better decisions, analyze complex data very fast and produce reports in shorter time. All those factors increase productivity, consequently users are satisfied with BI systems. Increased productivity was also supported in our hypothetical analysis ($\beta(ip) = 0.808$). It indicates that end users' enhanced productivity, time saving benefits and ability to ability to manipulate with reports or dashboards lead end users to feel satisfied with BI systems.

Interview participants had different opinions on increased productivity. Respondents claimed that reports design is great and they are easy to use. At the same time, they complained about some capabilities of BI systems such as not being able to combine data into one report. It results in spending a lot of time and effort to find alternative ways either. However, they all agreed that they easily accomplish complex tasks with BI. Overall, survey and interview results indicate users' satisfaction with increased productivity, but there are issues that need to be addressed.

5.6 Customization

It is shown in the descriptive analysis that users are satisfied with customization that is offered by the BI systems. In the path analysis, it also shows that customization has a positive effect on satisfaction ($\beta(cu) = 0.222$) which indicates that offering the user the ability to create their own queries and reports leads to satisfaction. Having customized reports saves time for the

users as they only get to work on reports that have information relevant to them. It also decreases the dependency on BI support that the users have (Strom, 2016). It was pointed out in of the interviews that having a rigid BI system makes it a useless tool. Therefore, it is important that users are given the flexibility that comes with the tool. Also it means that the technology that the organization has invested in is being used to its full potential.

5.7 Satisfaction

Descriptive analysis shows that users are significantly satisfied with BI systems. The results indicate that users have access to the required data, satisfy their work needs and gain insight provided by BI reports. In the path analysis, satisfaction showed positive but low effect on BI continuous use. Despite the fact that users are satisfied with BI, it does not have strong influence on BI continuous use. In our model, 62 percent of the variance of satisfaction (S) was explained by customization, advanced reporting and increased productivity. During interviews we noticed that despite people working with BI, they complain about some functions of BI. Issues with increased productivity, advanced reporting and customization negatively influence users' satisfaction.

5.8 BI continuous use

The results from the path analysis show that BI continuous use (USE) is positively affected by information integration (II), satisfaction (S), relatedness (RE) and competence (C). At the same time information quality (IQ) does not support USE. II have the highest influence on USE, followed by C, RE and lastly S. Our research model explained 22 percent of the variance of BI continuous use (USE).

Consequently, we come up with the result that information quality, competence, relatedness and satisfaction influence users to use BI in the future. However, organizations still have to solve issues mentioned before in order to motivate end users for using BI systems over a longer period of time for their daily tasks.

6 Conclusion

This final chapter provides a summary of findings related to the research question. We also discuss the theoretical and practical implications of our study. We then conclude with limitations and suggestions for future studies related to our study.

6.1 Research question

The purpose of the study is to examine the determinants that influence users to continue using the BI systems and also determine the extent of the effect. To achieve this, we formulated a research question that explains and measures the influence of the factors that affect the users to continue using BI systems. We identified the factors and measured the relationship between the factors using a questionnaire based survey with questions built using the Likert scale. The analysis was done using statistical software and it is presented in Chapter 4. In addition to that we conducted interviews in order to enrich the data we received from the survey. The research question is therefore answered as follows:

Research question
What are the major antecedents to continuous use of BI systems in organizational settings?

After conducting the study, we realized that the identified factors greatly influence users to continue using the BI systems and based on the results the influence is greater on information quality and advanced reporting. Regarding information quality, the BI users showed a moderately positive attitude towards it and after testing the relationship between the constructs the results showed a negative relationship between continuous use and information quality. We did a follow up using the interviews and open question responses, we then realized that information quality is greatly influential to continuous use of BI systems and the lack of enthusiasm in responses reflects the problem that the users' organizations have with their information quality. It is an area that needs to be improved by the organizations as information quality is highly dependent on the processes put in place by the BI development team. If the information quality issue is not given attention, users are highly likely to discontinue as using inaccurate information leads to poor decision making. The study results also showed that advanced reporting has a high influence on continuous use as it improves BI users work and offers flexibility in using the information for decision making.

6.2 Implications

As mentioned in the literature review, there is still a lack of literature focusing on studying continuous use of BI or use of BI in a post adoption phase. Therefore, this study serves as a contribution to the existing academic work. Also our study presents a new model for studying BI continuous use which can be used by other researchers doing a similar study. It has been

validated in Chapter 4 and the results show that it is eligible to be used.The results show that in overall the attitude towards the continuous use of BI is mostly positive, but it needs to be improved. In order to make sure that end users will continue to use BI, organization should improve information quality and increase satisfaction with better advanced reporting function. These results are crucial in practice for organizations, because they can make decision making process more advanced and more proficient. Thus, in practical point of view we believe that this study provides valuable insight for those organizations that use BI. Major improvements need to be addressed in organizations where information quality is still an issue. A lot of research has been devoted for resolving this issue in different systems. However, it is still a problem for BI systems and has negative impact on end users' desire to use BI systems. Users responses showed confidence in mastering skills needed to use BI systems and this implies that users received training in using BI systems therefore is important that organizations consider the factors we identified to make sure that BI systems are being used. The potential of the BI systems can be realized if users have flexibility in using them otherwise the tool becomes useless as one of users mentioned. Organizations can also use these results as a basis of making sure that they implement successful BI systems.

6.3 Limitations

There are several limitations that have impacted the outcome of the study. For our data collection, we were not able to get a representative for each industry due to limited access to the individuals and organizations. Also with the interviews, not each company that participated in the survey had an interview representative. This low response rate implies that the results cannot be statistically generalized to all organizations. Another limitation is the inadequate time given to conduct the research study.

6.4 Suggestions for further study

Based on our study results, how we conducted it and the limitations that we experienced, we have decided to offer the following suggestions for future research.

Exploring other factors
We identified motivational factors, BI beneficial factors and BI success factors to explain the continuous use of BI systems by users. The study can be expanded by identifying other potential factors that influence users to continue using BI systems. Moderating variables such as organizational role and experience can also be included to assist in understanding the results.

Studying collective use of BI
As mentioned already, this study is focusing on individual use of BI systems therefore collecting perspectives of users. A future study can explain continuous use and collect data at a collective level instead of individual level, for example use of BI in a supply chain department vs. HR department.

Appendix I Research Questionnaire

BI Continuous Use Survey

Hello

We are Master's students at Lund university in Sweden doing a research study. We would like to invite you to take part in our short survey, it should not take longer than 10 minutes. The aim of our study is to find out what factors are affecting BI end-users to continue using the BI systems. This survey is aimed at helping us collect data in order to complete the research.

Participation in this survey is voluntarily and responses will be anonymous. Please fill the questionnaire carefully, there is no right or wrong response. We would really appreciate it if you could respond within 10 days.

Thank you for your time and participation!

*Required

Part 1: Demographics

A brief description about yourself.

1. Gender *

- Female
- Male

2. Work Industry *

3. Work position *

- Non-management/ Professional staff
- Middle-level management
- Top-level management/ Executives

4. BI experience (in years) *

- Less than 1
- 1-3
- Over 3

5. Frequency of BI system's usage *

- Almost everyday
- At least once a week
- At least once per month

Part 2: Questions about factors affecting continuous use of BI systems

6. Self Determination *

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I have mastered the skills necessary to use the BI system when doing my job.					
I am confident at using the BI system.					
I am better than others at using the BI system.					
Working with the BI system gives me an opportunity to interact with others within the organisation.					
I feel close to the people I work with while using the BI systems.					
Using the BI systems to make decisions makes me feel like a valuable member of the organisation.					

7. BI Success Factors *

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The information provided by the BI system is always accurate.					
The information is always updated.					
The information provided by the BI system is easy to make sense of.					

I am able to access data of different sections of the organisation by using the BI system.					
The information provided by BI systems provides me with a broad view of the organisation.					
The information provided by the BI systems is relevant to my work needs.					

8. BI Beneficial Factors *

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Using the BI system improves my work.					
The information provided by the BI system assists me in making better decisions.					
The BI systems are able to offer quick analysis on complex tasks.					
I am able to export my reports to Excel or to another system.					
I am able to drill down on the data using the reports.					
The reports design makes it easy for me to understand the information provided.					
I am able to create reports that show only information that is relevant to my work.					
I am able to create my own queries to get a better understanding of the data.					

I enjoy creating my own reports.					
Using the BI system enables me to accomplish my tasks in shorter time.					

9. Satisfaction *

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The BI system satisfies my work needs.					
The information provided by the BI system is adequate.					
I am satisfied with the insights that are provided by the BI reports.					

10. BI Continuous Use *

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I intend to continue using the BI system.					
In future i will be relying on BI to perform my tasks.					
All things considered, I expect to continue using the BI system in the future.					

10. BI Continuous Use *

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I intend to continue using the BI system.	○	○	○	○	○
In future i will be relying on BI to perform my tasks.	○	○	○	○	○
All things considered, I expect to continue using the BI system in the future.	○	○	○	○	○

Part 3: Comments

Is there anything that you would like to add regarding factors affecting your continuous use of BI system?

Submit

Never submit passwords through Google Forms.

Appendix II Summary of demographics

Categories	Range	Frequency	Percentage
Gender	Male	41	56.9%
	Female	31	43.1%
Industry	Banking	46	63.9%
	Financial services	11	15.3%
	Manufacturing	9	12.9%
	Oil and energy	6	8.3%
Role	Middle-level management	36	50%
	Non-management/ Professional staff	36	50%
Experience	1-3	11	15.3%
	Less than 1 year	6	8.3%
	Over 3	55	76.4%
Frequency of BI system's usage	Almost everyday	62	86.1%
	At least once a week	8	11.1%
	At least once per month	2	2.8%

Appendix III - Summary of descriptive measurement scales

Constructs items	Code	Mean	Std. Deviation
Competence (C)		**4,24**	
I have mastered the skills necessary to use the BI system when doing my job.	C1	4,42	0,727
I am better than others at using the BI system.	C2	3,85	0,944
I am confident at using the BI system.	C3	4,46	0,604
Relatedness (RE)		**4,13**	
Working with the BI system gives me an opportunity to interact with others within the organization.	RE1	4,25	0,746
I feel close to the people I work with while using the BI systems.	RE2	3,93	0,793
Using the BI systems to make decisions makes me feel like a valuable member of the organization.	RE3	4,21	0,786
Information Quality (IQ)		**3,82**	
The information provided by the BI system is always accurate.	IQ1	3,54	0,963
The information is always updated.	IQ2	3,74	1,007
The information provided by the BI system is easy to make sense of.	IQ3	4,18	0,828
Information Integration (II)		**4,34**	
I am able to access data of different sections of the organization by using the BI system.	II1	4,36	0,844
The information provided by BI systems provides me with a broad view of the organization.	II2	4,25	0,666
The information provided by the BI systems is relevant to my work needs.	II3	4,42	0,666
Increased Productivity (IP)		**4,41**	
Using the BI system improves my work.	IP1	4,46	0,604

The information provided by the BI system assists me in making better decisions.	IP2	4,46	0,670
The BI systems are able to offer quick analysis on complex tasks.	IP3	4,24	0,796
I am able to produce reports in shorter time by using BI systems.	IP4	4,47	0,750
Advanced Reporting (AR)		**4,54**	
I am able to export my reports to Excel or to another system.	AR1	4,64	0,539
I am able to drill down on the data using the reports.	AR2	4,60	0,597
The reports design makes it easy for me to understand the information provided.	AR3	4,38	0,759
Customization (CU)		**4,29**	
I am able to create reports that show only information that is relevant to my work.	CU1	4,31	0,833
I am able to create my own queries to get a better understanding of the data.	CU2	4,22	0,967
I enjoy creating my own reports.	CU3	4,35	0,790
Satisfaction (S)		**4,21**	
The BI system satisfies my work needs.	S1	4,35	0,675
The information provided by the BI system is adequate.	S2	4,01	0,741
I am satisfied with the insights that are provided by the BI reports.	S3	4,26	0,787
Continuous Use (USE)		**4,60**	
I intend to continue using the BI system.	USE1	4,67	0,475
In future i will be relying on BI to perform my tasks.	USE2	4,50	0,581
All things considered, I expect to continue using the BI system in the future.	USE3	4,64	0,484

Appendix IV - Summary of descriptive statistics

Construct	Items	Measures	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Competence (C)	C1	Freq.	0	3	1	31	37
		(%)	0,0%	4,2%	1,4%	43,0%	51,4%
	C2	Freq.	0	6	20	25	21
		(%)	0,0%	8,3%	27,8%	34,7%	29,2%
	C3	Freq.	0	0	4	31	37
		(%)	0,0%	0,0%	5,6%	43,1%	51,4%
Relatedness (R)	RE1	Freq.	0	3	4	37	28
		(%)	0,0%	4,1%	5,6%	51,4%	38,9%
	RE2	Freq.	0	3	16	36	17
		(%)	0,0%	4,2%	22,2%	50,0%	23,6%
	RE3	Freq.	0	1	13	28	30
		(%)	0,0%	1,3%	18,1%	38,9%	41,7%
Information Quality (IQ)	IQ1	Freq.	0	15	12	36	9
		(%)	0,0%	20,8%	16,7%	50,0%	12,5%
	IQ2	Freq.	0	14	6	37	15
		(%)	0,0%	19,4%	8,3%	51,4%	20,9%
	IQ3	Freq.	0	2	13	27	30
		(%)	0,0%	2,8%	18,0%	37,5%	41,7%
Information Integration (II)	II1	Freq.	0	5	2	27	38
		(%)	0,0%	6,9%	2,8%	37,5%	52,8%
	II2	Freq.	0	1	6	39	26
		(%)	0,0%	1,4%	8,3%	54,2%	36,1%

	II3	Freq.	0	2	1	34	35
		(%)	0,0%	2,8%	1,4%	47,2%	48,6%
Increased Productivity (IP)	IP1	Freq.	0	0	4	31	37
		(%)	0,0%	0,0%	5,6%	43,0%	51,4%
	IP2	Freq.	0	1	4	28	39
		(%)	0,0%	1,4%	5,5%	38,9%	54,2%
	IP3	Freq.	0	3	7	32	30
		(%)	0,0%	4,2%	9,7%	44,4%	41,7%
	IP4	Freq.	0	3	2	25	42
		(%)	0,0%	4,2%	2,8%	34,7%	58,3%
Advanced Reporting (AR)	AR1	Freq.	0	0	2	22	48
		(%)	0,0%	0,0%	2,7%	30,6%	66,7%
	AR2	Freq.	0	0	4	21	47
		(%)	0,0%	0,0%	5,6%	29,1%	65,3%
	AR3	Freq.	0	4	0	33	35
		(%)	0,0%	5,6%	0,0%	45,8%	48,6%
Customization (CU)	CU1	Freq.	0	4	5	28	35
		(%)	0,0%	5,6%	6,9%	38,9%	48,6%
	CU2	Freq.	0	7	6	23	36
		(%)	0,0%	9,7%	8,3%	31,9%	50,1%
	CU3	Freq.	0	2	8	25	37
		(%)	0,0%	2,8%	11,1%	34,7%	51,4%
Satisfaction (S)	S1	Freq.	0	1	5	34	32
		(%)	0,0%	1,4%	6,9%	47,2%	44,4%
	S2	Freq.	0	5	4	48	15
		(%)	0,0%	6,9%	5,6%	66,7%	20,8%
	S3	Freq.	0	4	3	35	30
		(%)	0,0%	5,6%	4,2%	48,6%	41,7%

Continuous Use (USE)	USE1	Freq.	0	0	0	24	48
		(%)	0,0%	0,0%	0,0%	33,3%	66,7%
	USE2	Freq.	0	0	3	30	39
		(%)	0,0%	0,0%	4,1%	41,7%	54,2%
	USE3	Freq.	0	0	0	26	46
		(%)	0,0%	0,0%	0,0%	36,1%	63,9%

Appendix V - Interview guide

Part 1: Introduction and general questions.
1. Can you briefly describe your company?
2. What is your current role in the organization and responsibilities?

Part 2: General questions.
3. What kind of BI solution do you use?
4. How often do you use it?
5. How long have you been using it?
6. In your line of work what do you use it for?
7. With regards to data, what can you say about its accuracy?
8. How often is it updated?
9. Is the data relevant to what you do?
10. Are there any restrictions when it comes to data access? Can you see everything that you want to see?
11. How is the design of the report?
12. Is there flexibility? Are you able to create your own reports and do anything that you want with the data?
13. Since you have been using the BI solution, what do you like most about it? What is exceptional about it?
14. And what is not working for you? What things do you feel should be changed?

Part 3: Closing.
Inform the interviewee that the interview has come to an end. Thank them of their participation and time and inform them about sending them the transcription.

Appendix VI - Interview transcript 1

Interview Date: 12 May 2016
Present: Babalwa Golimpi (BG), Gulnaz Jabarova (GJ) and Interviewee 1 (INT1)
Interview Format: Phone interview
Interview Duration: 15mins 14 seconds
Transcribed by: Babalwa Golimpi and Gulnaz Jabarova
Transcription Date: 13 May 2016

Line	Speaking	Text
1	BG	Well, since we've already done your profile via email and we have limited time since you're on the road, we'll just skip the intro.
2	INT1	Yes thanks, okay.
3	BG	So let's get started.
4	INT1	Okay
5	BG	What BI solution are you using in your line of work?
6	INT1	It is a system called HRBI, built on an Oracle platform. We've been using it for a year now. We had other BI solutions before that.
7	BG	So, how often do you use the BI system?
8	INT1	About once a week.
9	BG	What do you use it for?
10	INT1	To draw people data. Information like leave transactions, change in assignment, salary information, departmental information and other things.
11	BG	OK. So who is designing your BI systems? Do you have an inhouse BI or you are using an external entity?
12	INT1	What is the non-entity?
13	BG	Sorry?
14	INT1	What is the last option?
15	BG	External entity is ...
16	INT1	Oh external entity. We use an external entity, a joint venture company that owns the BI tool.
17	BG	You mentioned that you're using a solution called BIHR?

18	INT1	HRBI
19	BG	HRBI... and you have been using it for a year
20	INT1	This version before was not called HRBI. It was called Evolve which was another BI tool, but that had great data reports. So this HRBI we've had it for a year.
21	BG	OK. So what is the difference in this one compared to the previous version?
22	INT1	Its supposed to be an improved version, it's not. Maybe it is with other platforms, because the Oracle platform has payroll, accounts, receivables and procurement as well. Maybe with other platform are improved, but it was always an Oracle version so this is an upgraded version. For me the standard reports are not sufficient.
23	BG	What is the main problem? Is it information accuracy or quality would you say?
24	INT1	About quality, the argument could be that the capturers are not following the same standard so for instance sometimes an employee number will have a prefix like W or F and sometimes it won't so when you draw the report you first have to fix that column. So in terms of data quality the argument could be the capturing is not standardized. But the problem with the reports is that they are not integrated they are much segmented. So if you want to combine the demographical information of the employee with their contact detail information and other information as well as their performance information and maybe their talent scripts, those are already about three or four reports. It is not integrated you cannot have one view of an individual. So you spend a lot of time getting information from various reports and sometimes the standard of capturing is not the same. So not only are you viewing multiple records of the same individual, in some cases their last name is used in a different variation to another report. I think a good example would be, one report would have in separate columns; first name, second name, preferred name and surname whereas another report has all of that information in one column. So if you wanted all the details you either have to combine all the columns of the one sheet or you have to build the information in another sheet because otherwise you cannot match them in an automated way. So that is a problem and it takes a lot of time
25	BG	So you have to pull out four different report for just to get unified view of what you want
26	INT1	Yes and obviously you can develop reports but what I am experiencing is that because they are trying to limit the number of reports to get the report that you want there is so much red tape so that's the other frustration.
27	BG	In the survey comments, i saw someone commented about an open book report complaining that you can't use filters properly in the reports
28	INT1	That was probably filled by someone from the Risk report.
29	BG	Back to the tool you are using, the version that you are using is about a year old, before upgrading to the new version did you meet with the BI development team?
30	INT1	Some of the HR did, what happened to put it in perspective is that the previous Oracle version, the one called Evolve was sitting with the external entity. There were a lot of customized reports done by the external entity so overtime with the

		business requirements there were a lot of customized reports that were available that you could pull then the management decided that all the entities are going onto one platform so all the customization was lost and the teams did meet with the development team to say but these reports we still want, these reports we still need. So out of all the reports that were available say 1000 reports across the franchises, the project team decided on a certain number let's say 10 to be kept, it's not that the system is not capable of having that information or developing those reports it's just that those reports are not available so you can't at a click of a button request the information that you want.
31	BG	In terms of design, are the reports easy to understand? Do they make sense?
32	INT1	Yes they are, I can even export to Excel. They are easy to understand.
33	BG	How often does the data get updated?
34	INT1	Yeah the data is real-time I think, let me say some of the data I've realized that its real time and some of it is an overnight upload.
35	BG	You seem disappointed with the new version of HRBI, do you feel you should be allowed to go back to the old version or maybe get a new tool
36	INT1	I don't think it's the version, I just think the customization needs to be flexible. You can't be that rigid otherwise the tool becomes useless so for me it's not that I want to go back to version 11 or whatever Oracle version we were on. I want to have the ability to get the reports that I'm used to or that I know give me worthwhile data so it's about the flexibility of designing new reports/system generated reports I mean the whole point is not to spend time filtering.. It's more about flexibility of generating or creating reports. Even before, you were able to create your own reports, you were able to generate the data from wherever and create a report and you can decide if you want to keep the report or discard it. And if you want to keep it, it would ask you if you want the report to be generated monthly or weekly so that is a good BI tool .. the one that gives you the ability to create your own reports.
37	BG	So the biggest thing for you is customization and data integration.
38	INT1	Yes, you've summarized it nicely as in those would be my major wins if I get it.
39	BG	Do you have any issues with data access or data control?
40	INT1	Data is controlled but at the level that I am in, I can see anything so I am fine. I can view anything that I need.
41	BG	Putting aside these issues, what is really working for you with regards to your BI tool?
42	INT1	There are some standard reports that are fine, I can say 20% of the reports that are available on the system are useful. Those that work fine are appreciated.
43	BG	We have come to the end of our interview, again thanks for your time. We will email you the transcription once the analysis is done. Thanks!
44	INT1	It's a pleasure!

Appendix VII - Interview transcript 2

Interview Date: 13 May 2016
Present: Babalwa Golimpi (BG), Gulnaz Jabarova (GJ) and Interviewee 2 (INT2)
Interview Format: Phone interview
Interview Duration: 09mins 18 seconds
Transcribed by: Babalwa Golimpi and Gulnaz Jabarova
Transcription Date: 14 May 2016

Line	Speaking	Text
1	BG	Hi, how are you?
2	INT2	I'm alright and how are you?
3	BG	I'm good, we've been trying to get hold of you for a while.
4	INT2	Sorry, i was busy with one of the branches on the phone…. I support the branches.
5	BG	Oh ok we won't take long then.
6	INT2	Okay
7	BG	Let's go into it then, can you give us a brief background about what you do and what your role is.
8	INT2	Ermhh.. Basically i am..., i just changed my role. I am now a business intelligent analyst. I work with the WASP team, what we do is.. On MyBI we develop WASP exceptions and then support the branches in terms of compliance. The Wasp exceptions are risk exception reports.
9	BG	So how long have you been working in that team?
10	INT2	8 to 9 months.
11	BG	Are you using any BI solutions?
12	INT2	We use the Wasp Qlikview model
13	BG	What is it called? What exactly do you use it for?
14	INT2	It's called the WASP Qlikview, we use the WASP Qlikview and the GL sign off. So the GL sign-off model is used as a user portal, we load all the branches' reviewers and approvers and that is linked to our WASP. The WASP portal is where we have linked all the risk exceptions that will come up and the QV model is the one that has the dashboard that shows us who is outstanding, how many exceptions are done, how many are finished. Basically the statuses of our exceptions.

15	BG	How often do you use the WASP QV model and the GL sign off?
16	INT2	I use them daily.
17	BG	And your experience with using these BI solutions, how are they?
18	INT2	They are excellent, slow at times but i guess it could be that there are many users logged in and the solutions are user friendly.
19	BG	Now in terms of data quality, can you say you are satisfied with it? Is it accurate?
20	INT2	Yes
21	BG	Do you get updated data?
22	INT2	It's updated, on our model its live data. It updates every, I think every 10 minutes.
23	BG	And how relevant is this data to your work?
24	INT2	Yeah, because I use it daily. I use it do my work, I rely on it to do my work.
25	BG	What about the design? How flexible is it? Can you create your own reports?
26	INT2	Yes, I can export. What I do is that I can select a call center, any category i want whether an exception is active or inactive, whether it is closed or finished so any status in a call center in any category I can select and pull a report out of it.
27	BG	Are you satisfied with your data access? Do you feel limited?
28	INT2	Yes, for my role.
29	BG	Looking at your BI solutions, what is it that you don't like that you feel can be changed?
30	INT2	Basically because we a GL sign off portal, what we want in wasp is to have our own portal where we can load our users.. We don't want the GL sign off to load our reviewers and approvers. And then coming to the wasp report, what we don't like is that if you 50 exceptions you can't filter by branch and date.
31	BG	So you would want a unified view of both?
32	INT2	Basically we want our own user portal
33	BG	So who owns the GL sign off?
34	INT2	It's another team.
35	BG	What can you say you like about both, GL sign off and Wasp Qlikview model? What can you say is working for you?
36	KM	For me it's the fact that i can pull reports, i can make any selection and pull reports and also that its real time data. If somebody actions now, it will reflect so i can go in and the status will be changed.
37	BG	I think that's about it, thanks a lot.

Appendix VIII - Interview transcript 3

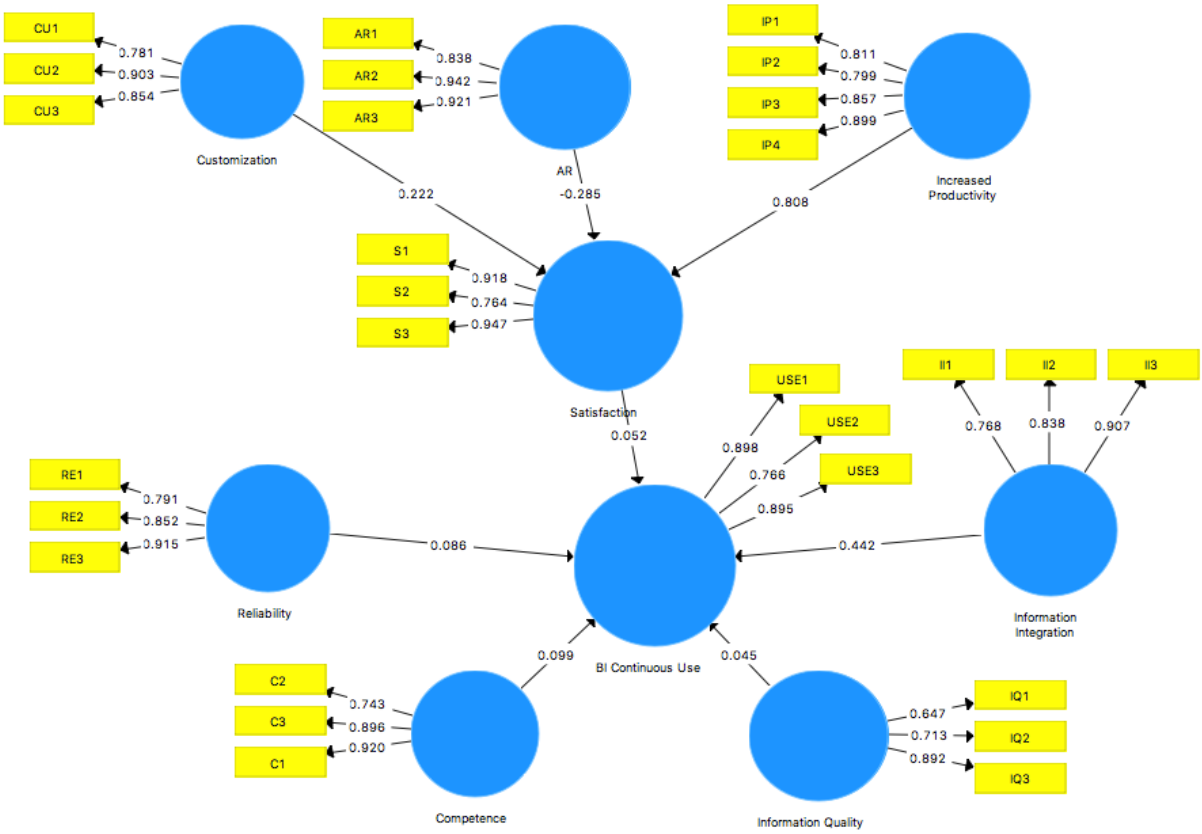
Interview Date: 13 May 2016
Present: Babalwa Golimpi (BG), Gulnaz Jabarova (GJ) and Interviewee 3 (INT3)
Interview Format: Phone interview
Interview Duration: 10mins 31 seconds
Transcribed by: Babalwa Golimpi
Transcription Date: 15 May 2016

Line	Speaking	Text
1	BG	Okay, before we start I need to ask you to give us a brief background, what you do, what your role is.
2	INT3	Okay, I am a financial accountant. I learned accounting at school
3	BG	Okay, so what is your role there?
4	INT3	Like you want me to explain my function as a financial accountant what I do?
5	BG	Yes
6	INT3	Okay, so we provide a support function to branches nationwide, i work with the balance sheet compliance management team and we monitor suspense and control accounts.
7	BG	Okay so...
8	INT3	Yes so you wanted something to ask?
9	BG	No it is fine continue
10	INT3	Yes, you know in a bank, suspense accounts are very high risk accounts. It is where fraudulent activities always take place like money laundering .Yes so monitoring those activities is basically my function
11	BG	Okay, so how long have you been working there?
12	INT3	I have been working in here for 2 years 4 months
13	BG	and now in terms of BI, what kind of BI report are you using?
14	INT3	To be honest I am not really using it intensively, because we only get like MI report for a like daily register for anything that is outstanding and we also use BAS. The bulk of our work is done in BAS and then on the myBI Qlikview model we use OMAC.
15	BG	Oh, okay

18	INT3	Yes, so those are the BI things that i use
18	BG	Hmm… how often do you use the BI system?
20	INT3	Well the MI report is the daily report that we get, that is where we check if the branches are out of policy in the system because they need to reconcile with what is on BAS. So the MI report shows us branches that are out of policy and if they are not matching with what is on BAS then we need to investigate.
21	BG	Okay and you mentioned OMAC in MyBI
22	INT3	Now and again i got to OMAC to confirm the structure of the cost centers and sometimes confirm closed branches.
23	BG	So you've been using these BI models that you mentioned for 2 years?
24	INT3	Yes
25	BG	Is there flexibility when it comes to the reports? Are you able to create your own reports?
26	INT3	The reports are just basic, they give me the information that i want but i check if the data is correct because sometimes there are glitches with the data. The MI report is also used for payroll so you have to check the data.
27	BG	Since you mentioned data glitches, what is your take on the data quality?
28	INT3	Most of the time the data is accurate. No system is always 100% so in terms of integrity I can say it's okay. The report that we are getting is just to help us mitigate risks.
29	BG	Is the data updated?
30	INT3	Yes, up to the previous day.
31	BG	Is the data relevant to your work?
32	INT3	Yes very much so.
33	BG	Coming to data access, do you feel limited? Can you see anything that you want to see in the reports?
34	INT3	There are restrictions but I understand that it is because of the nature of our work, we are a risk function and we deal with information that can't be made available to anyone so the restrictions depend on the level of your work.
35	BG	Is there flexibility when it comes to the reports? Can you export and create your own queries?
36	INT3	I get an Excel report via email and I can also go to the qlikview model and export it to Excel from there.
37	BG	Last 2 questions, what is it that you don't like about any of the BI solutions that you feel can be changed?

38	INT3	On BAS sometimes the data does not get imported on time and because there are certain rules on the system you find out that branches get charged if they reflect out of policy and this is something that is beyond the branches control. If the data is imported late then it means they can't do the reconciliation. Also with their rules, they sometimes count days as days and not working days. I don't know if you understand what i mean...
39	BG	Yes, that would be an issue of business rules
40	INT3	Yes
41	BG	And is there anything that you like or you feel is really working for you?
42	INT3	Mhhh I don't know what to say. Well, ok the qlikview model is constantly being improved so I guess that is impressive for me.
43	BG	Oh okay
44	INT3	I hope I was helpful
45	BG	Yes, you were. Thank you for your time and contribution.
46	INT3	Okay, bye.
47	BG	Bye.

Appendix IX - Hypothesis testing and result



Standardized Regression Weights:
(Group number 1 - Default model)

			Estimate
s	<---	cu	0.287
s	<---	ar	-0.255
s	<---	ip	0.784
use	<---	s	0.05
use	<---	r	0.033
use	<---	ii	0.688
use	<---	iq	-0.187
use	<---	c	0.194
C1	<---	c	0.895
C3	<---	c	0.801
C2	<---	c	0.649
IQ1	<---	iq	0.967
IQ2	<---	iq	0.756
IQ3	<---	iq	0.352
II1	<---	ii	0.626

II2	<---	ii	0.691
II3	<---	ii	0.936
RE1	<---	r	0.673
RE2	<---	r	0.786
RE3	<---	r	0.865
USE1	<---	use	0.852
USE2	<---	use	0.61
USE3	<---	use	0.811
S1	<---	s	0.901
S2	<---	s	0.663
S3	<---	s	0.944
IP1	<---	ip	0.729
IP2	<---	ip	0.706
IP3	<---	ip	0.825
AR1	<---	ar	0.814
AR2	<---	ar	0.945
AR3	<---	ar	0.812
CU1	<---	cu	0.651
CU2	<---	cu	0.866
CU3	<---	cu	0.769
IP4	<---	ip	0.86

Regression Weights

			Estimate	S.E.	C.R.	P
s	<---	cu	0.339	0.111	3.046	0.002
s	<---	ar	-0.372	0.121	-3.076	0.474
s	<---	ip	1.142	0.185	6.175	***
use	<---	s	0.031	0.063	0.488	0.025
use	<---	r	0.026	0.084	0.309	0.017
use	<---	ii	0.51	0.115	4.445	***
use	<---	iq	-0.079	0.047	-1.683	0.062
use	<---	c	0.117	0.066	1.781	***

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